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N.B.—In this Index (P) indicates that the matter referred to is an abstract of a Patent.
Titles of new books are indicated by “ ”.

LIST OF ABBREVIATIONS.

App:	Apparatus	Estim:	Estimate,-tion,-ing	Precip:	Precipitation,-ing
Applic:	Application,-able	Evap:	Evapora,-tion,-ing	Prep:	Prepara,-tion,-ing
Artif:	Artificial	Exam:	Examine,-ation,-ing	Prev:	Prevention,-ing
Atmos:	Atmospheric,-sphere	Extrac:	Extraction,-ing	Prod:	Produce,-tion,-ing
Aurif:	Auriferous	Ferment:	Fermentation,-ing	Protect:	Protection,-ing
Auton:	Automatic	Forma:	Formation	Purif:	Purification,-ing
Charac:	Character,-istic	Gen:	Generation,-ing	Qual:	Quality,-tative
Chem:	Chemical,-s,-istry	Impt:	Improvement,-s	Quant:	Quantity,-tative
Co:	Company	Inf:	Influence	Rectif:	Rectification,-ing
Col:	Colours,-ation,-ing	Manuf:	Manufacture,-ing	Reg:	Regulation,-ing
Collect:	Collecting,-tion	Mat:	Matter,-s	Separ:	Separation,-ing
Comp:	Composition,-pound	Mech:	Mechanism,-cal	Soc:	Society, Societe
Concent:	Concentration,-ing	Min:	Mineral,-s,-ogy	Sp. Gr:	Specific Gravity
Const:	Construction,-ing	Modif:	Modification,-ing	Temp:	Temperature
Contrib:	Contribution,-ing	Nat:	Natural	Titanif:	Titaniferous
Cultiv:	Cultivation,-ing	Org:	Organic,-ism	Util:	Utilisation,-ing
Decomp:	Decompose,-ition,-ing	Photo:	Photography,-graph-ic	Veg:	Vegetable,-tion
Detect:	Detection,-ing	Physiol:	Physiology,-ical	Volum:	Volumetric
Determ:	Determine,-ation,-ing			Vorn:	Normals
Diam:	Diameter				
Discrim:	Discriminate,-tion,-ing				
Distill:	Distillate,-tion,-ing				

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LIST OF ERRATA.

Page.	Column.	Line.	Description.
1895.			
269	1	2	From bottom: for "sulphuric acid" read "nitric acid."
1896.			
28	1	1 & 2	Delete "compound with," and for "α-naphthylamine sodium sulphonate," read "α-naphthalene sulphonic acid salt."
49	2	1	Top: for "greater" read "less."
106	2	7	From table: for "per ton" read "per 1,000 lb."
106	..	..	Table, last column, heading to right: for "per ton" read "per 1,000."
107	1	4	From bottom: for "per ton" read "per 1,000 lb.," and bottom line, for "per ton" read "per 1,000."
179	2	..	Title of paper: for "C. W. Thompson" read "G. W. Thompson."
272	1	18	From top: for "cochineal" read "cochineal."
296	2	31	From bottom: after "furnace" insert the words "fill the copper fuses."
460	1	..	Bottom line: for "saave" read "sanve."
732	2	..	"Denaturing Alcohol." In this article, "Methylene" is to be understood to mean crude methyl alcohol, or wood spirit.

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SESSION 1895-96.

February 3rd, 1896.—Mr. Walter F. Reid. "Manufacture of Linoleum."

Meeting held Monday, January 6th, 1896.

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A STUDY OF COMPARATIVE AFFINITIES IN
THE CASE OF CERTAIN SALTS OF AMMONIUM,
SODIUM, &c.

BY WATSON SMITH.

A known weight of ammonium sulphate was heated in an air-bath to between 270° and 310° C., allowing the latter temperature to be gradually attained. Steam was at the same time passed through the apparatus. The issuing steam was cooled by a condenser, and the vapours, &c., collected in normal hydrochloric acid. It was thus found that one-half of the ammonia was expelled from the salt. The residual salt, it was found, melted at 140° C., and solidified at 128°, the temperature on solidification rising to 130° C. But on one occasion, whilst heating up the sulphate of ammonium in an air-bath and passing steam through the mass, the steam was accidentally cut off. The result was an immediate evolution of sulphurous acid and ammonia, forming ammonium sulphite, which at once stopped up the tubes of the apparatus. This phenomenon was never observed when steam was employed, *i.e.*, no SO₂ could be detected by the smell, and only a very slight turbidity was produced in the distillate with barium chloride. In other words, then, it would be possible to prepare a tolerably pure ammonia solution by heating ammonium sulphate alone and passing steam through the mass.

This steam process was, however, a very slow one for the complete production of a residue containing but one-half of the original ammonia, and a quantity of ammonium sulphate was heated in a platinum dish, as described in this Journal, 1895, 629.

In an analysis of the ammonium bisulphate obtained, the numbers were as follows:—

	Found.	Calculated.
	Per Cent.	Per Cent.
Ammonia.....	15.965	14.78
Free acid	42.90	42.61
		NH ₄ HSO ₄

In answer to the question, "What actually takes place at the commonly repeated melting point of ammonium sulphate, viz., 146° C.?" (This Journal, 1895, 629.) Dry crystals of ammonium sulphate begin to decrepitate at about 290° C., ammonia coming off very perceptibly at 250° C. If superheated steam be passed through the mass of heated crystals, ammonia comes off very perceptibly at 200° C. This was an experiment in which, however, only good-sized crystals of the salt were taken. The experiments now to be described will do more than answer the question above recorded.

I.—SOLID AMMONIUM SULPHATE.

1. A quantity of pure ammonium sulphate was powdered pretty finely and introduced into a small retort connected with a condenser. A thermometer was placed amongst the salt in the retort, and the latter was slowly heated on the sand-bath. At 180° C. ammonia could be distinctly perceived at the end of the condenser, and at 250° C. drops of ammoniacal water began to fall. The salt did not melt until 300° C. was reached, when the portion nearest the glass in the interior of the retort began to fuse.

2. Some powdered ammonium sulphate was placed in a test tube with perforated cork and two pieces of bent tube. One of the tubes connected the test tube with an air blast, and a gentle but steady stream of moist air was passed through whilst the temperature was being gradually raised on the sand-bath. Another thermometer was placed in the sand close to the side of the test tube, and the temperature thus given was taken.

Ammonia, it was found, first became perceptible to red litmus paper at 129° to 125° C.

3. The same experiment was repeated with the powdered salt, using, however, an oil-bath instead of a sand-bath, the thermometer being placed in the oil. The air employed in the blast was passed through dilute sulphuric acid, so that it might carry no ammonia from the external air.

Ammonia became manifest at 177° C.

4. Some more salt was now pulverised in a mortar, and then sifted through linen by means of a Bunsen's bag apparatus. The sulphate, in the form of this impalpable powder, was now treated just as in experiment No. 3.

Ammonia plainly evolved at 105° C. After cooling down and then reheating very gradually, ammonia was detected at 86° C.

These experiments prove how greatly physical condition influences the decomposition point of the sulphate of ammonium by heat.

II.—AMMONIUM SULPHATE. CONCENTRATED SOLUTION.

5. Of course a still greater degree of attenuation is obtained in solution.

It was then discovered that from a concentrated solution of pure ammonium sulphate, ammonia begins to be evolved at a temperature so low as 60° C., and is very decidedly manifest at 65° C. On cooling and then gradually reheating, ammonia was detected as low as 58° C.

6. The concentrated solution of ammonium sulphate which had previously been heated at about 70° C., was now maintained at that temperature for about an hour. Ammonia was evolved the whole time, and at the end thereof, the solution showed a decidedly acid reaction to blue litmus paper. The solution of the sulphate was, to begin with, perfectly neutral.

7.—(a.) Some commercial ammonium sulphate was now dissolved in water. The solution was acid to litmus. Neutralised with ammonia and then evaporated for some time at a temperature about boiling point, keeping up the

level of the liquid with fresh additions of water. The final liquid was distinctly acid.

(b.) Evaporated similarly a concentrated solution of pure sulphate. The result was just the same as in (a.).

In the cases of (a) and (b), when a piece of red litmus paper was held in the vapours evolved by the boiling solutions, it is turned quickly blue. But the experiment becomes striking, when a piece of red litmus of about a superficies of 2 or 3 square inches, is held in the vapours so near the boiling liquid that some of the fine spray comes in contact with it. The red paper turns quickly blue, and then immediately becomes covered with red spots on a blue ground. This is due to the fact that whilst ammoniacal vapours are evolved from the heated liquid, the fine vesicles of the liquid itself have a decidedly acid reaction. Hence the test paper bears witness at one and the same time to (1) the acidity of the liquid and (2) the alkalinity of the vapours.

These experiments have a technical bearing, indicating the losses of ammonia that must follow any attempt to concentrate by evaporation solutions of ammonium sulphate so as to reach the crystallising point. Bone distillers who manufacture bone black, animal charcoal, and bone manures, are generally content with a very crude sulphate of ammonia, obtained by neutralising their bone liquors with sulphuric acid. These solutions I have myself seen in course of evaporation in iron pans to the crystallising point, the liquors being in a very active state of ebullition. There is not the least doubt that considerable losses of ammonia are sustained in such cases, and no doubt as concentration increases and consequently acidity, there will be increased action on the iron pans, with formation of iron sulphate.

But on heating ammonium sulphate, ammonia is not the only constituent driven off; we have already learnt that sulphurous acid is also liable to be set free. An interesting question now unfolds itself:—

What are the precise conditions under which the sulphur trioxide molecule in the sulphate is reduced to sulphur dioxide, and this sulphur dioxide then expelled?

We have already learnt that on heating ammonium sulphate to a temperature of about 270° C. to 300° C., and passing steam through the mass, pure ammoniacal gas is set free and escapes.

(1.) Having regard to the heating of sulphate of ammonium *without steam*, the experiment was tried of heating pure sulphate to from 270° to 280° C. for 19 hours, any vapours evolved being aspirated through water. It was found that 14 per cent. of the one equivalent of NH₃ was evolved, and that a little over 0.01 per cent. of the SO₃ was lost as SO₂.

(2.) Powdered ammonium sulphate was heated to from 300° to 310° C. for 12 hours, aspirating through water and afterwards through normal acid.

19 per cent. of NH₃ (of the one equiv.) were found, and 0.016 per cent. SO₂ lost as SO₃.

(3.) Powdered sulphate heated to 275°–280° C. for 12 hours, aspirating so as to create a more considerable vacuum, and passing first through water and then acid, as before:—Found 37.4 per cent. NH₃; and no SO₂ lost.

It was found that the sample which had lost 19 per cent. NH₃ (experiment No. 2), when dissolved in water and mixed with zinc powder, evolved hydrogen gas freely.

(4.) (NH₄)₂SO₄ heated for 8 hours at 300° C. in a test tube of hard glass, aspirating the gases through water and then normal acid, with considerable suction, yielded 99.1 per cent. of the one equiv. of NH₃, and 0.146 SO₂ lost as SO₃.

(5.) (NH₄)₂SO₄ heated for 13 hours from 310°–315° C. Evolved: 99.4 per cent. NH₃. After the 13 hours' heating, on increasing the current of air by aspiration, ammonium sulphites began to sublime abundantly, and would soon have stopped up the connecting tubes. The bath for heating the tubes, was one of "fusible metal." In one experiment, in which a tube of soft soda-glass was used, 3.3 grms. of (NH₄)₂SO₄ were heated for 15 hours at 300° C. 100.4 per cent. of NH₃ was found, but also 0.825 per cent. SO₂ lost as SO₃, and also 0.16 per cent. SO₂ lost as sublimed sulphite. However, on removing the coat of fusible alloy from the bottom of the test tube, it was found that the glass had been attacked throughout and thoroughly decomposed

by the ammonium bisulphate formed. This, together with the increased percentage of SO_2 evolved, are evidences, together accounting for the large percentage of ammonia found, some NH_3 of the NH_4HSO_4 having evidently been sacrificed.

6.6 grms. of ammonium sulphate were heated to between 270°C . and rising to 310°C ., steam being meantime passed through. On condensing and testing, it was found that just about the full one equiv. of ammonia had been expelled and absorbed in the acid used.

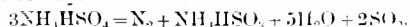
Glancing at a statement made (this Journal, 1895, 629) as to the disintegration of $(\text{NH}_4)_2\text{SO}_4$ at high temperatures: "*If NH_3 thus loses H to reduce SO_3 in the molecule of $(\text{NH}_4)_2\text{SO}_4$ or NH_4HSO_4 to SO_2 , what actually becomes of the nitrogen of such NH_3 ?*"

Some ammonium bisulphate (NH_4HSO_4) was placed in a small bulb with bent tube, such that but little air was enclosed. The tube dipped under caustic soda solution and entered the lower part of the graduated test tube acting as gas receiver, and also filled with caustic soda. The gases first evolved were allowed to escape so as to remove air from the bulb apparatus. It was at length noticed that when heating from 300 — 350°C ., bubbles escaping at the end of the tube were completely absorbed by the soda, when the stem was placed under the orifice of the test tube. The fact was now observed that whilst SO_2 seemed to be abundantly evolved, it was nearly all absorbed by the soda, no permanent gas at first collecting in the test tube, and hence very little nitrogen was concurrently liberated from the NH_4HSO_4 . At last, on applying considerably more heat (bare flame of the lamp), some permanent gas collected in the test tube, but apparently a minute proportion in comparison with the volume of the SO_2 evolved. The small amount of residual gas collected, extinguished a taper, and did not render lime-water turbid, and it appeared to be nitrogen (no oxygen could be detected amongst it). As stated (this Journal, 1895, 630), nitrogen only appears to be perceptibly evolved at temperatures between 360° and 400°C ., whilst with a fair amount of freedom at 450°C . and above. See also J. Chem. Soc., 1884, 92, Ramsay and Young, where it is shown that "The temperature at which ammonia begins to decompose, under the most favourable circumstances, lies a little below 500°C .". In the present case, of course, the ammonia is being heated in presence of an oxidising agent (SO_3). At the latter temperature, though but proportionately a small fraction of the nitrogen of the ammonia in the salt had been evolved as nitrogen, it was found that the SO_3 in the residue had been largely reduced to SO_2 , i.e., the residue consisted largely, almost wholly, of sulphites.

At 350°C ., whilst SO_2 was decidedly formed and evolved free, very little nitrogen could be detected, i.e., very little uncondensable and inert gas.

The question arises, then, "*If SO_2 is evolved and yet very little free nitrogen from the NH_4HSO_4 , can any other reaction which expresses the change in part, if not wholly, be regarded as admissible; along with that expressed by the equation $3\text{NH}_4\text{HSO}_4 = \text{N}_2 + \text{NH}_4\text{HSO}_3 + 5\text{H}_2\text{O} + 2\text{SO}_2$?*"

I had at one time believed I had obtained evidence of an intermediate formation of hydrazine sulphate, thus:— $2\text{NH}_4\text{HSO}_4 = \text{N}_2\text{H}_4\text{SO}_4 + \text{H}_2\text{O} + 2\text{SO}_2$; small portions of the substance being heated, at times giving an instantaneous dark precipitate of Ag in the cold, with ammoniacal silver nitrate. Curtius, Ber., 20, 1634. Of course, were this the case one would expect this compound at the elevated temperature, soon to break down again with evolution of N and SO_2 , thus:— $\text{N}_2\text{H}_4\text{SO}_4 + \text{NH}_4\text{HSO}_4 = \text{N}_2 + \text{SO}_2 + 3\text{H}_2\text{O} + \text{NH}_4\text{HSO}_3$. But until I can get more tangible evidence of such an interesting reaction, I must adopt the following, in which at the high temperature ammonium bisulphate breaks down into nitrogen, bisulphite, water and sulphur dioxide. This reaction also accounts for a considerable excess of SO_2 :—



(See also this Journal, 1895, 629.)

With regard to Kjeldahl's method, I may state, that though ammonium sulphate, as I have shown, is considerably

decomposed and modified on heating to temperatures below 300°C ., yet on heating some pure ammonium sulphate in presence of excess of concentrated sulphuric acid up to 300°C ., not a trace of NH_3 was evolved, which perfectly bears out the fact of the validity of this process.

I may just mention here that normal ammonium sulphite, on heating, decomposes like the sulphate, yielding ammonia and bisulphite.

VARIOUS DECOMPOSITIONS OF INTEREST BY MEANS OF AMMONIUM BISULPHATE.

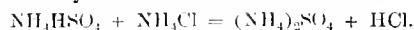
Oxalic Acid.—When ammonium bisulphate is fused and oxalic acid is introduced into it, decomposition of the latter at once takes place with evolution of CO_2 and CO.

REACTION OF AMMONIUM CHLORIDE WITH NORMAL AND ACID AMMONIUM SULPHATE.

Mixed Solutions.—5 grms. of ammonium sulphate and 2.026 grms. of ammonium chloride (i.e., equiv. weights) were placed in a suitable apparatus along with 20 c.c. of water. The liquid was now boiled and evaporated. It was observed that ammonia was copiously evolved as the solution became more concentrated. After about 8—9 hours' boiling, some little water being added from time to time, it was found that the escaping vapours had acquired an acid reaction, and that hydrochloric acid was coming off. After some time the test tube was filled again with water to the 20-c.c. mark and boiling continued. It was now found that ammonia was evolved, and this again continued until the solution became somewhat concentrated, when this particular reaction seemed to expend itself, then become reversed, and once more hydrochloric acid was evolved.

Mixed Solids.—Similar weights of the two salts were now taken, thoroughly mixed and the dry mixture heated in the sand bath, which was afterwards changed for a bath of fusible metal, in which a thermometer was placed. The apparatus was connected with a water-pump, so that the heating process was conducted under partial vacuum. The temperature was gradually taken up to 300°C ., when in about $\frac{1}{2}$ th of an hour the escaping vapours became acid. After nearly 10 hours' heating, with slow aspiration all the time, the litmus began to turn blue again through reversal of the reaction and evolution of ammonia. In 3 hours more HCl was evolved, and in $\frac{1}{2}$ hours more, ammonia. The rationale of this curious process of reversing reactions is, I believe, this:—Heat causes the ammonium sulphate to part with a certain proportion of its ammonia, and when a certain and sufficient quantity of bisulphate is thus formed, the latter attacks the ammonium chloride, takes from it some of its ammonia, and generates hydrochloric acid, which escapes. This re-saturation and so recovery of balance of the sulphate proceeds up to a given point, determined doubtless by the joint factors of temperature and mass, when balance is again upset, and the re-saturated sulphate again parts with ammonia, and so on. Thus we have a singular case in which from one saline mixture, alternately ammonia and hydrochloric acid is evolved by the mere application and maintenance of heat. Among the ammonia and hydrochloric acid thus evolved there are respectively ammonium sulphites and sulphurous acid to some extent present.

The determination was now made of the nature and extent of the reaction of ammonium bisulphate on ammonium chloride. To begin with it was found that ammonium bisulphate, NH_4HSO_4 , when heated with ammonium chloride, NH_4Cl , yields normal ammonium sulphate and hydrochloric acid—



However, this equation, like many others, would not guide the operator to a practical realisation of the reaction as stated. If this equation did hold good in practice, the death-blow to the Leblanc soda industry would already have been struck, for we have seen that pure ammonia can be obtained by suitably heating normal ammonium sulphate. Now what takes place when *equivalent weights* of ammonium bisulphate and ammonium chloride are heated together, is this:—A certain proportion of the chloride is decomposed by the bisulphate, yielding HCl and $(\text{NH}_4)_2\text{SO}_4$; the amount

and degree of acidity of the mixture at length become so reduced by dilution that the remaining NH_4Cl ceases to be acted upon. Further heating, and at somewhat higher temperatures, would then only lead to a reversal of reaction, with evolution of ammonia. This would lead to increased acidity (further formation of NH_4HSO_4), and after a time another reversal, the NH_4HSO_4 reacting once more on some residual NH_4Cl to form more HCl , and so on. It thus became clear that to effect the complete decomposition of a given quantity of ammonium chloride, a very large excess of bisulphate of ammonium would be necessary. For example, it is found that on heating in a special apparatus, 2 grms. of NH_4Cl with 20 grms. of NH_4HSO_4 , 92 per cent. of the HCl was driven off, whilst with 2 grms. of NH_4Cl with 30 grms. of NH_4HSO_4 , as much as 95 and 97.6 per cent. respectively of HCl were obtained in two experiments. (A specimen of fuming hydrochloric acid prepared from HCl thus evolved, was now exhibited.) Moreover, it was found that after thus obtaining the HCl , on heating the residue in the hopes of now expelling the ammonia at the same time taken up from the NH_4Cl , only a fraction thereof is obtained, the remainder being obstinately retained, and at the temperature required to expel it, a considerable loss is sustained by formation of sulphites.

It will be noted that in this latter case, the effort is being made to expel ammonia in presence of a large excess of ammonium bisulphate, a condition approaching that which confers so much value upon the Kjeldahl's process.

To show the extent of the reaction if a smaller excess of ammonium bisulphate be used with the ammonium chloride, the following experiments were tried:—

1 equiv. of NH_4Cl was heated in concentrated solution, with 2 equivs. of NH_4HSO_4 , and heating was continued until NH_3 began to be evolved. 53 per cent. of the HCl obtained.

Two experiments were now tried with above mixture, dry, when in one case 30.5 per cent. and in the other 42 per cent. of the HCl in the NH_4Cl was obtained. In the second experiment the vapours were passed through fused and heated NH_4HSO_4 . By modifying the apparatus so that if any NH_4Cl sublimed, it would be decomposed in a further quantity of NH_4HSO_4 , and improving the system generally, 72 per cent. of HCl was obtained. But along with HCl , SO_2 was also obtained, indicating some reduction.

A further experiment was now made. Having prepared some acid ammonium sulphate by heating the normal salt, common salt (NaCl) was added to the hot fused liquid. Hydrochloric acid was copiously evolved, and on further addition of NaCl , the reaction came to an end, with formation doubtless of NaNH_2SO_4 . This on further heating evolved ammonia, and at length NaHSO_4 remained behind. But on addition of NaCl to the fused NH_4HSO_4 , do not think that the formation of NaNH_2SO_4 is a complete formation, or that it is unattended by side issues, which represent on a working scale, by-products. The reaction proceeds up to a point, at which the acidity of the mixture still containing some NH_4HSO_4 , is so reduced, that it refuses further to act upon the NaCl . If now, about such a point of unstable equilibrium, the heat be further pushed, I have always found that a considerable tendency, the maximum tendency to a reducing action, arises, with formation of sulphurous acid, and so of sulphites.

A process has been devised in time past for obtaining at one and the same time ammonia and bisulphate of soda, by heating a mixture of equivalent quantities of ammonium sulphate and sodium sulphate, and injecting steam into the liquid mass. The bisulphate of soda is then further heated with common salt, with production of hydrochloric acid and regeneration of normal sodium sulphate.

This is a portion of the beautiful process of Carey, Gaskell, and Hurter (this Journal, 1885, 117). What I wish now to show is that something approaching the reverse of this process will also operate. If ammonium sulphate be heated, till one-half its ammonia is expelled, bisulphate remaining, and then to this in a fused state, sodium chloride be added, hydrochloric acid is abundantly evolved, and sodium ammonium sulphate produced. But reduction of SO_3 to SO_2 , with formation of sulphites, also occurs, and the reaction is not complete. On further heating, NH_4NaSO_4

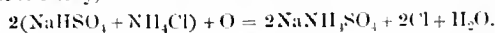
yields up its NH_3 and leaves NaHSO_4 . If to this NaHSO_4 in the fused state NH_4Cl were added, HCl would be generated, and NaNH_2SO_4 obtained, providing the temperature of the fused mass were kept sufficiently low, and other suitable conditions provided. Yet this reaction could not be completed, for reasons already given, and the attempt would lead to the reduction of SO_3 to SO_2 , besides sublimation of NH_4Cl . What double salt was formed, would on further heating be, of course, decomposed, with liberation of ammonia, and re-formation of sodium bisulphate. If you ask me, "Could a process be based upon such a reaction as this for yielding ammonia and hydrochloric acid?" I reply that such a process could scarcely be carried out as a commercial success. Nor would the case be materially improved, if a commencement were made with fused bisulphate of soda, and to this were added ammonium chloride, HCl being generated and NH_4NaSO_4 produced, plus a necessary excess balance of NaHSO_4 , without which the reaction would not be completed. It is true that on heating, with injection of steam, ammonia would be expelled, and sodium bisulphate reproduced, but unfortunately, at the temperature required to complete this reaction, the SO_3 molecule would be to some extent reduced, and some of the ammonia would come over as sulphites, blocking up tubes and pipes most inconveniently. But as you may anticipate, the incompleteness of reaction does not stand still in the cycles of process; it increases, and at length brings the work to a standstill. The decomposition, with formation of sulphites, must always be accounted a constant in any process in which heat of any considerable degree is used, when ammonia is liberated in presence of ammonium sulphate or bisulphate. This evil is avoided to a considerable extent, though not altogether, if steam be injected, but then the process becomes a long one to complete, as the superheating temperature must be moderate.

But unfortunately, and further, the very condition for obtaining a good yield of HCl , viz., large excess of bisulphate, forms also the condition for very special stability of the ammonia fixed by that excess, which consequently suffers only very partial expulsion by subsequent heating.

Chlorine from Ammonium Chloride.—The next point I turned my attention to was the possibility of utilising the reaction of ammonium bisulphate upon ammonium chloride for the sake of producing chlorine directly. On heating together a mixture of ammonium bisulphate, chloride, and Weldon mud, under suitable conditions, chlorine is generated, and on being passed into potassium iodide solution, iodine is set free. On heating 1 equiv. NH_4Cl , 2 equivs. of MnO_2 and 4 equivs. of NH_4HSO_4 together with a little water, for about half an hour, aspirating the gases through potassium iodide, free iodine was liberated equivalent to a liberation of 12 per cent. of the combined chlorine. The above experiment was repeated with an increase of MnO_2 to 4 equivs., when 14.2 per cent. of chlorine was obtained.

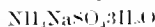
The experiment was now varied by taking 1 equiv. of NaCl instead of NH_4Cl , when in one case 18.3 per cent. and in another 22.9 per cent. of Cl were obtained. Another variation was now tried, with better success. 1 equiv. of NH_4Cl and 4 equivs. of NaHSO_4 were heated with 1 equiv. of MnO_2 and a little water, in a test tube made of hard glass. Iodine equivalent to 81.5 per cent. of chlorine was liberated. In another experiment this was increased to 83.5 per cent. of chlorine.

Now this process, judged from the results just stated, has so far a somewhat favourable appearance technologically. It looks as if, with a little improvement, something might be done with it. When bisulphate of soda thus acts upon ammonium chloride in presence of MnO_2 , we may say, to put it briefly,—



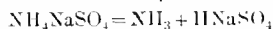
The next step of importance would be the possible liberation of the NH_3 in this salt by heat suitably applied, so that that NH_3 should be recovered, leaving the acid salt also available for further use. Of course, the reaction with NH_4Cl (omitting MnO_2) so as to produce HCl , would be a useful one, if available, as already pointed out. To ascertain whether such a reaction would be a smooth one, I prepared some of the double salt NaNH_2SO_4 . 36.796 grms. of 89.2 per cent.

caustic soda, were dissolved in water and treated with 45.5 c.c. of 96.1 per cent. sulphuric acid. Excess of ammonia was added, and the solution was evaporated to the crystallising point. Fine crystals were obtained of the double salt. Now, W. A. Miller, in his work, *Miller's Elements* (1864), and Dammier, in his *Handbuch der anorg. Chem.* II. [2], 268, write the formula of this salt as $\text{NH}_4\text{NaSO}_4 \cdot 2\text{H}_2\text{O}$. By direct estimation of NH_4 in the salt (as NH_3), 9.4 per cent. of NH_4 was found. $\text{NH}_4\text{NaSO}_4 \cdot 2\text{H}_2\text{O}$ requires 10.4 per cent., whilst—



requires 9.42 per cent. of NH_4 . A determination of SO_4 gave 50.84 instead of 50.26 per cent. required by the formula $\text{NH}_4\text{NaSO}_4 \cdot 3\text{H}_2\text{O}$. On ignition, 1.1851 grms. of salt left 0.4751 grm. $\text{Na}_2\text{SO}_4 = 12.99$ per cent. Na. $\text{NaNH}_4\text{SO}_4 \cdot 3\text{H}_2\text{O}$ contains 12.04 per cent. Na. The attempt was made to determine the NH_4 and H_2O together by heating a known weight of the salt gently in a platinum crucible until SO_2 just became perceptible. Two determinations were made, with the following results:—

(1.) 38.6 per cent. loss. (2.) 39.1 per cent. loss. Mean = 38.85. Deducting in each case the NH_3 already determined, the content of water would be $38.85 - 9.10 = 29.75$. This last result for water could not be much relied upon on account of the incipient evolution of SO_2 . It was further discovered that at the point at which acid fumes began to be set free, there still actually remained in the residue in the crucible, some ammonia. The effort was now made to push the heating process somewhat further, when it was found that as the last traces of ammonia were evolved, they came off as sulphite along with SO_2 , and then SO_3 followed. Thus, then, the failure of this latter process for water determination, as one of quantitative estimation, confirmed a tendency, already alluded to, which would probably render futile the attempt to utilise the reaction—



and especially if a considerable excess of NaHSO_4 were present, the intention being to again act with this acid sodium sulphate upon a further molecule of NH_4Cl . In presence of increased excess of NaHSO_4 , the NH_3 becomes more and more firmly fixed, till at length the exalted temperature sufficing to displace it, also suffices to induce reduction of SO_3 .

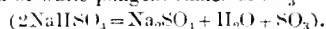
If, on the other hand, the refractory portion of the NH_3 be left in combination, only a reduced area of reaction would be obtained for the next stage; and in large-scale working especially this area of reaction would become still further reduced. We arrive, then, at two facts:—

(1.) That the double salt NH_4NaSO_4 is probably one crystallising with $3\text{H}_2\text{O}$, and not $2\text{H}_2\text{O}$ as generally stated.

(2.) That not only is ammonia very stable in presence of excess of strong sulphuric acid (Kjeldahl), but its stability also increases in like manner, in presence of excess of an alkaline bisulphate; indeed, to such an extent that the heat required to dissociate it, also suffices to bring about reduction of SO_3 to SO_2 .

A few experiments were now made with portions of the pure double sodium ammonium sulphate.

1. A quantity of the double salt was heated in a platinum crucible. The dried salt first melts and then evolves ammonia, but at the closing stage of this evolution does not perceptibly evolve SO_2 , the next stage being characterised by evolution of white pungent fumes of SO_3 —



2. 3 grms. of double salt heated in a hard glass test tube in a bath of fusible metal for 12 hours at $300^\circ - 305^\circ \text{C}$., aspirating the vapours through water and normal sulphuric acid. On titration, it was found that 68.75 per cent. of the NH_3 had been given off. Testing with iodine solution and thiosulphate showed no sulphurous acid had passed over.

3. A concentrated solution of the double salt was heated by means of the oil-bath, air being gently blown first through dilute sulphuric acid and then through the tube containing the heated salt. Ammonia first began to appear (indicated by test paper) at 65°C ., and decidedly at 90°C .

In another experiment, with still more careful observation. First appearance of NH_3 at 58°C .; decided tokens at 80°C .

4. On similarly treating the crystals themselves (not in solution), NH_3 first appeared at 78°C ., and decidedly at 100°C .

It is interesting to note that crystals of the normal ammonium sulphate similarly heated, began to evolve NH_3 at 130°C ., and decidedly at 155°C .

Thus, then, the NH_3 held by NaHSO_4 as the double salt $\text{NH}_4\text{NaSO}_4 \cdot 3\text{H}_2\text{O}$, is much more lightly held, than it is as $(\text{NH}_4)_2\text{SO}_4$, i.e., it is more easily and smoothly expelled.

5. Finally, the following experiment was tried, and it is one offering much technical suggestion:—3 grms. of the double salt were heated in a hard glass test tube in a bath of fusible alloy, so that a Chorley and Baly thermometer could also be used.

Heating was continued for 13 hours at $300 - 305^\circ \text{C}$., the vapours being aspirated through water and then semi-normal sulphuric acid. On back titration it was found that 66.57 per cent. of the NH_3 had been evolved. Tests with iodine and thiosulphate showed that no SO_2 had come over.

After this the tube containing the double salt was connected to two tubes, the first containing semi-normal sulphuric acid, and the second, water containing starch iodide sufficient to induce a pale blue colour. The temperature was raised to 450°C ., and kept at that for nearly an hour, when acid vapours began to appear. Stopped the experiment and titrated the excess of acid, finding that 7.7 per cent. more of NH_3 had come over, but no SO_2 could be detected. The tube was now maintained at 450°C ., for another hour, passing the acid vapours first through water and then water coloured blue with a little iodine and starch paste. Enough SO_2 to decolorise the iodide of starch solution passed over in just under the hour.

a. From the foregoing, it will be plain that though the NH_3 in association with NaHSO_4 as NH_4NaSO_4 , is at first very easily expelled by heat, as the excess of residual NaHSO_4 increases, the stability of the remaining NH_3 rapidly increases, and the latter portions of NH_3 remain more firmly combined with the excess of NaHSO_4 than is the case with a similar excess of NH_4HSO_4 .

b. Also that whereas on heating the double salt NaNH_4SO_4 , ammonia is first evolved, and that later on, the sodium bisulphate left is further resolved into $\text{H}_2\text{O} + \text{SO}_3$ and Na_2SO_4 ; more complexity of decomposition ensues on heating $(\text{NH}_4)_2\text{SO}_4$. For whilst at the outset, ammonia is evolved at moderate temperatures without much loss of SO_3 as SO_2 , the case is different when the condition of ammonium hydrogen sulphate is reached.

c. It is thus interesting, and to technologists may be useful, to note that the breakdown or reduction of the SO_3 group, is not appreciably effected in the expulsion of NH_3 from $(\text{NH}_4)_2\text{SO}_4$ —that can be avoided,—but is effected largely and chiefly by the prolonged action of heat on the ammonium bisulphate left.

I have to acknowledge the zealous help and co-operation of my former assistant, Mr. J. C. Chorley, in the first part of this investigation, and in the latter portion the great care and skill of my present assistant, Mr. Albert Shonk.

DISCUSSION.

The CHAIRMAN considered that all present would agree that Mr. Watson Smith's paper was one of great interest. The fact that ammonium sulphate was decomposed at moderate temperatures was not generally understood. It was known, however, that if sulphate of ammonia were put into the mixer in the manufacture of superphosphate and other artificial manures, a notable loss of ammonia occurred.

Mr. W. CROWDER agreed with Mr. Newlands' remarks, and referred to a paper published about 10 or 12 years ago in the *Chemical News*, dealing with investigations of a similar character to those of Mr. Watson Smith's.

Mr. DAVID HOWARD asked if there was the smallest proof that normal sulphate of ammonia existed in solution. It was a point on which he had grave doubts, for it invariably

behaved as an acid towards iron plant. He assumed that it was another instance of practical work differing from textbook equations.

Mr. WATSON SMITH, in reply to Mr. Newlands, said he believed that if evaporation took place in leaden pans, and an excess of acid were employed, there would be no loss of ammonia. He thought, however, that the excess of acid would need to be tolerably large, since on heating and concentrating sulphate of ammonia solutions, a considerable degree of acidity was produced by loss of ammonia. He handed round a specimen of hydrochloric acid made by the reaction of ammonium bisulphate upon ammonium chloride.

The CHAIRMAN, in proposing a vote of thanks to Mr. Watson Smith, said that the use of a very slight excess of acid would prevent loss of ammonia.

Liverpool Section.

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SESSION 1895-96.

Wednesday, February 5th, 8.30 p.m.—Smoking Concert at the Reform Club.

Meeting held Wednesday, January 8th, 1896.

MR. EUSTACE CAREY IN THE CHAIR.

SOME EXPERIMENTS RELATING TO THE MANUFACTURE OF CYANIDES.

BY JAMES T. CONROY, B.Sc., Ph.D.

IN the process of making ferrocyanide of potassium by fusing together potassium carbonate and iron borings with subsequent addition of animal matter, considerable losses take place, firstly, of potassium carbonate, but more especially of nitrogen. These losses make the process far from economical, and, notwithstanding the large amount of work done with a view to minimise these defects, it seems as if the efficiency of the process has practically reached its highest point.

For this reason many attempts have been made to prepare potassium cyanide otherwise than through the prussiate compound, and during the last half decade a very special impetus has been given to the study of these processes. The cause of this is the general adoption of the cyanide process in the recovery of gold from its ores, and although I cannot, unfortunately, give any figures showing the increased demand for this reagent, I think a study of the Patent Office Journal will afford some idea of the immense activity at present shown in this field.

The number of patents dealing with cyanides, ferrocyanides, and sulphocyanides, published during the years 1886 to 1895 is given in the following table:—

1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
4	5	2	4	4	5	7	12	15	33

From a study of the specifications, we see that while the original method of manufacture is left almost entirely alone the newer methods proposed readily range themselves into two main divisions or groups. These are—

a. Methods for the direct production of cyanide, using as the source of nitrogen—

(1) the atmosphere,

(2) ammonia.

b. Methods in which sulphocyanides are prepared as intermediate products.

I propose to consider these methods in the order given, paying more particular attention to the processes falling under heading b.

The discovery that potassium cyanide could be produced directly and without the intermediate formation of ferrocyanide was made by Prof. Clark in 1837, who, on examining an efflorescence occurring near the boshes on some of the Clyde blast furnaces, which were worked with Neilson's hot blast, found it to consist chiefly of potassium cyanide.

A similar phenomenon was found to occur in the Harz, where carbon and the hot blast were used, and in 1843 Redtenbacher found it near the light hole in the furnaces at Mariazell in Styria, where it has since been produced in marketable quantities. In 1845, Bunsen and Playfair investigated the subject and found that the zone of formation was confined to the region just above the tuyères, that is, just above the point at which the air is blown in. To estimate the quantity formed they drilled a hole in this portion of the furnace and conducted the issuing gases into water. Analysis gave—

N	58.05
CO	57.43
H	3.18
CN	1.34

A gas of this composition meant in the Alfreton furnaces a daily production of 224.7 lbs. of cyanide of potash.

As a result of his work, Bunsen proposed a special blast furnace for the production of cyanide, in which coke and potash were arranged in alternate layers and heated in a strong blast—the cyanide fused as it was formed and could be run off at the bottom of the furnace.

Previous to this, in 1839, Lewis Thompson had already drawn attention to the fact that air led over a heated mixture of potash, carbon, and iron yielded cyanide, and his results were confirmed by Desfosses, and again in 1841 by Fownes and Young. Bunsen and Playfair also concluded that the cyanogen was produced from the nitrogen of the air, but this view was combated by Erdmann, Marchand, and Wöhler, who gave as their opinion that all cyanogen formed resulted from the fixed nitrogen of the coal.

Riecken then investigated the subject, and found, under conditions in which only atmospheric nitrogen was present, that cyanides were formed, and he further showed that the temperature of reaction must be sufficiently high to produce metallic potassium and that the nitrogen gas should be previously heated.

His experiments were confirmed by Delbrück.

These facts having become now firmly established, many attempts have been made to found a working process upon them, and numberless patents, all very similar to each other, have been taken out, but none have proved commercially successful. The essential feature is conducting N, or in later processes ammonia gas, over a heated mixture of coke and potash prepared in various ways (or in Mond's modification of Marguerite and Soudeval's process over barium oxide, which unites more readily with the nitrogen than the alkali metal) and the recovery of the resulting cyanide by distillation or lixiviation. The temperature of formation of the cyanide is in all cases extremely high, in fact so high as to kill the process, especially when ammonia is used, since this gas decomposes rapidly at the temperature employed.

According to Grüneberg (Eng. Pat., 1889, No. 13,697), the yield is much increased by absorbing the ammonia at a comparatively low temperature and then heating the resultant cyanate with charcoal at one much higher.

In an experiment performed by myself, 143 grms. of charcoal broken into pieces the size of peas were taken to

dryness with a concentrated solution containing 200 grms. potassium carbonate. The mixture was then filled into an iron tube and heated in a rapid current of ammonia gas at 900° — $1,000^{\circ}$ C. for six hours.

100 grms. of the raw material contained—

	Grms.
K_2CO_3	58
C.....	42

100 grms. of the product gave—

	Grms.
K_2CO_3	12.44
C (by diff.).....	44.93
KCN.....	3.74
$KCNO$	1.25
KHO.....	5.04

This analysis shows that a very appreciable quantity of cyanide and cyanate, in approximately molecular proportions, has been produced, but when it is considered that only 4 per cent. of the ammonia entering the apparatus was converted into cyanogen, and that the remainder was practically entirely lost, it becomes evident that we have here only a poor basis on which to ground a commercial industry.

Much better, but still very far from perfect, are processes, falling under this heading, in which a mixture of carbonic oxide and ammonia is led over, or through, a molten mixture of potash and carbon.

Young and Macfarlane (Eng. Pat., 1892, No. 3092) have produced, working on these lines, a cyanide containing 70 per cent. KCN. I have made some experiments on this process and on the lines proposed by these chemists, but my results were much less satisfactory than theirs, the products obtained containing only about 30 per cent. KCN.

The carbonic oxide was prepared by forcing a slow air current through a strongly heated and upright iron cylinder filled with small pieces of re-ignited wood charcoal. The resulting gas usually contained about 4 per cent. CO_2 , and after being freed from this by passing through potash solution and over lime it was led through a measured quantity (usually 200 c.c.) of concentrated ammonia solution of known strength. The mixture of carbonic oxide and nitrogen, now saturated with ammonia gas, was dried by passing over lumps of quicklime and finally through drying bottles filled with stick potash and then conducted into a curved steel tube of $1\frac{1}{2}$ inch bore, and containing just sufficient potash and carbon to form a lute in the bend. The mixture consisted at the start of about 200 grms. of caustic potash and 20 grms. of charcoal, and this was heated in the iron tube to from $1,000^{\circ}$ — $1,200^{\circ}$ C., and coarsely powdered charcoal added from time to time till the amount reached from 20—30 per cent. of the KHO present.

The temperature of reaction was sufficiently high to distil a small quantity of potassium from the mass and also to a slight extent some of the potassium cyanide formed. The mixture was well stirred from time to time, and when the experiment was completed the molten mass was poured into moulds and, when cold, well ground and tested.

The ammonia still remaining in the ammonia flask was estimated and a means thus found to determine what proportion had undergone useful change. From a series of fairly concordant experiments the following might be given:—

I.—KHO.....	200 grms.
C.....	20 grms. at start and 5 grms. at intervals of 6 hours.
Temperature.....	$1,150^{\circ}$ C.
After 24 hours the mass contained	21 per cent. KCN.
.. 30	29.6 ..
II.—Temperature of mass.....	$1,100^{\circ}$ — $1,200^{\circ}$ C.
Duration of experiment.....	5 hours.
The initial mixture contained ..	20.4 per cent. KCN.
The product mixture contained ..	34.4 per cent. KCN.
Per cent. NH_3 converted to KCN.	26

The analysis of several of the products gave the following values:—

	1.	2.	3.
KCN	22.1	18.59	29.6
K_2CO_3	66.9	74.35	71.0
KHO	1.5	..	..
C	7.7	..	..

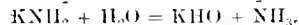
The process possesses many drawbacks. Chief amongst these is the loss occurring in the ammonia used, of which, even under the very best conditions, only some 30—33 per cent. is converted into cyanide, the remainder, owing to dissociation, being entirely lost. Another disadvantage is that the formation of cyanide takes place very slowly, a production of 60—70 per cent. cyanide requiring about 30—36 hours (Macfarlane); this rate appears to increase with the continuation of the experiment, the rapidity of formation being much greater after a 30 per cent. cyanide was reached.

The most serious item, however, is the high temperature necessary to effect the conversion, the wear and tear of the apparatus owing to this cause being enormous and being the main cause of the ill-success of my investigation.

In their work Young and Macfarlane had employed a steel tube, and after a thirty-six hours' heating, this had become reduced to a thin shell. After several experiments, similar to those indicated above, it was replaced by one similar in size and shape but made of cast iron. After the first experiment (one of 26 hours' duration) the central, most strongly heated, portion had been converted almost entirely into the magnetic oxide, and this led me to think that the products of combustion had been entering through this part into the alkaline mass. This view seemed to be borne out by analysis of the products, which showed 60—75 per cent. K_2CO_3 , and also by direct experiment, in which a mixture of carbon monoxide and nitrogen, absolutely free from carbon dioxide before entering the heated tube (filled only with this gaseous mixture), contained a large percentage of this gas on leaving.

The chemistry of the reaction is supposed to lie in the formation of formamide from the ammonia and carbonic oxide and the subsequent splitting up of this, and absorption of the HCN formed by the molten potash. Under the conditions of experiment, I think that very little formamide is produced, although, working under suitable conditions CO and NH_3 give a good yield of this substance. The formation, to my mind, rather lies in the simultaneous action of potassium, carbonic oxide, and ammonia on each other, potassiumamide being perhaps formed as an intermediate product.

That carbonic oxide reacts with potassiumamide to form cyanide of potassium and water was pointed out, many years ago, by Beilstein and Geuther, but their results were only qualitative. I have found in a rough experiment, in which the potassiumamide was prepared in a glass tube, that carbon monoxide at a temperature of 560° — 600° C. readily converts this compound into cyanide, giving a yield of some 35 per cent. Working in iron vessels where the amide cannot be decomposed with formation of silicate, the yield would be much better, and possibly approach the theoretical value, that is, the formation of one molecule cyanide from two molecules of amide—



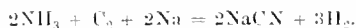
In carrying out Macfarlane's process it is not necessary to conduct the ammonia and carbonic oxide through the molten potash. In an experiment carried on in a covered iron crucible, the gaseous mixture was introduced by a tube at a point 1 inch above the fused mass (temp. $1,150^{\circ}$ C.), and the unabsorbed gas conducted away by an exit tube at the top of the crucible. After six hours, a product containing 7.4 per cent. of potassium cyanide was obtained; the absorption of the ammonia was not, however, so good as when Macfarlane's apparatus was employed, the conversion in two experiments amounting only to 4.5 and 3.1 per cent. respectively.

A process in which metallic sodium, previously or separately prepared, is used, has been patented by Castner (Eng. Pat., 1894, Nos. 12,218, 12,219). The molten metal is allowed to flow downwards over heated coke, whilst a stream of ammonia gas passes upwards through the mass.

The reaction proceeds at a much lower temperature than when potassium hydrate is used, and therefore the loss of potassium by volatilisation is diminished, and there is less loss due to dissociation of the ammonia.

Castner states that the whole of the alkali metal may by suitable working be recovered as cyanide; the conversion of ammonia to cyanogen is, however, not complete.

The reaction is thus represented:



The process, however, which seems to have the greatest future before it is the preparation of cyanide from sulphocyanide, which salts are now manufactured on the large scale by a modification of Gelis' process.

The thiocyanates were previously manufactured by fusing the cyanide (or ferrocyanide) with sulphur, and the total reversal of the old order of things here as well as in the preparation of cyanide from ammonia, for the manufacture of which latter compound the cyanides had been frequently proposed as a source, are points worthy of notice.

According to Gelis' process, which was worked some time on a manufacturing scale, ammonium sulphocyanide was prepared, according to the following equation, by heating together ammonia and carbon bisulphide under pressure—



From the equation it is seen that in each operation only a small percentage of the ammonia employed is converted into sulphocyanide, by far the greater part going over into ammonium sulphide.

This, at the temperature employed, exerts very great pressure, and the machinery required on this account to carry on the process was both complicated and costly.

The pressure from the various liquids likely to be present in the vessels have been determined by Mr. A. E. Wareing, by heating these at 100° C. in a strong iron cylinder fitted with a gauge. The volume of the iron vessel was 500 c.c., and in each case the quantity of liquid heated was the same, viz., 400 c.c.

All the ammoniacal solutions contained 6 per cent. of NH_3 . The following were the values obtained:—

	Lbs.
Water.....	20
$\text{Ca}(\text{SH})_2$ solution.....	25
NH_4HO ".....	40
$(\text{NH}_4)_2\text{S}$ ".....	50
NH_4HS ".....	140

It is thus seen that the value for the ammoniacal liquors is high, while that for $\text{Ca}(\text{SH})_2$ is not much higher than that of steam at atmospheric pressure, and these measurements give a good indication of the value of one of the recently introduced improvements shortly to be described.

A further difficulty in this process is the economical conversion of the sulphocyanide into cyanide.

To overcome the first of these difficulties, that caused by the sulphuretted hydrogen, several modifications of Gelis' process have been proposed, the principle of all, however, being the same, viz., the absorption of the evolved sulphuretted hydrogen by some non-volatile basic substance to cause a diminution in the pressure and to leave all the ammonia free for conversion to sulphocyanide.

The first patent was taken out in 1891 (No. 5351) by Hood and Salamon, who proposed the use of peroxide of manganese for this purpose. This they obtained, mixed with lime, by washing Weldon mud till completely free from calcium chloride, or by using the native ore (wad), or by ignition of the carbonate. A mixture of calcium and manganese sulphocyanides was thus obtained, together with sulphide of manganese and sulphur. The soluble sulphocyanides were then filtered and the contained manganese and calcium separated by fractional precipitation with

alkaline carbonate, the manganese, which possesses a greater affinity for carbonic anhydride than the calcium, coming down first.

In 1893, two patents were taken out, quite independently, for a modified process very similar to the above; the first by Crowther and Rossiter (No. 17,846) and the second by Hurter, Hetherington and others (No. 21,451); and this process, to be now described, is the most important of those yet evolved.

The above-mentioned chemists found that oxides of iron and manganese or other element to form an insoluble sulphide were not necessary to the reaction, and that lime was by itself quite sufficient to cause a rapid and complete conversion.

According to these specifications, calcium hydrate, water, ammonia, and carbon bisulphide in certain proportions are agitated in a closed, steam-jacketed iron vessel fitted with a pressure gauge, thermometer, and the necessary taps for charging and withdrawing the contents. The agitation is carried on at 100° C., and lasts for from 2—6 hours, until complete reaction has occurred.

The product, after distilling off any excess of free ammonia, is filtered from the lime, &c., and carbon dioxide is blown through the liquor in any suitable apparatus, e.g., Chance carbonators. This drives off sulphuretted hydrogen, at the same time precipitating the lime of the calcium sulphhydrate as calcium carbonate, whilst the calcium sulphocyanide remains in solution and may be utilised as desired.

I have made some experiments on the formation of sulphocyanide under varying conditions and on the subsequent conversion of this into cyanide, and the following is a record of the results obtained:—

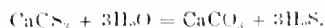
I. Preparation from carbon bisulphide and ammonia. Carbon bisulphide and ammonia in the proportion ($\text{CS}_2 : 4\text{NH}_3$) were heated in a revolving iron cylinder for $3\frac{1}{2}$ hours at 100° C.; the product was filtered for the precipitated iron sulphide, and after the removal of the accompanying ammonium sulphide the amount of NH_4CNS formed was determined.

The yield was quantitative.

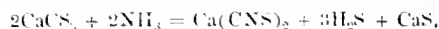
II. A mixture of calcium hydrate, carbon bisulphide, and ammonia (in the proportions $\frac{1}{2}$, 1, 3 mols. respectively) were heated together as in Experiment I. Here the lime added is just sufficient to form calcium sulphocyanide, the whole of the SH_2 liberated being absorbed by the ammonia.

Here again the yield was quantitative.

III. In Hetherington's specification we find the statement that excess of ammonia over that necessary to give the nitrogen of the CNS is required, since during the reaction calcium thiocarbonate is formed, and unless there is plenty of ammonia to decompose this compound some of the CS_2 is lost:—



This statement may be put into the form of the following question:—Supposing that some of the CaS and CS_2 combine to give CaCS_3 , can this compound react with ammonia as follows:—



or is excess of ammonia necessary to bring about the decomposition?

That excess is necessary, the following experiments, carried out by Dr. B. Zahorski and myself, show. A solution of calcium sulphhydrate was mixed with calcium hydrate and carbon bisulphide in theoretical proportion to form calcium thiocarbonate, and the mixture heated in a closed vessel under pressure, and with agitation at 60° C. On opening the vessel the whole of the carbon bisulphide was found to have disappeared and a solution of calcium thiocarbonate remained.

This was made up to a known volume, and equal parts were heated in beakers or open dishes, or under pressure in a closed cylinder with ammonium carbonate or sulphate, and varying amounts of free ammonia. The results obtained are embodied in the following table, in all cases

1 mol. CaCS_3 being treated with 1 mol. Am_2CO_3 or 1 mol. Am_2SO_4 :—

	Mols. NH_4HO added per 1 mol. CaCS_3 .	Per Cent. CaCS_3 converted to NH_4CNS .
a. $(\text{NH}_4)_2\text{CO}_3$ in open vessels	0 0 1 3 5 6 20 25	3.27 3.91 5.30 11.30 12.90 21.20 28.50 47.80
b. $(\text{NH}_4)_2\text{SO}_4$ in open vessels	0 12	5.10 27.10
c. $(\text{NH}_4)_2\text{CO}_3$ in closed vessels ...	2 12	72.10 92.95

Allowing for impurities in the carbon bisulphide, the yield of sulphocyanide was looked upon as theoretical when it reached 95 per cent. of that calculated from the weight of carbon bisulphide added.

The conversion of the ammonium sulphocyanide into the Ca and K salts was effected by boiling the solution with the calculated quantity of calcium hydrate, caustic potash, or potassium carbonate, and collecting all the evolved ammonia in acid.

The quantity of ammonia evolved was calculated and the amount of sulphocyanic acid present in the residue determined.

The following results were obtained—

NH_4CNS in Still calculated to KCNS .	Ca or KCNS found, calculated to KCNS .	NH_3 Theoretically Recoverable.	NH_3 Recovered.
18.31	18.24	3.21	3.05
2.187	2.173	1.22	1.23
"	2.178	"	1.23
"	2.192	"	1.21
"	2.211	"	1.13
"	2.182	"	1.22

From these experiments the following conclusions may be drawn :—

1. The reaction between carbon bisulphide and ammonia to form sulphocyanide proceeds easily and completely. The addition of lime does not influence the yield in one way or the other, provided that ammonia is present in excess, but simply serves to reduce the pressure within the apparatus.

2. Carbon bisulphide and calcium sulphide combine quantitatively in theoretical quantities, when treated under suitable conditions, to form the soluble calcium thiocarbonate. This combination takes place in the cold or at 100°C ., but especially well at 50° — 60°C .

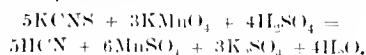
3. The solution of calcium thiocarbonate may be quantitatively converted, under suitable conditions, into sulphocyanide. For a good yield there must be a large excess of ammonia present and the reaction must be performed under pressure.

In later specifications it has been proposed to replace a portion of the lime by magnesium hydrate, which, under pressure, absorbs the SH_2 , but on releasing the pressure, evolves the gas below 100°C ., the $\text{Mg}(\text{OH})_2$ being reprecipitated ready for use.

Conversion of Sulphocyanide to Cyanide.

The conversion of sulphocyanide to cyanide is, as inspection of the formulae at once shows brought about by the withdrawal of one atom of sulphur from the former compound. This change may be accomplished either by reduction or by oxidation; in the first case the sulphur is withdrawn by means of some suitable metal, and in the second case it is oxidised to sulphuric acid. This oxidation of the sulphur of sulphocyanides to sulphuric acid and

the simultaneous formation of hydrocyanic acid was first observed by Erlenmeyer, who proposed titration with permanganate of potash as a method of determining sulphocyanides. The reaction which must be carried out in acid solution proceeds thus :—



Parker (Eng. Pat., 1888, No. 17,417, and 1889, No. 2383) found that a similar oxidation occurred on electrolysis, and he patented a process in which a current is driven through a solution of pure hydrocyanic acid or one of a soluble sulphocyanide in sulphuric acid solution. The HCN gas evolved must be collected and absorbed in alkali or utilised in other ways; a sulphate remains in solution.

Naturally such a process as this, in which large quantities of a poisonous gas have to be dealt with, is not very pleasant to work, and a simple removal of the sulphur by some metal with the direct formation of potassium cyanide is much more desirable.

Playfair (this Journal, 1892, p. 14) has investigated this subject and published the results he obtained.

In the first experiment he tried heating the sulphocyanide in a current of hydrogen or hydrocarbon gas, hoping by this means to remove the sulphur as SH_2 or CS_2 and to leave a residue of pure cyanide behind.

With hydrogen gas he found that 80 per cent. of the sulphocyanide was decomposed, but not altogether in the desired direction. The reaction which he found to occur was :—



i.e., by this method only half of the sulphocyanide, at the most, can be recovered as cyanide, and this 1, also, have found to be the case. With hydrocarbon vapours SH_2 was evolved as with hydrogen, but no trace of cyanide could be found in the product.

Playfair next tried reducing with carbon at a red heat; here a small amount of conversion occurred, but not sufficient to give any practical results.

He, therefore, next turned his attention to metals, and with these obtained much more satisfactory yields, and he has patented a process (1890, No. 7764) in which lead or zinc, separately or mixed together, are used.

He states in the Society's Journal that he has obtained with zinc an average yield of 70 per cent.; with lead the reduction is more difficult to effect, whilst with copper, tin, &c., only poor results are obtained.

I have examined the reduction of potassium sulphocyanide by means of lead and zinc by heating quantities, ranging from 40—100 grms., of potassium sulphocyanide with granulated zinc and lead scrapings respectively. The sulphocyanide was contained in a porcelain dish and the metal stirred well in, the temperature being about 400°C . As the reaction proceeded the insoluble metallic sulphide was seen to gradually form and separate out from the mass, but the reduction was a very gradual process, especially in the case of the lead, owing to the fused heavy metal sinking to the bottom of the containing vessel and thus preventing an efficient stirring being carried on.

In all cases from 70—80 per cent. of the sulphocyanide reacted upon was converted into potassium cyanide, but, working with the metals and KCNS in equivalent proportions, after 30 minutes' heating less than 10 per cent. of the sulphocyanide present had been reacted upon. To increase the rapidity of the decomposition it was sought to effect a more intimate mixture of the reacting materials. This could be done either by means of a more perfect mixing arrangement or by employing the metal in a very finely divided state. This latter method was adopted as being the more convenient of the two, and a number of experiments using zinc dust were made.

The zinc dust and sulphocyanide were well ground and mixed together and then heated cautiously in a crucible. The mass became pasty and frothed, and after a short time began to harden at the bottom of the crucible. When this stage was reached the source of heat was removed, and, maintaining a constant stirring, the reaction was allowed to extend to the rest of the mass, which became suddenly red hot and perfectly solid. The resulting product was in

all cases porous and capable of easy lixiviation. The yields varied with the amount of zinc used, and employing only the calculated quantity of zinc the reaction did not proceed quantitatively, as the following table shows:—

Theoretically 40 grms. KCNS require 25·8 grms. zinc for complete conversion.

KCNS.	Zinc Dust.	Per Cent. KCNS Converted to KCN.	Per Cent. KCN in Lixivated and Dried Product.
40	27	50·5	..
40	30	54·0	..
100	100	59·8	13·76
20	20	60·6	6·8
30	25	68·9	15·5

The poorer conversion obtained by using zinc dust compared with that from the granulated zinc is due to impurities in the dust, and also to the fact that some of the dust became oxidised before entering into the reaction with the sulphocyanide. Working in a reducing atmosphere would probably improve the results. In nearly all cases some sulphocyanide remained unattacked, and most of the preparations contained a fair proportion of cyanate.

When zinc and copper were used some of the metal went into solution in the form of a double cyanide; in some cases, when a large excess of zinc had been used, colourless crystals of $\text{Zn}(\text{CN})_2$, 2KCN would separate out from the liquors on standing.

It is practically impossible to remove the zinc completely from the finished product without causing a considerable loss of cyanide or introducing some other impurity, and it will be a matter of extreme difficulty, using this metal, to obtain a perfectly pure product.

With copper and sodium lead alloy a moderate decomposition was obtained; the products were, however, far from pure. In the one case, much copper had formed compounds soluble in water, and in the second, sodium sulphide was produced. Antimony and bismuth seem to be practically without action on the sulphocyanide.

The product obtained by lixiviating the raw cyanides obtained as above and evaporating to dryness the solution so obtained, gave a cyanide containing about 50 per cent. KCN. The solutions evaporated were at the start not pure, containing carbonate, cyanate, &c., and these salts possibly aided the decomposition of the cyanide, the loss of which, during the evaporating process, varied from 3 to 15 per cent.

This shows that a serious loss must be looked for here unless special precautions are taken. Playfair states that this loss may be entirely avoided by evaporating the solutions in a good vacuum, and it is better to have them as concentrated as possible at the start. It is also important to have no large excess of free alkali present, otherwise brown insoluble decomposition products are formed.

From Crowther and Rossiter's specification (Eng. Pat., 1891, No. 8365), it appears that it is necessary to have the sulphocyanide absolutely dry before treatment with the metal, and that simply heating the salt above its melting point is not sufficient, but that a current of some dry, indifferent gas, *e.g.*, nitrogen or carbon dioxide, must be blown for some time through the fused salt.

To obtain a cyanide free from zinc and products due to secondary decompositions formed on fusion with zinc, it has been attempted to convert the sulphocyanide into ferrocyanide, from which compound, either by simple heating or by fusion with metallic sodium or sodium lead alloy, a cyanide of fine quality is readily obtained.

Experience has taught that for a good reaction to take place between iron and sulphocyanides the following conditions must be observed:—

- (1.) The materials must be perfectly dry.
- (2.) The iron must be very finely divided.
- (3.) The substances must be intimately mixed.
- (4.) A reducing atmosphere should be maintained around the reacting mass.

Iron Powder.—This was prepared by well mixing 200 grms. of oxide of iron with 100 grms. of pitch, and heating

the mixture in a crucible for three hours at a temperature of over 1,000° C. The resulting mass, which contained 83 per cent. of its iron in the metallic form, was ground with a second 50 grms. of pitch and then heated as before for a further three hours. The iron present in the product of this second heating was wholly metallic.

The total iron was estimated by ordinary methods, and that present in the metallic condition was determined by titration of the ferrous sulphate liberated by addition of the powder to copper sulphate solution.

Formation of Ferrocyanide (Eng. Pat., 1893, No. 21,451).—20 grms. KCNS, 26 grms. Fe powder (60 per cent. Fe, 40 per cent. C.) 8 grms. pitch to prevent oxidation occurring, were well mixed and heated to about 400° C. for half an hour, being well stirred the whole time. The mixture on warming gave at first a thick fluid which became, on continuing the heating, gradually dry and solid. The reaction was discontinued when this stage was reached and the product tested for K_4FeCy_6 and KCNS.

K_4FeCy_6 formed 15·36 grms.	76·8
KCNS recoverable 3·64 grms.	18·2
Loss	5·0

In a second experiment, performed as nearly as possible under the same conditions, the yield of ferrocyanide was much less, amounting only to 48 per cent.; 40 per cent. of the sulphocyanide remained however in this case unattacked.

Calculated on the amounts of sulphocyanide decomposed the quantities converted to ferrocyanides were 93·9 per cent. and 80 per cent. in the respective experiments.

On heating the second product further, in the hope of increasing the yield, it was found that the whole of the sulphocyanide disappeared without any formation of ferrocyanide occurring; in fact the quantity of this substance present had diminished.

In an experiment in which the upper and lower portions of the product were analysed separately it was found that for every 100 parts KCNS originally present in the lower solid portion, 64·2 had been converted to ferrocyanide and 28·4 remained unchanged; and that in the upper, more granular part, only 26·5 had been converted to ferrocyanide, whilst 51·6 remained unchanged.

An attempt to convert the sulphocyanide into ferrocyanide by heating a concentrated aqueous solution with iron wire and the iron used in the foregoing experiments in a sealed tube entirely failed, no decomposition whatever occurring.

These experiments, and others, indicate that although a good conversion may occur under suitable conditions, the reaction proceeds very irregularly, and that its end point is difficult to determine—a too long continuation of the heating results in changes opposite to those desired.

A short account of the analytical methods employed might be of interest, one or two of the observations noted here being, I think, new.

It is to be understood that in all cases sulphides, if present, were removed by means of lead carbonate before the testing for cyanogen compounds was proceeded with.

KCN.—This was estimated in the usual way by titration with iodine in neutral solution or by decinormal silver nitrate in alkaline liquids.

In a paper recently published by Clennell (Chem. News, 72, 227), mention is made of the interfering action of ferrocyanides, &c. in the determination of potassium cyanide. His experience is borne out by my own experiments, and the error introduced seems to vary with the percentage of admixed ferrocyanide. It makes no difference whether the ferrocyanide is present at the beginning of the titration or whether it is only added after the milkiness in an ordinary cyanide titration has been reached; in this latter case the milkiness disappears on the addition of ferrocyanide and returns when more silver solution has been added. The magnitude of the error may be judged by the following titrations:—

25 c.c. KCN solution (5·25 grms. per litre) required to milkiness.	10·53 c.c. $\frac{N}{10}$ AgNO_3
25 c.c. KCN solution + 5 c.c. K_4FeCy_6 (10 grms. per litre) required to milkiness.	10·55 ..

25 c.c. KCN solution + 5 c.c. K_4FeCy_6 (10 grms. per litre) required to milkyness.....	10.55 c.c. $\frac{n}{10}$ $AgNO_3$
25 c.c. KCN solution + 10 c.c. K_4FeCy_6 (10 grms. per litre) required to milkyness.....	10.73 "
25 c.c. KCN solution + 10 c.c. K_4FeCy_6 (10 grms. per litre) required to milkyness.....	10.75 "

KCNS.—The method employed here was to add nitric acid and a little ferric sulphate solution, and to then titrate with silver nitrate solution until the red colour due to ferric thiocyanate vanished. The nitric acid must be free from the lower nitrogen oxides, which rapidly destroy the sulphocyanides, and the ferric chloride solution free from chlorides, which interfere with the reaction.

The colour change is sharp. Soluble ferrocyanides interfere with the precipitation of sulphocyanides by means of silver nitrate, and it is therefore important to precipitate them completely before titration, and when much Prussian blue is present the solution should be filtered.

Experiment has shown that silver sulphocyanide is precipitated before silver cyanide in acid solutions, whilst the reverse is the case when the solution is alkaline. It is thus possible by two silver titrations to find the amounts of these substances present in any sample. This may even be done in one portion of the solution, when the —CNS present is more than half the —CN. In this case the slightly alkaline solution is titrated to milkyness with $AgNO_3$ and is then acidified, and the titration continued, after the addition of ferric sulphate, with good stirring till the red colour vanishes.

25 c.c. KCNS solution required	11.20 c.c. $AgNO_3 \frac{n}{10}$
25 c.c. KCNS solution + 10 c.c. KCN solution required	11.85 "
25 c.c. KCNS solution + 10 c.c. KCN solution required	11.95 "
25 c.c. KCNS solution + 25 c.c. KCN solution required	11.95 "
25 c.c. KCNS solution + 25 c.c. KCN solution required	11.90 "

when the solution had been made acid at the start; when not made acid until after the KCN had been determined the readings were 11.8 and 11.9 c.c.

In a mixture containing KCN, KCNO, KCNS, and K_4FeCy_6 it was found possible to obtain rapidly satisfactory results (approximately, but not quite, accurate) by the following procedure:—

- (1.) Titration with silver nitrate to milkyness (KCN).
- (2.) Addition of potassium chromate (after neutralisation of the solution) and continuation of the silver titration to completion (KCN, KCNO, KCNS, K_4FeCy_6).
- (3.) Titration with potassium permanganate ($\frac{N}{2}$) in acid solution (KCNS + K_4FeCy_6).
- (4.) Determination of K_4FeCy_6 by precipitation as Prussian blue, and estimation of this in the usual way with potassium permanganate.

In conclusion, I wish to express my sincere thanks to Dr. Hurter for help in many ways, and kindness in placing certain of the results here given at my disposal, and also to the directors of the United Alkali Company, in whose laboratory the above work was carried out, for permission to read this paper.

Manchester Section.

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SESSION 1895-96.

Friday, February 7th, 1896:—

Dr. G. Grossmann. "Recent Developments in the Manufacture of Chlorates."

Mr. J. Barnes. "The Estimation of Organic Matter by means of Chromic Acid."

Meeting held on Friday, December 6th, 1895.

MR. GEORGE E. DAVIS IN THE CHAIR.

CONTRIBUTIONS TO THE ANALYSIS OF FATS.

V.—THE DETERMINATION OF UNSAPONIFIABLE MATTER.

BY DR. J. LEWKOWITZCH.

THE determination of the unsaponifiable matter in fats and oils appears to be very easy and the directions given in text-books seem to be simplicity itself. I have elsewhere (Chemical Analysis of Oils, Fats, and Waxes, &c., pp. 171, 172) compiled the most important methods under two heads, viz. (a) Extraction of the soap solution with ether or petroleum ether; and (b) Extraction of the dry soap with solvents. There are, however, cases in which the choice of the solvent is not a matter of indifference, and where it is necessary to use circumspection instead of trusting blindly to text-books. Such a case presented itself to me in the examination of a sample of shark liver oil and of some kinds of whale oil.

When using petroleum ether (carefully fractionated so as to exclude all portions boiling above $80^{\circ}C$.) for the extraction of the unsaponifiable matter, it was found that large quantities of soap were dissolved, so large, indeed, that the petroleum ether could not be distilled off easily on account of the violent frothing of the solution. It was, therefore, necessary to remove the dissolved soap by washing the petroleum ether with dilute alcohol (50 per cent.) before the amount of the unsaponifiable matter could be determined.

The results obtained with petroleum ether were very striking indeed; they were very capricious and differed enormously from those obtained by means of common ether. Whereas the latter solvent gave invariably about 10 per cent. of unsaponifiable matter, the petroleum ether yielded results varying from 1.38 to 3.73 per cent.

The second of the above-mentioned methods, viz., extraction of the dry soap with solvents, was then resorted to, but with no better result; large proportions were dissolved by the petroleum ether and had to be washed away by means of dilute alcohol.

No doubt this peculiar behaviour of the shark liver and whale oils is due to the nature of the unsaponifiable matter, which would naturally be assumed to consist of the aliphatic alcohol derived from the spermaceti dissolved in these marine animal oils. Evidently the alcohol is sparingly soluble in petroleum ether, and on treating the saponified oil with that solvent large proportions of soap are dissolved simultaneously with the unsaponifiable matter.

The same difficulty has been experienced by Allen in the case of beeswax, carnauba wax, and other substances

containing myricyl alcohol, which is but sparingly soluble in the cold solvent, and he recommends in such cases to neutralise the saponified mass exactly with acetic acid, using phenolphthalein as an indicator, and to precipitate with lead acetate. The precipitate is then washed, dried, mixed with sand, and boiled out repeatedly with petroleum ether.

I intend investigating more closely the cause of the peculiar behaviour of marine animal oils mentioned above, and have instituted two series of experiments comprising (1) the examination of mixtures of olive oil (and similar oils as regards the proportion of unsaponifiable matter) with varying proportions of spermaceti; and (2) the isolation of the unsaponifiable matter from shark liver oil and study of its solubility in the solvents employed usually.

It will be clear from the foregoing remarks that it is the safest to employ common ether for extraction, and the fear of continental chemists lest the results may be vitiated by dissolved soap can be easily allayed by using the precaution I have recommended some time ago, viz., to incinerate the unsaponifiable matter and determine the alkalinity of the residue, if any should be left.

In conclusion, it may be useful to point out, at the hand of a practical example, the pitfalls open to the analyst if due caution be not exercised. Suppose the shark liver oil has been saponified in the usual manner—giving the correct saponification value—and exhausted with petroleum ether: the amount of unsaponifiable matter will be found far too low, say, 1 per cent.

On acidulating the exhausted soap solution with a mineral acid, there would separate an oily layer supposed to consist of fatty acids. By weighing these, one would obtain, say, 96 per cent. So far everything would appear simple. On further examining the fatty acids, one would obtain an acid value leading to a very high molecular weight, and it would be but natural to draw the inference that the oil under examination contains fatty acids of abnormally high molecular weight. The true explanation, however, is that the separated oily layer consisted of a mixture of fatty acids and that portion of unsaponifiable matter which had not been extracted by the petroleum ether. The acid value would consequently be wrong, and all conclusions drawn from the wrong premises valueless.

CONTRIBUTIONS TO THE ANALYSIS OF FATS. VI.—WOOL-WAX.

BY DR. J. LEWKOWITZ.

SEVERAL years ago I published an inquiry into the constitution of wool-fat (Yorkshire grease), the nature of which had not been known till then in such completeness as to assign to wool-fat the place it should occupy in a natural classification of fatty substances. The results of that inquiry led unmistakably to the conclusion that that portion of natural wool-fat which I then termed neutral fat is a true wax in the strict sense this generic term implies. Natural wool-fat resembles beeswax, its closest relative, in that it contains a considerable proportion of free fatty acids and a small amount of free alcohols, besides true waxes, and the term "wool-wax" should therefore be substituted for "wool-fat." But, considering the fact that the waxy matter obtained from wool by extraction with volatile solvents contains notable proportions of potassium salts of fatty acids, and, further, considering that the commercial wool-fat is, as a rule, contaminated with fatty acids derived from the soap used in scouring the wool, it is more convenient to retain the term "wool-fat" for the commercial product. I propose, therefore, that the name "wool-wax" be given to the neutral portion of the wool-fat. This neutral portion consists of a mixture of a true wax and free alcohols, the former predominating considerably. The name "wool-wax" appears to me all the more desirable as this neutral portion of wool-fat is now obtainable in commerce in large quantities, both in the anhydrous and hydrated state (comp. Chemical Analysis of Oils, Fats, and Waxes, &c., p. 584), and confusion with the crude wool-fat is thereby avoided. Of course, it must be borne in mind that the various commercial preparations need not be

necessarily of uniform composition. In fact, wool-waxes of different origin vary within certain limits, much as other natural products do.

I have undertaken the examination of "wool-wax" with a view to elucidating the nature of its constituents, and although the results detailed below are very far from being complete, still I publish the results obtained hitherto, as I may not be able to conclude this work within the near future.

The wool-wax was dehydrated by melting and allowing the water to subside. The anhydrous wax was then dissolved in absolute alcohol and saponified by means of metallic sodium in a flask attached to an inverted condenser. The alcohol was distilled off and the mixture of soap and alcohols, whilst still warm, poured into water, with which it was shaken up until the temperature had fallen so that common ether could be added with safety. After vigorous shaking the mixture was allowed to stand for some days. It then separated into three layers, viz.:—

(1.) Ethereal layer on the top, consisting of the ethereal solution of the alcohols—unsaponifiable matter.

(2.) An aqueous layer on the bottom, being a solution of soap.

(3.) An intermediate thick layer, representing a soap sparingly soluble in water.

The ethereal layer was drawn off, washed well with water (which was later on added to 2 and 3), and the mixture of 2 and 3 exhausted with ether until no more unsaponifiable matter was extracted. Each portion was examined for soap. The first extractions yielded the unsaponifiable matter free from soap; later on, small quantities of soap appeared in the extracts, increasing in inverse proportion to the quantity of unsaponifiable matter. These were treated separately with warm water until free from ash before being united with the main portion.

Thus the alcohols—unsaponifiable matter—were obtained free from ash.

1. *Unsaponifiable Matter*.—The amount of unsaponifiable matter obtained was 51.84 per cent. It represented a very mucous substance of light yellow colour. The following constants were ascertained:—

Melting-point	46°–48° C.
Iodine number	26.35
Increase in weight on boiling with acetic anhydride	5.26 per cent.
Saponification value of the acetate	153.23

From the table given by me in this Journal, 1892, 138, and reproduced here—

	Increase on Boiling with Acetic Anhydride. Per Cent.
Cetylalcohol	17.2
Cerylalcohol	10.6
Cholesterol (or ischolesterol)	11.3

it will be seen that cetylalcohol must be almost absent. Further, we may conclude from the low iodine number that the proportion of the two cholesterol cannot be very large, the iodine value of cholesterol being 67.7 (this Journal, 1892, 143).

A method of separating aliphatic alcohols from the cholesterol seemed to be afforded by the behaviour of the former with soda-lime, when the alcohols are converted into the corresponding fatty acids. A few crucial experiments with sperm oil and pure cholesterol decided in favour of this method. On heating the sperm oil alcohols with soda-lime, the bulk of the alcohols were converted into fatty acids, only 4–6 per cent. of unsaponifiable (unchanged alcohol) being recovered. The crude fatty acid had the melting-point 38°–40° C., and the acid value 181.7.

On the other hand, pure cholesterol on being treated in the same manner gave 93 per cent. of unchanged cholesterol, even when the temperature was kept for two hours at 280° C. Only traces of an acid substance were obtained.

On subjecting the wool-wax alcohols to the soda-lime treatment, maintaining the temperature at 250° C., about 80 per cent. were recovered as unchanged alcohols and 6 per cent. of fatty acids, of the melting-point 51°–53° C., isolated from the soap solution.

I intend to treat larger quantities of the wool-wax alcohols in this manner, and to further study the nature of its components. It may be pointed out here that Marchetti has recently detected the presence of a new alcohol—lanolinalcohol, $(C_{12}H_{24}O)$ —in the unsaponifiable portion of wool-wax. The amount of this new alcohol in the mixture of the alcohols is stated to be 1 per cent.

2. *Fatty Acids of the Easily Soluble Soap.*—The separation of the easily-soluble soap from the solid soap, 3, was effected by filtration.

The soap solution was freed from the dissolved ether by distilling it off, and the fatty acids were then isolated in the usual manner by boiling. The amount obtained was 25.5 per cent. The colour of these acids was light reddish-brown.

The following constants were determined:—

Melting-point.....	52°5'—56°5' C.
Iodine value.....	9.95
Acid value.....	173.88
Saponification value.....	189.67
Ether value.....	15.79

The definite ether value points to the presence of lactones, as I have shown before (this Journal, 1892, 137).

A series of experiments was carried out to determine the degree of dehydration that takes place with increase of temperature; at the same time the change in the iodine value was ascertained. The results obtained hitherto merely show that above 120° C. the acids rapidly lose water, whereas the iodine value varies but little.

It then occurred to me that dehydration might take place the very moment the fatty acids were isolated by boiling the soap solution with mineral acid. Therefore, in another preparation of substance the ether was not removed by distillation but mineral acid was added to the cold solution and more ether added, so that the separated fatty matter was at once transferred to the ether, from which it could be recovered at a low temperature. The fatty matter thus obtained was *white* and gave the following constants:—

Iodine value.....	10.1
Acid value.....	168.22
Saponification value.....	192.82
Ether value.....	25.9

The ether value is in this case larger than before, and it thus becomes evident, that whereas the iodine value remained practically constant, on heating the acids with water—as it happens on liberating them from the solution on boiling—the lactones are partially converted into fatty acids.

There is no doubt that lactones are present, and the next step was to isolate the lactones. This was done by carefully neutralising the fatty matter with aqueous potash and exhausting the soap solution with petroleum ether. The fatty acids were liberated from the soap solution in the usual manner; if the separation of lactones from fatty acids was complete, the acid and saponification values of the acids should be identical. I actually found—

Acid value.....	194
Saponification value.....	193

The examination of the lactones led to the following constants:—

Iodine value.....	2.4
Acid value.....	1.5
Saponification value.....	174.63

It was therefore practically free from free fatty acids. The soap solution obtained from the lactones (anhydrides) by boiling with alcoholic potash was treated with a mineral acid to separate the fatty acid. The determination of the acid value of the latter was to show whether the lactones had been re-formed. The acid value of the substance was found 61.24, thus proving that lactones had been re-formed to a considerable extent.

3. *Fatty Acids of the Sparingly Soluble Soap.*—The fatty acids were at first liberated by boiling. They gave the following constants:—

Iodine value.....	6.95
Acid value.....	166.5
Saponification value.....	128.2
Ether value.....	21.7

In a second preparation the fatty acids were liberated in the cold in the same manner as described above. The isolated fatty matter is but sparingly soluble in cold ether or petroleum ether, and large quantities of the solvent had to be used to effect complete solution. The fatty substance thus obtained was white; its quantity was almost equal to that of the fatty acids from 2, amounting to 26 per cent. On examination, the following constants were obtained:—

Iodine value.....	3.9
Acid value.....	86.16
Saponification value.....	135.86
Ether value.....	49.70

This portion of the wool-wax contains therefore a larger amount of lactones than that dealt with under 2.

The fatty substance was then separated, in the manner described above, into (a) fatty acids, and (b) lactones.

The fatty acids (a) gave the following constants:—

Iodine value.....	1.85
Acid value.....	131.38
Saponification value.....	141.8
Melting-point.....	65°—66° C.

It will thus be seen that either the separation had not been complete, or, what is more likely, judging from some experiments, that further formation of lactones had occurred on decomposing the soap.

The lactones (b) had the following constants:—

Iodine value.....	8.69
Saponification value.....	115.0

On separating the fatty matter from the alcoholic soap solution by acidulating with a mineral acid, lactones were re-formed to a varying extent in various experiments; but this much was established with certainty, that the re-formation of lactones in this portion of the wool-wax took place to a very much smaller extent than in the corresponding portion of 2.

It would be premature to draw any conclusions from these incomplete experiments, which I publish here but with reluctance. However, some useful purpose may be served if I have succeeded in showing that the composition of wool-wax represents perhaps the most interesting amongst the many unsolved problems in the chemistry of fats and waxes.

Meeting held on Friday, January 3rd, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

ON SOME NEW METHODS OF TESTING INDIGO.

BY DR. B. W. GERLAND.

THE number of methods described for analysing indigo is considerable; but of all these not one is known which is reliable, and the only way left to arrive at an approximate valuation is swatch dyeing. This is all the more surprising in consideration of the great value of indigo as a commercial article. The analytical method most relied on is the reduction process, and weighing of the recovered indigotine, although it has been repeatedly shown that part of the indigotine is lost; and recently I have convinced myself that the indigotine recovered and weighed in this process is impure. Some time ago I was anxious to ascertain the precise amount of indigotine on a piece of calico, and followed most carefully the rules given for this method, but obtained very inconsistent results. Moreover, the indigotine obtained was very impure, in fact, to such an extent that it could not be titrated by hydrosulphite by the Berthsen-Müller process. With similar results I applied the reduction process to commercial indigo. In conversation with

several chemists who are chiefly engaged in indigo testing, I stated these facts, but found that their implicit faith in this method remained unshaken. Through the courtesy of some of them I obtained samples of the indigotine weighed, and found these to be as impure as my own preparations. It is not impossible that by some lucky chance this method may occasionally give correct results as loss and gain may compensate.

These experiences induced me to endeavour to find a more reliable process, and I directed my attention to the well-known property of indigotine to enter into solution with several carbon compounds at high temperatures, and to crystallise on cooling.

Of all these solvents tried nitrobenzol appeared to be in all respects the most suitable. The article prepared on the large scale is of great purity, certainly pure enough for this purpose. The early trials yielded crystals, but they took several days for extraction and were not therefore very encouraging. By degrees, however, the apparatus was perfected and simplified, and with this I can now effect the complete extraction in from half an hour to one hour.

The apparatus consists of a large test tube 10 mm. diameter and 15 to 20 cm. long, clamped in a retort stand above a burner; a glass tube of 7 to 8 mm. inside diameter and about 50 cm. long serves as a reflux condenser. Its lower end is ground off obliquely, and has glass knobs fused to it to secure the wire hook, on which is suspended the filtering tube. This tube is formed of thin glass tubing about 20 mm. diameter, and 4 to 4.5 cm. long, both ends slightly belled out. Over the lower one a piece of fine calico is wired, upon which a few drops of fine paper pulp are placed, this, after drying, forming a serviceable filter. The cloth is protected against the squirts of the boiling nitrobenzol by a small shield, such as the lid of a porcelain crucible. The upper end is tied with thin wire, which allows it to be connected to the hook of the condensing tube. The latter passes through a glass funnel, whose tail has been cut off, resting on the top of the test tube. The condensing tube is held in a central position to the test tube by means of a cork, through which it passes loosely, so as to allow it to slide up and down, and which is held in a clamp. Lastly, the condensing tube is connected with an aspirator drawing a gentle current of air during the operation.

The ground sample of indigo is weighed into the filtering tube, this is hooked to the condensing tube, and the latter fastened in its position centrally to the large test tube, so that the filter is about 6 cm. above the bottom of the test tube. The latter is charged with about 25 c.c. of nitrobenzol, the lamp is lighted, and the aspirator set to work. The function of the latter is highly essential. It draws the vapours of the boiling nitrobenzol, which, without it, would condense on the sides of the test tube and escape between its mouth and the covering funnel, and conveys the condensed liquor into the filtering tube. It also carries off the steam from the water, which otherwise would condense and fall into the filter tube, causing explosions. By a careful regulation of the aspirator and the heat no nitrobenzol vapours escape into the room, and the test tube is fully supplied with condensed liquor. The vapours of the nitrobenzol do not rise in the tube above 20 cm. With 0.5 gm. of indigo and 25 c.c. of nitrobenzol the extraction requires from one half to one hour, during which time the aspirator discharges about 2 litres of water. Crystals separate at an early stage, but with regular boiling the operation is not interfered with by bumping. When the droppings from the filter tube are colourless the extraction is complete: the lamp is removed and the apparatus cooled and dismantled.

The indigotine has separated in beautiful crystals in a deeply coloured liquor, and only a very small portion remains in solution. To save the trouble of recovering this I use the nitrobenzol saturated with indigotine in the cold. The liquor is passed through an extracted weighed filter, washed with benzol and dried. The beautiful appearance of the indigotine thus separated is deceptive. It still contains impurity amounting to from 3 to 6 per cent., and is not fit to be tested by the Bernthsen method, owing to the deep colouration. A prolonged treatment with hydro-

chloric acid, or, better still, hydrochloric acid and hydrogen peroxide, leaves it in a pure state fit for weighing or testing with hydrosulphite. The indirubine being slightly more soluble in cold nitrobenzol than indigotine it is to be apprehended that a small loss cannot be avoided in the simple manner as was done for indigotine. This loss may possibly amount to 0.1 or 0.2 per cent. on the colouring matters.

With this slight exception the method is thoroughly reliable and trustworthy and is applicable to all classes of indigo.

Estimation of Indigotine by the Monosulphonic Acid Method.

Endeavouring to have a method free from the objection just mentioned I have turned my attention to the phenicic acid and its property of being insoluble in dilute sulphuric acid. In the literature accessible to me, no statement is made about any process according to which the whole of the indigotine can be entirely transformed into the monosulphonic acid, nor any about the effect of weaker sulphuric acid on indigotine. I have ascertained that by acting with vitriol of a certain strength, and at a certain temperature, on indigo, the whole of the indigotine is converted into monosulphonic acid, so that by dilution with water the whole of the indigo is separated and the filtered liquor is colourless or pale yellow. It is necessary to observe carefully a certain relation between strength of sulphuric acid and temperature. For 0.5 gm. of indigo I use 40 c.c. sulphuric acid of specific gravity 1.67 and digest under repeated shaking for an hour in the boiling water bath. The large excess of sulphuric acid assists the subsequent filtration over the sand filter, which, with less sulphuric acid, would require to be steam-jacketed. Filtration is easily accomplished on the vacuum filter, and washing of the latter is performed with acids of the same strength heated to 100°. With proper manipulation the exhaustion of the filter is accomplished with about 40 c.c. more of the acid when the washings have become colourless. If an acid of greater specific gravity than 1.67 is used, for instance 1.7 sp. gr., digestion has to take place at a temperature of about 80°, as in the boiling water bath soluble sulphonic indigo acid would be formed. If an acid of less specific gravity than 1.67 is used the difficulties of filtration are increased. The filtrate is mixed with twice or thrice its volume of water and filtered. This filtrate is pale yellow, or with indigo prepared, as subsequently described, quite colourless, without a trace of blue in it. The monosulphonic acid remaining on the filter is washed with water containing 20 per cent. of sulphur trioxide. Boiling water dissolves this indigo sulphonic acid only partially, leaving a small amount of indigo or indigotine compound undissolved. For this reason I prefer to carry out this operation on a sand filter, dry the whole in an oven, add strong sulphuric acid, digest at about 100° for some time and remove the indigo, which is now entirely changed into the indigo disulphonic acid, from the filter by water. An aliquot part of the filtrate is then submitted to titration. My hope of being able to estimate the indigotine corresponding to the sulphonic acid by the hydrosulphite method was not realised; the neutralised solution of the sulpho acid took such a dark colour that the point at which the blue disappeared could not be sharply ascertained. It is surprising how, probably, the same impurity of commercial indigo sticks to the indigotine and its compounds when treated by the reduction method, the nitrobenzol extraction method just described, and this monosulphonic acid method. Thus Bernthsen's (August Bernthsen, *Berichte* XLII., 2277) titration of indigotine with hydrosulphite, one of the sharpest volumetric methods, is made unavailable for commercial indigos unless they have been previously submitted to an elaborate and troublesome purification. I leave it at present an open question whether the substance separated by this process is the phenicic acid of Berzelius or a new acid. I hope to finish the examination of it shortly.

So far the readiest way that I have been able to find for overcoming this difficulty has been treating the sample of raw indigo with hydrogen peroxide and hydrochloric acid, digesting some time in cold, boiling, filtering, and washing well with boiling water or weak soda solution.

After the drying of the sample thus prepared, the described treatment with weak sulphuric acid yields the sulphonic acid sufficiently pure to give good results with the Berthsen titration method. The apparatus I have used for this titration is very similar to that described by Fiemann and Preuss (Berichte XII., 1768) for the estimation of oxygen in water, and adopted by Berthsen for the titration of indigotine. It consists of:—

1. The laboratory vessel—a Woulff's bottle with three necks, of 300 to 500 c.c. capacity, standing in a white vessel with water kept at 45° to 50°. The corks are perforated for six tubes, the entrance tube for the gas free from oxygen, cut off level with the cork, the exit tube for the gas, the syphon-tube reaching to the bottom of the bottle for emptying the liquor, the tube of a tapped funnel and two tubes for two burettes.

2. Two burettes connected with the latter tubes by means of long india-rubber tubing to allow shaking of the bottle. One is charged with indigo solution, the other is for the hydrosulphite.

3. The store bottle, which I choose of large size—two litres—to minimise the effect of a possible remnant of oxygen in the gas. It communicates with the lower end of the burette by means of a glass tube and india-rubber with pinch-cock, and is placed sufficiently high to fill the same.

4. A store bottle for boiled water kept at about 45° to 50°.

Illuminating gas passed through a column of pumice charged with ferrous hydrate (amalgamated aluminium would probably be more convenient) is divided into three branches, one for the laboratory vessel, one for the hydrosulphite burette and store vessel, and the third for the boiled water store vessel. All the gas exits dip 1 to 2 cm. under water, so that these parts of the apparatus are constantly kept under that pressure.

To begin operations the laboratory vessel and hydrosulphite burette are filled with gas free from oxygen. The store vessel is filled with the hydrosulphite solution and shaken. The burette is repeatedly filled and emptied into the laboratory vessel until the oxygen has been all absorbed and the solution in the burette is of uniform strength with that in the store vessel. The liquor in the laboratory vessel is brought to the neutral point by allowing the indigo solution from the other burette to run into it. It is emptied through the syphon and rinsed with boiled water through the tapped funnel. The apparatus is now ready for standardising the hydrosulphite against the standard copper solution or against the standard indigo solution and for titrating the sample. These measured volumes are introduced through the tapped funnel, and this is rinsed with boiled water.

The mounting of the apparatus is troublesome, but when once it is set up any number of tests can be done with very little more trouble than an ordinary titration, and, as compensation, we have results which are thoroughly reliable. The indirubine is estimated as indigotine. The results obtained by this hydrosulphite acid method are about 0.3 to 0.4 per cent. of the indigotine higher than those obtained by the nitrobenzol method above described. This I attribute to the small loss of indirubine there pointed out.

Nottingham Section.

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Meeting held on Wednesday, January 8th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

ON SOME PROPERTIES OF FERRIC PHOSPHATE.

BY R. M. CAVEN, B.Sc. (LOND.), A.I.C.,

Lecturer and Demonstrator in Chemistry, University College, Nottingham.

IN analysing the ash of the root of a ginger containing a fair amount of phosphoric acid combined with iron, aluminium, calcium, magnesium, &c., I was anxious, if possible, to ascertain the method of distribution of the PO_4 radicle among the metallic radicles present. With this object in view, I consulted one of the several phosphate tables which profess to indicate the presence of certain metals as phosphates. With the precise significance of the expression "presence of Fe, &c., as phosphate," I am not, in the present paper, concerned; suffice it to say that once the solution of a complicated mixture of phosphates is effected by means of an acid (e.g., dil. HCl) it is then impossible by any known analytical methods to discover how the phosphoric acid in solution was originally distributed throughout the solid substance.

If NH_4HO is added to an HCl solution of a mixture of phosphates, the PO_4 radicle will be precipitated in conjunction with metals which form phosphates insoluble in the supernatant liquid present, i.e., dilute NH_4HO solution together with soluble salts.

The distribution of PO_4 in this precipitate does not necessarily bear any relation to its distribution in the original solid substance; in fact the PO_4 radicle acts apparently as a free ion in the liquid, and in the presence of NH_4HO attaches itself to those metallic ions present which will form insoluble precipitates by union with the PO_4 radicle.

In what way the PO_4 will distribute itself between the various metals present capable of forming insoluble salts, and whether the proportions of the insoluble phosphates originally present in the solid state will, as a general rule, have any influence as regards the reprecipitation of these salts from solution, is a question upon which I cannot pronounce any definite opinion. To state the problem in a general way we may say that the active masses of all the ions present must be considered as affecting the result; and during precipitation these active masses are rapidly changing by the removal from participation in the changes going on of the matter precipitated.

Hence the solubility of the various phosphates which could theoretically be formed will have a great influence upon the proportions in which the insoluble phosphates will be present in the precipitate in any particular case. The affinity coefficients of the various ions will have little or no influence in this as in other cases of precipitation. Whether there is any predisposing tendency for reprecipitation of phosphoric acid in conjunction with the metallic ion with which it was originally combined in the solid state,

or whether the PO_4 radicals are free to rearrange themselves in an entirely new fashion, would seem, however, to be answered, in part at least, with regard to iron by the following experiment.

If FePO_4 is digested with cold, dilute HCl and the excess of FePO_4 removed, after a short time, by filtration, a solution is obtained which is almost colourless. If strong HCl is then added to this solution a bright yellow colour is produced, similar to the colour of a solution of FeCl_3 in water. If H_2SO_4 is substituted for HCl , and the experiment performed as before, little or no change of colour is produced on adding the strong acid. The most obvious interpretation of these facts is that it is possible to make a solution of FePO_4 in a dilute acid in which the double decomposition with the production of free H_3PO_4 does not take place to any extent, and that on addition of excess of acid, the latter acts by virtue of its mass so as to bring about the double decomposition.

The yellow colour with HCl in excess will then be due to the formation of FeCl_3 , and little change of colour is noticed with strong H_2SO_4 , because $\text{Fe}_2(\text{SO}_4)_3$ is nearly colourless. The yellow colour may be produced in the H_2SO_4 solution, even after the addition of strong acid by adding a large excess of strong HCl . We must then suppose that the pale solutions of ferric phosphate and sulphate which can be obtained, do not undergo dissociation with the liberation of ferric ions, or revert to the old view that the colour of the solution is simply that of the dissolved substance. This would certainly seem to offer a better explanation of the colours of the solutions of bright yellow ferric chloride, and pale ferric phosphate and sulphate, respectively.

This, however, does not touch the main question of the independence of the ions as regards precipitation purposes, because decompositions of salts and fresh combinations may take place to a large extent in the act of precipitation; as, indeed, we represent them as taking place, by means of the ordinary equations.

The ash which I examined contained a considerable quantity of iron as well as phosphoric acid, and on adding NH_4HO to the HCl solution I obtained a precipitate containing, among other things, ferric phosphate (FePO_4).

In considering the problem of the way in which the iron existed in the original substance and also in the precipitate by NH_4HO , I was led to investigate the properties of ferric phosphate rather carefully; and the results which I now lay before you are the outcome of observations of my own, supplementary to, and in extension of, the work of others on the subject.

The following is the information with regard to the properties of FePO_4 which I have been able to gather from various sources. FePO_4 is said to be only partially precipitated from acid solution by NH_4HO , and the reason attributed is that unless excess of iron is used, a phosphate will be formed which dissolves in ammonium hydrate. On the other hand, FePO_4 is soluble in excess of FeCl_3 , so that the complete precipitation of phosphoric acid in ammoniacal solution by iron is interfered with both by excess of NH_4HO and of FeCl_3 . *Rammelsberg* (Watts' Dict., 1877 Ed., art. *Phosphates*) found that on boiling FePO_4 with ammonia, a basic phosphate, containing an excess of iron, was formed, and he assumed from the fact that this basic phosphate did not appear to be constant in composition, that it consisted of a mixture of $\text{Fe}(\text{OH})_3$ and FePO_4 .

In order to test these conclusions and see what bearing they had upon the precipitation of FePO_4 by ammonia, I proceeded to prepare some FePO_4 in as great a state of purity as possible. In several attempts which were made to prepare FePO_4 , some curious results were obtained. In one case a certain quantity of a solution of FeCl_3 of known strength, from which free HCl was carefully excluded, was added gradually, and with constant stirring, to an equivalent quantity of $(\text{NH}_4)_3\text{PO}_4$ solution contained in a porcelain dish. A white precipitate of FePO_4 formed at first, and seemed to increase up to a certain point, after which the precipitate commenced to re-dissolve in the liquid, until just about at the point when the equivalent quantity of iron solution had been added, the precipitate disappeared altogether, leaving an almost colourless solution, containing

nothing but FePO_4 and NH_4Cl in approximately equivalent quantities. It was hoped that on evaporating this solution down, the FePO_4 would be recovered, but although at a certain stage small crystals made their appearance, no distinct precipitation occurred until near dryness, when the residue contained a considerable quantity of FeCl_3 , and was useless.

The idea of precipitating equivalent quantities of Fe and PO_4 was not however, abandoned, and the precaution of adding a solution of $(\text{NH}_4)_3\text{A}$ acidified with H_2A , in which FePO_4 is insoluble, was resorted to. The FePO_4 was produced as a white precipitate on mixing equivalent quantities of the iron and phosphate solutions, and this was washed with hot water until the washings were free from chlorine. A lot of PO_4 appeared in the wash water, and only a trace of iron. The precipitate was dried, and appeared dark coloured, as if contaminated with Fe_2O_3 . On ignition, the mass went dark red, and appeared like Fe_2O_3 , so that we may consider that the original precipitate was basic, or else underwent considerable decomposition during the process of washing.

The method which was found most satisfactory was as follows:—

FeCl_3 solution was added to a solution of H_3PO_4 —made by boiling glacial metaphosphoric acid with water until it ceased to give a precipitate with BaCl_2 solution—in such proportions that rather more than twice as much H_3PO_4 was present as was necessary to precipitate the iron. The precipitate thus obtained appeared, when suspended in water, perfectly white, and when strained on calico had a slightly bluish tint.

The first filtrate contained, as might be expected, much PO_4 and a trace of Fe . The precipitate was washed repeatedly with hot water in a large beaker of about 2 litres capacity, the supernatant liquid being removed in each case, when the precipitate had subsided, by means of a siphon. Careful experiments were made this time in order to verify the apparent decomposition of FePO_4 by water. The parts per 1,000,000 of chlorine and acidity, reckoned as HCl , in the three final washings, were as follows:—

Chlorine.	Acidity as HCl .
10	7
12	29
2	14

Thus the ratio of acidity to chlorine as chlorides increases rapidly as washing proceeds. Moreover, not a vestige of iron appeared in any of the final washings. These facts therefore establish beyond doubt the *hydrolysis* of FePO_4 by hot water, and explain the high percentage of iron found in former specimens of FePO_4 , which had been carefully washed and gently ignited until they ceased to lose weight. The percentages of iron found in two samples were respectively 43.02 and 43.52, whereas the theoretical percentage for $\text{FePO}_4 = 37.08$.

Having established the fact of the slow hydrolysis of FePO_4 by water, it is natural to expect that more powerful agents, viz., aqueous alkalis, would also effect the decomposition, and such is actually the case. Mention has already been made of the fact that *Rammelsberg* obtained a basic phosphate by boiling FePO_4 with NH_4HO . I have found that by continued boiling practically all the PO_4 may be extracted and $\text{Fe}(\text{OH})_3$ left behind, according to the reaction $\text{FePO}_4 + 3\text{NH}_4\text{HO} = \text{Fe}(\text{OH})_3 + (\text{NH}_4)_3\text{PO}_4$.

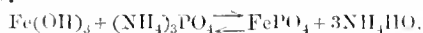
The results obtained were:—

Estimated percentage Fe in FePO_4	43.0
Percentage Fe calculated from $\text{Fe}(\text{OH})_3$ obtained....	43.6
Estimated percentage PO_4 in FePO_4	59.3
Percentage PO_4 obtained from solution after boiling....	58.3

The achievement of the above reaction depended upon the presence of a large excess of NH_4HO , and this reagent was renewed at intervals, during the process of boiling, which lasted many hours. The reaction is only completed by the agency of a large excess of NH_4HO , because in the

presence of a soluble phosphate the reverse change takes place, viz., $\text{Fe}(\text{OH})_3 + (\text{NH}_4)_3\text{PO}_4 = \text{FePO}_4 + 3\text{NH}_4\text{HO}$.

To prove this I boiled freshly precipitated $\text{Fe}(\text{OH})_3$ suspended in water with $(\text{NH}_4)_3\text{PO}_4$ in a porcelain dish. A strong smell of NH_3 gas was perceived and the colour of the precipitate rapidly changed from reddish-brown to yellow, and after an hour's boiling the suspended matter presented exactly the appearance of freshly precipitated FePO_4 , so that the reaction is reversible and we may write it thus:—



The direction which the reaction takes depends, as in other reversible reactions, upon the active masses of the constituents, and the formation of ferric phosphate from the hydrate is easier and speedier than the reverse process, because the latter is largely prevented by the removal of the volatile NH_4HO as soon as formed in the process of the reaction. On the other hand, the difficulty of bringing about the formation of ferric hydrate from phosphate is accounted for, also, by the volatility of the NH_4HO , which is required to be in excess, and by the presence in the solution of all the $(\text{NH}_4)_3\text{PO}_4$ formed during the decomposition.

Ferric phosphate dissolves in NH_4HO to a brown solution, which is decomposed with the deposition of $\text{Fe}(\text{OH})_3$ on further heating with NH_4HO , and $\text{Fe}(\text{OH})_3$ dissolves in $(\text{NH}_4)_3\text{PO}_4$, forming a solution which deposits FePO_4 with the evolution of NH_3 on further boiling. So that the formation of complex mediating solutions, seems to play a part both in the direct and the reverse reaction, though this phenomenon is relatively unimportant, since most of the solid matter never enters into solution.

DISCUSSION.

Mr. Wood said that Mr. Caven's discovery of the washing out of phosphoric acid by water from ferric phosphate would certainly be of great interest both to analytical and technical chemists. Although it seemed to be known that the analysis of this body was not capable of great accuracy, it was not known why this was so. It was to be hoped that all new editions of analytical tables and text books would give the general analyst the benefit of Mr. Caven's discovery.

The CHAIRMAN remarked that Percy had verified in his laboratory the statement of Pierre that water saturated with CO_2 dissolves nearly $\frac{1}{1000}$ of its weight of phosphate of protoxide of iron. Mr. T. Phillips, who conducted the investigation in Percy's laboratory, found that when saturated with CO_2 at the ordinary pressure of the atmosphere, water dissolves 0.54 part by weight of the phosphate in 1,000 parts of solution, which is little more than half of what had been previously looked upon as correct. He would like to know whether Mr. Caven had had any experience of this solvent.

Mr. LOXLEY MEGGITT said that one inference to be drawn from Mr. Caven's interesting paper was that in the estimation or precipitation of iron as phosphate the solution after the addition of ammonia should be boiled no more than was necessary, or else partial decomposition of the ferric phosphate might occur. He had always understood that in the precipitation of iron as phosphate from any phosphatic material, ammonia should only be added in slight excess. It appeared from Mr. Caven's paper, if too large an excess of ammonia were added the reverse reaction was apt to take place, in which the precipitated phosphate would be converted into ferric hydrate and ammonium phosphate. It was stated by Mr. A. Smetham in J.S.C.I., 1893, page 114, that unless an ammonium salt be used in washing a double precipitate of iron and aluminium phosphate, there was a tendency for the precipitate to split up into a basic phosphate, and a portion of the iron and alumina might wash through the filter. The most accurate method of precipitation of iron as phosphate was to add ammonia in slight excess to the cool hydrochloric acid solution of the substance, then add HCl drop by drop until the liquid was again quite clear, and then sufficient ammonium acetate to convert the HCl into ammonium chloride, stir well, let stand some time,

filter, and wash, first with cold water and finally with hot. (J.S.C.I., 1893, page 115.)

Mr. R. M. CAVEN said, in reply, that Fresenius had mentioned that the estimation of phosphoric acid as ferric phosphate was liable to be inaccurate, owing to the solution of the precipitate in the wash water. His own opinion was that ferric phosphate was insoluble in water, but that it suffered hydrolysis by continued washing, since while phosphoric acid continually made its appearance, he did not find in his experiments that iron appeared in the wash water. If FePO_4 were dissolved unchanged the residue would not be basic, and Fresenius noticed the alteration in composition of the precipitate by continued washing.

He was of opinion that this method of estimation of iron or phosphoric acid was necessarily inaccurate, because of the apparent impossibility of freeing the precipitate from dissolved salts, without at the same time decomposing it. He had had no experience of the action of carbonic acid on ferrous phosphate.

A METHOD OF SILVERING GLASS.

BY J. T. WOOD.

Mr. J. T. WOOD, the hon. local secretary, exhibited a simple process of silvering glass, which he had used many times for silvering the speculum of an astronomical telescope. The first process for silvering glass was that of Liebig, a description of which would be found in Roscoe and Schorlemmer's Chemistry, Vol. II., pt. I., p. 363. Other processes were the Rochelle salt, Brashear's, Petitjean's, and Martin's process (Monthly Not. R.A.S., Dec. 1875).

The present process was in the English Mechanic, Vol. LIX., p. 85. With care it gives very certain results and good films.

The subject of thin mirror films having recently come up before the Liverpool Section, he thought a practical illustration might interest the members.

Mr. Wood took a solution of silver nitrate, strength 1 grm. to 20 c.c., to which strong ammonia was added until the precipitate just re-dissolved. A solution of potash was then added, the weight of the KOH being exactly equal to the silver nitrate.

The precipitate formed was again dissolved in ammonia, the addition of ammonia being stopped before the whole of the precipitate was dissolved and the solution filtered. To the clear filtrate nitrate of silver solution was again added till the liquid had the colour of weak tea. The glass to be silvered was placed in a shallow dish, and so supported as to be raised half an inch from the bottom; distilled water was then poured into the dish until it reached the lower surface of the glass.

The glass was raised and the solution as above prepared mixed thoroughly with the distilled water. (The strength of the silvering solution was calculated so that 1.4 grm. silver nitrate = 100 c.c. water.)

A solution of dextrose of half the weight of silver nitrate was added, and the glass replaced. The dextrose slowly retaced the silver and a very perfect mirror was produced in 15 to 20 mins. It was explained that one of the chief elements of success is that the surface of the glass to be silvered should be chemically clean.

Mr. Wood exhibited a 10-in. speculum thus silvered.

Scottish Section.

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Hon. Secretary and Treasurer:

J. Stanley Muir, Chemical Laboratory, The University, Glasgow.

SESSION 1895-96.

Tuesday, February 4th, 1896, at the Philosophical Institution, Edinburgh.—Mr. D. B. Dott. "Opium Assaying."

Meeting held in the Philosophical Society's Rooms, 207, Bath Street, Glasgow, on Tuesday, January 14th, 1896.

DR. JOHN CLARK IN THE CHAIR.

A METHOD OF OBTAINING THE SPECIFIC GRAVITY AND POROSITY OF COKE.

BY W. CARRICK ANDERSON, M.A., F.R.S.

THE determination of the true specific gravity of coke is a tedious operation, owing to the difficulty of removing the occluded gases from the pores.

The only method I have been able to find on record is that used by F. P. Dewey in determining the specific gravity and porosity of American cokes, which he describes in "Iron" of 22nd October 1883 (Vol. XXII., p. 376). That method is, shortly, as follows:—Suitable specimens (of from 20—40 grms.) are selected, brushed free from dust, dried, and weighed in air. They are then filled with water by being allowed to soak for 12—24 hours, afterwards placed under the receiver of an air-pump, from which the air is exhausted from three to five times, then boiled for three hours in water, and finally exhausted again at intervals till air-bubbles cease to come off. To make sure that saturation is complete, the exhaustion is repeated six to eight times. The saturated specimens are weighed first in water, and thereafter the water is allowed to run off as completely as possible, and they are then rapidly weighed in air. These three weighings furnish the data necessary for calculating the apparent specific gravity, the real specific gravity, and the porosity or percentage volume of pores.

If p = weight of dry coke in air,

q = weight of saturated coke in air,

r = weight of saturated coke in water,

S_1 = the apparent specific gravity,

S_2 = the real specific gravity (specific gravity of the particles),

C = the percentage volume of pores (porosity),
Then—

$$S_1 = \frac{p}{q - r}$$

$$S_2 = \frac{p}{p - r}$$

$$C = \frac{q - p}{q - r} \times 100$$

An objectionable feature in this process is the weighing of the coke with a necessarily variable amount of adhering water, which, moreover, evaporates continuously during the operation. There is the further drawback that it is not possible to get a result in this way in less than 24—36 hours, and it was principally to shorten the time required that I was led to adopt the following plan. The time occupied by my process is about $3\frac{1}{2}$ hours. An average sample of coke is prepared, and of this 45—50 grains ($3-3\frac{1}{2}$ grms.), previously ground in a Wedgwood mortar to a condition resembling fine sand, and dried, is weighed out in a dry tared specific-gravity bottle. The sample is then covered with about an inch of water, and the bottle is placed in a beaker of water kept at a temperature of 90° — 100° C. The neck of the flask is attached by a tube to a Bunsen water-pump with a good supply of water, and the air exhausted. The exhaustion is kept up for $2\frac{1}{2}$ hours, a gentle ebullition being meanwhile maintained. The tube is then detached, the bottle filled up with water, subsequently brought to the correct temperature, dried, and weighed.

Weight of dry sample.

Sp. gr. = $\frac{\text{Weight of (bottle + sample + water-content of bottle) - Final weight of (bottle, sample, and water required to fill)}}{\text{Weight of dry sample}}$

To test the accuracy of the method, six samples of coke were taken, of the following composition before drying:—

	A.	B.	C.	D.	E.	F.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	0.20	0.21	0.19	0.63	0.17	0.53
Ash	8.06	6.07	5.10	8.69	7.25	8.43
Volatile matter	0.50	0.35	0.30	0.47	0.71	0.57
Fixed carbon ..	91.24	93.37	94.41	90.21	91.87	90.47
Sulphur	100.00	100.00	100.00	100.00	100.00	100.00
	0.79	0.90	0.92	1.07	1.79	1.23

In the following table the first set of figures gives the specific gravities found for these samples by the method described above; the second set, the results got by exhausting similarly powdered samples with an air-pump, as described by Dewey. The third set contains results got for some of the cokes by Dewey's method, using the samples in small fragments:—

	A.	B.	C.	D.	E.	F.
Real specific gravity got by new method	1.838 1.842 1.837	1.818 1.820 1.818	1.841	1.846	1.889	1.879 1.878 ..
Real specific gravity got by air-pump method (with powdered samples)	1.847 ..	1.832 ..	1.840 ..	1.850 ..	1.891 1.891	1.879 ..
Real specific gravity got by Dewey's method (with fragments) ..	.. ..	1.623 1.626	.. ..	1.700 1.660	1.703 1.699	1.730 1.728

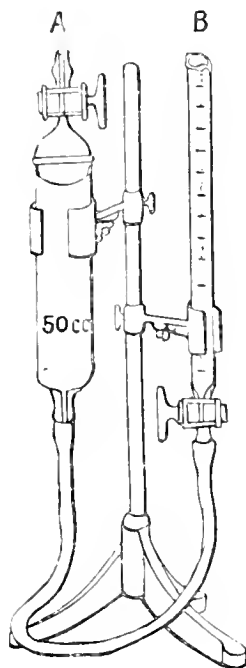
¶ The last set of figures was got after the fragments of coke had been soaked for 24 hours, then placed in water under the receiver of air-pump for 18 hours, and afterwards boiled and exhausted alternately, and allowed to soak until they had been altogether seven days under water. Finally, they were exhausted under water with a Bunsen pump for two hours. The fact that the results thus obtained are uniformly much lower than those got by powdering the samples, seems to point to the existence of water-tight

vesicles in the coke, which prevent its complete saturation. The researches of Dr. W. Thörner (Stahl und Eisen, Vol. VI., pp. 71—83) have been held to show (Mills and Rowan, "Fuel") that, "whereas charcoal consists of a large number of more or less regularly arranged cells, which are joined to one another longitudinally, coke contains generally separate unconnected cells, or groups of cells, the walls of which are composed of a dense and vitreous mass which does not admit of the passage of gas through it."

The results of a series of experiments I have made on various coals in fragments seem to confirm the latter statement, and to lead to the conclusion that it is impossible in this way to remove all the gases from the pores.

The figures got above are sometimes called the "apparent specific gravities" of the samples, but it seems more correct to call such results the "real specific gravities," seeing that they give the true specific gravity of the coke particles; and this title I have given them throughout.

To ascertain the percentage volume of pores in a coke sample, or the volume of the pores in 100 parts by weight, it is necessary first of all to know the apparent specific gravity, or the relation between the weight of the coke sample and the weight of a volume of water at 4° C. equal to the volume of the particles and the pores of the coke taken together. This can be rapidly and accurately obtained by means of a simple "volumenometer" which I have designed in conjunction with Mr. J. Stanley Muir, B.Sc.,



primarily for this purpose, although it is equally available for ascertaining the specific gravity of all insoluble bodies, ores, alloys, &c., which can be obtained in fragments of suitable size, whether the bodies be lighter or heavier than water. The instrument consists of two parts, one of which, A, is a receiver capable of holding 25–100 c.c. of water. This is closed at the top by an accurately fitting, hollow glass stopper, which is prolonged upwards into a narrow tube closed by a stop-cock. The receiver is connected at the bottom by means of a piece of nitrometer tubing with the measurer B, which is an ordinary glass burette capable of being read to $\frac{1}{10}$ c.c., and the whole instrument is clamped to a suitable stand.

To obtain the specific gravity of a solid, the measurer is moved up and down so as to fill the receiver with water exactly to the level of the stop-cock, which is then closed, and the reading on the measurer taken. The stop-cock is next opened, and part of the water in the receiver caused to flow into the measurer, and the stopper is then removed to admit the weighed sample. The dry sample, brushed free from dust, should be from 5 to 30 grms. in weight, and in the case of coke should be in fairly large pieces. When the sample has been gently placed in the receiver, the stopper is replaced and the water caused to return to the level of the stop-cock, which is then closed. The instrument is next shaken to detach adhering air-bubbles, which are allowed to escape, and a new reading is taken. Ten minutes,

or at least equal intervals of time, should be allowed to elapse before taking each reading, to admit of the liquid running down. The difference of the two readings gives the volume of the sample in c.c.'s, which at the ordinary temperature may be assumed with sufficient accuracy to represent an equal number of grms. of water, and therefore,

$$\text{Apparent specific gravity} = \frac{\text{Wt. of sample in grms.}}{\text{Volume in c.c.'s.}}$$

In the case of coke, using 12–20-grm. samples, results can be got differing only in the third decimal place, thus:—

Apparent Specific Gravity by New Volumenometer.

Sample.	A.	B.	Difference.
I.	1.012	1.038	0.004
II.	0.923	0.919	0.004
III.	1.212	1.206	0.003
IV.	1.088	1.091	0.003
V.	1.017	1.027	0.010
VI.	1.080	1.071	0.009
VII.	1.025	1.022	0.003

Combining the figures thus obtained with those representing the real specific gravity, we get the porosity or percentage volume of pores in a sample, and also the volume of pores in c.c.'s per 100 grms. of coke.

$$\text{Porosity} = \frac{(\text{Real sp. gr.} - \text{Apparent sp. gr.}) \times 100}{\text{Real sp. gr.}}$$

$$\left. \begin{array}{l} \text{Volume of pores in c.c.'s} \\ \text{per 100 grms. coke} \end{array} \right\} = \frac{\text{Porosity}}{\text{Apparent sp. gr.}}$$

The following table gives examples of such results:—

No. of Sample.	Real Sp. Gr.	Apparent Sp. Gr.	Porosity.	Volume of Pores in c.c.'s per 100 Grms.
1	1.854	1.040	43.91	42.22
2	1.837	0.921	49.86	51.13
3	1.936	1.210	37.50	30.90
4	1.837	1.089	40.72	37.39
5	1.873	1.022	45.44	44.1
6	1.850	1.075	41.89	38.97
7	1.913	1.023	46.52	45.47

That the relationship between the volume of the pores and the weights of combustible material in a coke has an important bearing upon its efficiency in the furnace, is generally admitted, but, so far as I know, it has not been usual to make systematic determinations of the figure for coals produced by the various types of oven working on different coals. This is perhaps largely due to the troublesome and tedious nature of the operations involved in exhausting with air-pumps to remove the gases from the pores of the coke fragments.

The publication of figures showing the porosity and the ash-content of average samples of the coke made in various districts and works, could not fail to be both interesting and instructive, provided these figures were obtained by a uniform method of experimenting. The method suggested above affords a means of arriving at the porosity quickly, with little trouble, and by the use of simple apparatus; and, in the belief that on this account it may be of practical utility, I have ventured to lay it before you.

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I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

Refrigerating Machinery, New Improvements in.
 Wochenschr. f. Brauerei, 1895, 12, 602—604.

REFRIGERATING machinery can be divided into three classes:—

- (1) Absorption machines, such as ammonia machines.
- (2) Vacuum machines, such as those in which water vapour is absorbed by sulphuric acid *in vacuo*.
- (3) Compression machines, in which ammonia, carbon-dioxide, or other substances are liquefied by compression, the liquid, when allowed to evaporate, producing cold.

(1.) The most recent absorption machines are improvements of the old Carré machine. Only the weaker ammonia solution is boiled; the ammonia is expelled from the strong solution by leading the gas from the boiler through it. Another improvement is to divide both the boiler and the absorber into chambers, in the innermost of which is the worm through which respectively passes steam or cooling water; by this arrangement the stronger solutions are separated from the weaker ones. However, these machines will not bear comparison with compression machines.

(2.) The vacuum machines are not capable of much improvement. In the newest, a separate apparatus is provided for concentrating the sulphuric acid, but this is at best unsatisfactory. These machines are not used to any extent.

(3.) In contrast to the two above-described machines, the compression machines have been greatly improved of late. There has been no alteration in the general style of construction and working. The valves are now made with wide seatings and the stuffing boxes with metal packings. For high pressures, leather backed with india-rubber has been used with success in the pistons and the stop-valves. Glycerin is used as a lubricant for leather and Baku oil for metal on metal.

The use of superheated steam is found to be useful, as thereby the loss of power by condensation is avoided. On the other hand, this leads to an increased decomposition of the oil which it is necessary to use in the ammonia cylinder.

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Luck, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

It has also been found advisable to allow only a fixed quantity of the liquefied substance to pass from the compressor to the evaporator at one time.

Every increase in the difference of temperature between the cooling water and the refrigerating solution diminishes the efficiency of the apparatus. This is a most important point, and unless a proper relation exists between the constants of the refrigerating material and the temperature of the water, the efficiency of the machine is much diminished—A. L. S.

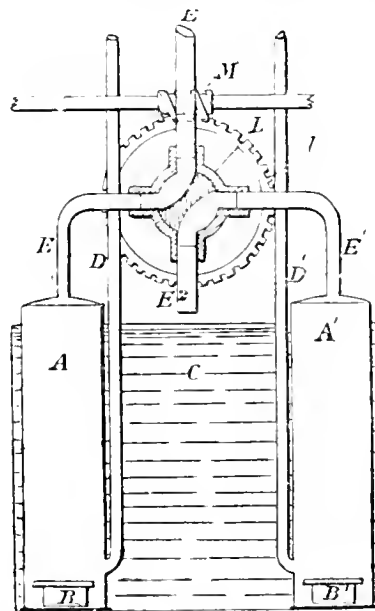
PATENTS.

Improvements in Apparatus for Raising or Pumping Corrosive or other Liquids. T. T. Best, Ph.D., S. A. Hollingsworth, and J. Brock, Liverpool. Eng. Pat. 17,593, Sept. 15, 1894.

THE object of this invention is to dispense with the labour and attention required in raising corrosive liquids, by means of large strong eggs or montejus and compressed air, and by rendering the operation automatic and practically continuous.

The liquor to be raised passes through the inlet valve B in the vessel A, standing in or connected with the cistern C.

To A is connected a pipe E, conveying compressed air, which passes through the four-way hollow-plug tap L. To the plug of this tap is attached a toothed wheel I, rotated by the worm wheel M, which latter is kept revolving by any suitable means. In the position shown in the figure, compressed air enters through the pipe E into A and forces the liquor along D to its destination; whilst A¹ exhausts itself of the air from a previous compression through E¹ E² and at the same time refills itself with liquor through B¹.



When the valve L revolves to the opposite angle, the compressed air will enter through E E¹ into A¹, and A will then exhaust its air through E E² and fill itself with liquor ready for another compression. The apparatus must of course be made of materials able to withstand the action of the liquor being raised. Seven different patterns of valve arrangements are shown for the above purpose.

A Homogeneous Mixing Product of Mealy or Powdered Substances of Heterogeneous Composition, Mode of Preparing, and in Apparatus therefor. O. Fåhnehjelm, Stockholm. Eng. Pat. 20,781, Oct. 30, 1894.

THE "meal" or powder is caused to fall down on the upper part of inclined planes or floors, so arranged one above the other, that the lines of inclination shall represent those observable in the contour of the upper surface of the heap formed, when the material referred to has been allowed

to fall down freely on to a horizontal plane. These conditions are practically those observed in the spread and formation of the lower sand heap, when a sand-glass is used.

Such a distribution of the particles in thin layers covering each other is so effected that the complete homogeneity desired, is secured. Further uniformity is obtained by the arrangements for emptying the floors and for filling the meal collars.—V. C.

Boiler and other Furnaces, Improvements in or relating to. J. Sutton, Freshfield, Lancashire. Eng. Pat. 21,052, Nov. 2, 1894.

STEAM boiler- or other furnaces or flues are formed inside the flue in proximity to the bridge, with an air reservoir having an orifice for discharging air under the grate, and another orifice for discharging air through the bridge, in combination with air-supply pipes or channels leading through the flues from the front of the furnace to the air reservoir.

The foregoing arrangement in combination with means for inducing a forced draught is further claimed, viz., by injector nozzles through which steam is discharged.—R. B. P.

Furnaces for Treating Chemicals, Ores, or the like, Improvements in or connected with. W. Thomson and P. J. Worsley, Bristol. Eng. Pat. 21,946, Nov. 13, 1894.

IN furnaces for the manufacture of ultramarine, the heating of sodium bicarbonate, the chlorination of silver ores, the roasting of blende, or the distillation of shale, and for other purposes in which it is desirable to heat the charge without contact with fuel gases, the inventors apply the system of a furnace heated from flues beneath, and with a revolving roof carrying a stirrer frame, the roof being either single or double. The stirrer frame carries rotating stirrers, and another frame may be added carrying ploughs

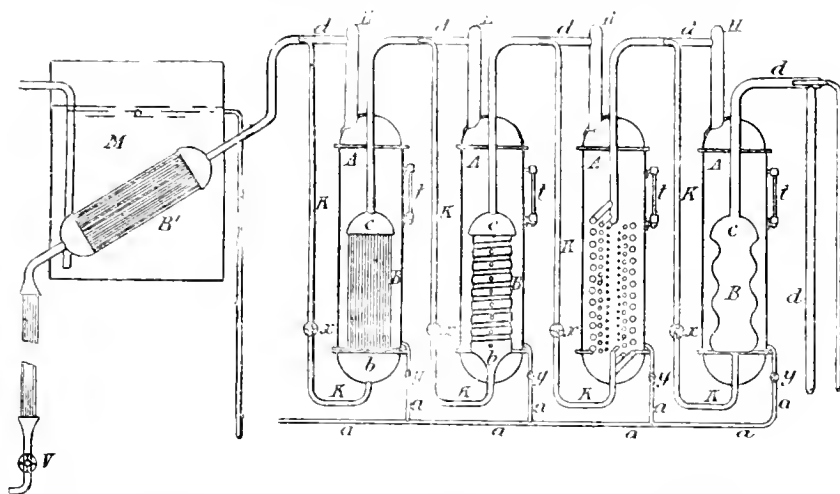
to turn over and discharge the contents of the furnace; or the frame with ploughs only, may be used. In order to heat the space under the arch, or between the two arches (in the case of a "closed furnace"), a fireplace is supported on the roof, the fuel gases from which pass through suitable apertures in the arch or the upper arch into the space beneath, and are withdrawn by flues leading to a chimney. Provision is made for continuous feed and discharge, as well as for withdrawing gaseous products.—E. S.

Filter Presses, Improvements in. J. Hill Fenton, Stoke-on-Trent. Eng. Pat. 22,645, Nov. 23, 1894.

AN apparatus for making potters' clay, compressing yeast, paraffin, sewage, and the like. It comprises a number of porous tiles held in frames and perforated by central longitudinal channels, so that the fluid to be filtered can pass freely from the outer filtering surface to the inner channels, and from thence can be drawn off by suitable outlet pipes. The frames are protected from contact with the material to be filtered by wood strips, and the cleansing of the tiles is effected by forcing or raising water through the outlet pipes.—E. G. C.

Distilling Apparatus, Improvements in. N. Yagu, St. Petersburg, and S. Bessonoff, St. Petersburg. Eng. Pat. 827, Jan. 12, 1895.

THE distilling apparatus is for producing distilled water or other liquid by means of a series of multiple liquid evaporators at the expense of the heat of a single quantity of steam, preferably high-pressure steam taken from a boiler. Successive evaporations at gradually decreasing temperatures are performed in a series of an indefinite number of closed metallic vessels A, provided with heating batteries B, of any form or shape of heating surface, so that the heating battery of each following vessel forms the



condenser for the preceding vessel. The steam from the boiler is led by a tube to the heating battery of the first vessel, where it condenses, and is generally returned to the boiler by a tube. The steam formed in the first vessel by the action of the heating battery therein, passes by the tube *d* into the battery of the second vessel, in which it condenses and causes the water in the second vessel to boil; the steam so generated passes into the battery of the third vessel, and so on, until the last vessel is reached, and steam from this is led to the condenser *B¹*. The water of condensation from each battery, except in most cases the first, is led by a tube *K* past a throttle valve *x*, which condenses any steam therein, and thence to the tube *d*, and on to the next battery. The condenser is placed in a tank *M*, continuously filled with cold water, and the heated water obtained therein is used to feed the vessels *A* by means of the tubes *a* and cocks *y*. A partial vacuum may be obtained in the condenser by means of a steam pump, or by providing a descending outlet thereto. The vessels *A* may be arranged in an ascending and descending order, such an

arrangement being also illustrated. A device is shown and described for drying the steam passing from one vessel to the next battery. Another device consists of heat transferers for preventing a deposit of salts on the tubes of the vaporising batteries when the feed water is saline, whilst a third consists of mechanism having a valve, operated by a rubber bag filled with water, for automatically maintaining a constant level in the distilling vessels.—R. S.

Smoke-consuming Furnaces, Improvements in or relating to. J. V. Gane, Paris. Eng. Pat. 11,185, June 6, 1895.

THE fire-box roof is built of bricks in which there are two separate sets of perforations. Through the first of these, the products of combustion pass from the furnace, and in doing so heat the brickwork. Air is introduced through the second set, and in passing along them is heated. These perforations terminate on the under side of the arch, and the heated air issuing from them meets the hot gases just as they are about to pass through the perforated arch, thus ensuring complete combustion.—R. B. P.

Raising or Forcing Liquid and Semi-Liquid Substances, Improvements in Apparatus for. A. Goodwin, Southwark, and T. Clay, Gravesend. Eng. Pat. 13,317, July 10, 1895.

Liquid and semi-liquid substances are raised from pits, wells, bore-holes, reservoirs, and other places, by means of compressed air, alternately admitted to and exhausted from each of two annular displacement chambers, adapted to be alternately placed in communication with a discharge pipe, and with the body of the liquid to be raised or forced. Two air tubes reaching down to the displacement chambers are provided, and are connected at their upper ends to an air-distributing valve, whereby alternately each tube is open to the atmosphere and is placed in communication with the compressed-air reservoir. To facilitate the outflow of air from the chamber to the atmosphere, compressed air is caused to blow over the top of the air-tubes: (a) By providing air ejection passages in the valve casing, the outer ends terminating in or above the ports of the said pipes, and the inner ends within the casing between the pistons; (b) By perforating the piston valves; or (c) By allowing a stream of compressed air to blow around the outer periphery of the piston.—R. S.

Burners for Incandescent Lighting, Improvements in and applicable to. E. H. C. Oehlmann, Berlin. Eng. Pat. 13,467, July 12, 1895.

This invention is for the purpose of effecting improvements in burners for incandescent light, in such wise that the mixture of air and gas can be heated in the mixing chamber before ignition. In the case of lamps in which the gas or vapour is formed in the lamp itself from volatile liquid materials, as spirit, benzene, &c., the aim is also to provide means whereby this gas or vapour may be conducted with facility to the mixing chamber.—W. S.

Discharging or Transferring Liquids, Improvements in Pumps or Apparatus for. P. Brandell, Council Bluffs, Iowa, U.S.A. Eng. Pat. 17,080, Sept. 12, 1895.

The apparatus consists of a hollow tapered plug for screwing into the cask or tank to be emptied, from the upper part of which plug depends a telescopic tube, whilst a side inlet or nipple is provided for coupling up to an air compressor or force pump, whereby the liquid is forced up the telescopic tubing into the receiver.—E. G. C.

Filtering Apparatus for Purifying and Sterilising Liquids, Fluids, Gases, and Vapours, Improvements in. C. Tissier, Paris, and H. J. Ernaux, Paris. Eng. Pat. 18,857, Oct. 8, 1895.

The apparatus contains one or more tubular bodies (formed of tubes of wire gauze or other perforated or permeable material strengthened internally by a wire coil and a star or cross-shaped stay) which are so arranged within a closed vessel that the liquid, fluid, gas, or vapour to be filtered is made to pass transversely through the tubular bodies in the direction from the outside to the inside, a coating of filtering material, as paper pulp, being in the first instance formed on the outer surface of the tubular bodies by mixing such material in a finely divided state with a portion of the liquid, which then deposits the material upon the outside of the tubes as it passes through them. Two forms of apparatus are shown, having suitable external tubes, connections, and valves for depositing the filtering layers, for passing the liquid, &c. to be purified, for discharging the purified liquid, &c., and afterwards for detaching and carrying away the pulp and its accumulated impurities from the outsides of the tubes.—R. S.

II.—FUEL, GAS, AND LIGHT.

Coal-Gas Flames, On the Alleged Escape of Carbonic Oxide and Unconsumed Carbon from. L. T. Wright. J. of Gas Lighting, 66, 1895, 1023—1024.

The charge that carbonic oxide is contained in the normal combustion products of gas flames, and, further, that this gas is able to pass through the iron of heating stoves and their flues, is disputed.

Carbonic oxide only passes through cast and wrought iron when they are heated to redness—a condition non-existent in the case of gas stoves. Moreover, experience shows that gas may be safely used in dwelling-rooms without any risk of such a result.

M. Gréhan (Comptes rend. 119, 146) caused some excitement by alleging that the products of combustion from the Auer-Welsbach burner contained carbonic oxide; but since then Renk, Boshard, and, independently, Bunte, have disproved this. Finally, M. Gréhan admitted that the use of the Welsbach burner is unattended with any danger of carbonic oxide poisoning.

V. B. Lewes (Jour. Chem. Soc. 61, 323) states that from the tip of a gas flame there escaped unburnt 0.39 per cent. of saturated hydrocarbons and 1.18 per cent. of carbonic oxide, but the difficulty of collecting gases from any particular part of a flame is so great that it is probable the gases were really drawn from an integral part of the flame before combustion was complete. Landolt ("Ueber die chemischen Vorgänge in der Flamme des Leuchtgases") supports this view.

Thomson (Brit. Ass. Rep. 1890, 786) showed that combustion in various gas burners was not so complete as desired; but his results practically went no further.

Experiments carried out in the Laneet laboratory (Laneet, 1895, 51) on the products of combustion from Welsbach, Argand, and Bray burners gave distinctly negative results as regards carbonic oxide and acetylene in the first two, and but a doubtful indication in the latter.

The author has also on two occasions conspicuously failed to find any traces of unconsumed gas escaping from the normal flames of ordinary gas burners, both lighting and non-luminous. Although he prefers to arrange for the discharge of the products of combustion into the outer air direct, it is only on the ground of general considerations of comfort.

Given normal conditions, a free air supply, and no striking back of the flame, there seems to be no difficulty in the case of the worst burner, in effecting combustion of the gas, and the author does not believe any case of imperfect combustion in the directions named, has ever been substantiated.—R. S.

Coal-Gas, Investigations on. H. Bunte. Chem. Zeit. Rep. 1895, 19, 255.

Products of Combustion.—The amounts of carbon monoxide and other products of incomplete combustion were so small in the case of Argand, Auer, and Bunsen burners that the combustion must be regarded as practically complete. Thus, lighting by gas should not be injurious to health. (See preceding abstract.)

Comparison of Incandescent Burners.—The Auer burner surpasses in durability, quantity, and quality of light most of the 13 of its competitors with which it was compared.

Carburisation.—The increase in luminosity, due to benzene and toluene in water-gas, carbon monoxide, and hydrogen flames, was only equalled by that produced by three or four times the quantity of pentane and hexane. The two hydrocarbons of each class produced almost the same effect. In the decomposition of the paraffins by heat (600°–1,000° C.), hardly 2 per cent. of acetylene and aromatic hydrocarbons is formed; the chief reaction results in the formation of methane and homologues of ethylene.

—A. C. W.

Petroleum, Influence of the so-called Resinous Constituents on the Illuminating Power of. The Acid Test. K. W. Charitschkow. Trudy. bak. otd. imp. russk. techn. obschtsch. 1895, 10, Pt. 1, 39.

With the idea of determining whether the "acid test" with sulphuric acid of sp. gr. 1.53 can afford any indication of the illuminating value of petroleum, the author examined oils refined in the ordinary way, together with some that had only undergone the alkali treatment, and found that the latter gave a more constant light, though the resinous constituents had not been removed. He asserts that although it is generally considered that the effect of the sulphuric acid treatment is to render the oil less subject to oxidation and alteration, it has not yet been proved how far such

changes lower the illuminating power, and he therefore considers testing oil for thorough acid purification superfluous, so long as the advantages of this purification remain undemonstrated.—C. S.

Kerosene from Ohio Petroleum. R. Kissling. Chem. Zeit. 19, 1549—1550.

REFERRING to statements advanced at the 1893 meeting of the Bavarian Society of Applied Chemistry (Chem. Zeit. 19, 1452), Kissling points out that the amount of paraffin in burning oils is very slight, and can, in any case, only affect the utilisation of the oil—not its illuminating power. In connection with the assertion that Ohio oil, containing a large proportion of sulphur, is now in the market, necessitating the examination of such oil for the detection of sulphur, he remarks that those who ought to know, deny that refined Ohio oil is dealt in in Germany, but that even if it be, the desulphurising processes this oil undergoes in refining render it undistinguishable from the Pennsylvania oil, containing but little sulphur.—C. S.

Coal-Dust Fuel. C. Schneider. Mitt. aus der Praxis des Dampfkessel- und Dampfmaschinen-Betr. 1895, 336 et seq.; Proc. Inst. Civil Eng. 1895, 123, 56.

AFTER describing in detail the Wegener, Schwartzkopf, Friedberg, Kuhl, and De Camp systems for burning coal-dust, the author gave some details of trials of the Wegener system.

The working pressure was seven atmospheres.

The coal-dust, thoroughly mixed with air, is introduced into the end of each of the flues and there burnt; the hot gases then traverse the internal flues, the outer surface of the lower shell from back to front, the external heating surface of the upper shell from back to front, and lastly, the 72 tubes of the upper portion. Five different trials were made on this boiler.

For the trials on the double boiler three kinds of coal-dust—Oberschleswig, English, and Bohemian—with calorific values of 6,626, 6,516, and 5,264 heat-units respectively, were used. The analyses of the different coal-dusts are given. In the double boiler, the quantities of heat utilised were respectively 78, 79, and 78 per cent. of the total heat-values of the fuel; the steam production in four of the trials being considerably above the average with ordinary coal firing.

The excess of air used in the first five trials was 0.84 per cent.

In the first five trials it was evident that the ashes contained a considerable proportion of unburnt coal-dust; in the sixth trial, therefore, the ashes were analysed, from which it appeared that the heat lost, due to imperfect combustion, was 4.7 per cent.

The results of these trials, as compared with those obtained from the usual methods of burning solid fuel are said to be very satisfactory.

The author considers the advantages are—most perfect utilisation of the fuel, complete smokelessness, small amount of manual labour required, favourable results from any kind of fuel that can be applied in the form of dust, adaptability of the system to any kind of requirements, preservation of the boiler, and rapid removal of the fire in case of danger. The disadvantages are—the grinding of coal into a uniform dust before it can be applied, the necessity of mechanical power, the deposit of ashes in the flues and tubes.

PATENTS.

Carbon for Electrical and other Purposes, Improvements in the Manufacture of. C. P. Shrewsbury, F. L. Marshall, and J. Cooper, London, and J. L. Dobell, Modbury, Devon. Eng. Pat. 15,782, Aug. 18, 1894.

THE claims are for mixing anthracite coal (10 parts), bituminous coal (4 parts), and tar, or pitch and tar, in such proportions as to constitute a material which contracts when exposed to heat. The mixture, after being submitted to pressure, drying, and baking, is exposed to a high temperature. "It is of paramount importance that the temperature of the ovens should be raised and lowered very

gradually, as in operation of baking, the contraction of the material is so great that any sudden change of temperature would cause the article under treatment to crack or break."

—J. C. R.

Gas, Improvements in the Production of, by Electricity. J. H. Dunn, London. Eng. Pat. 19,433, Oct. 12, 1894.

THE material to be converted into gas—coal, petroleum, or other carbonaceous matter—is placed in a retort provided with one or several pairs of carbon electrodes. An "arc" is established between these, and the carbonaceous matter converted into gas by the heat given off by the arc.

—R. B. P.

Acetylene, Improvements in Gas Generators suitable for Producing. E. Gearing, Harrogate. Eng. Pat. 25,203, Dec. 28, 1894.

THIS apparatus is for producing acetylene from water and a metallic carbide—calcium carbide, for instance.

It consists of a vessel containing the carbide, into which the water is admitted through a valve, the amount the latter can pass being controlled by the pressure of gas in the generator. The production of the gas is thus automatically adjusted to the rate at which it is consumed.

—R. B. P.

Coal-Slime, Improvements in the Treatment of, and Apparatus therefor. G. Baehner, Bohemia. Eng. Pat. 14,883, Aug. 6, 1895.

COAL-slime is subjected to a preliminary separation in one or more settling tanks, and to a final separation of the coal and slime by means of an ascending water current, allowing fine uniform coal to fall down, while the slime is carried off with the ascending stream of water and overflows along with it.—R. S.

Incandescent Mantles for Lamps, Improvements in. S. H. Crocker, London. Eng. Pat. 15,246, Aug. 13, 1895.

A thin sheet of a suitable material—paper, for instance—is coated with the incandescing material, preferably a salt of erbium. The sheet is then perforated to give it a grid-like structure, and corrugated to increase the radiating surface. The edges are then cemented together to form a mantle of suitable shape, which is baked or carbonised to destroy the supporting sheet.

According to a second method, the supporting paper is first sized or gummed, then coated with collodion, and finally with the incandescing material.

By immersion in water, the paper can be floated off the coated collodion film. The latter is then perforated, corrugated, and carbonised, as in the first case. With the second method the amount of material to be destroyed by burning in the oven is much less.—R. B. P.

Glass Chimneys, An Improvement in or applicable to. G. F. Trautler, Hatton Garden. Eng. Pat. 17,842, Sept. 24, 1895.

THE chimneys (for burners and lamps) are divided longitudinally, the parts being held together by bands.—R. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Paranthracene. W. R. Orndorff and F. K. Cameron. Amer. Chem. J. 17, 1895, 658—681.

AFTER reviewing the researches on the preparation and constitution of paranthracene, recently made by Elbs and Liebig (this Journal, 1892, 340, and 1893, 512), the authors give an account of their own investigations on this subject, which were undertaken with the view to adduce further proof as to the correctness of the assertion that anthracene and paranthracene have the same percentage composition. All previous investigators seem to have been satisfied on this point, on the grounds that sunlight converted anthracene into paranthracene, and that on heating

the latter to its melting point (224°), it gave a product which, after solidification, fused at 213° , the temperature at which anthracene melts.

Paranthracene was obtained in a pure state by exposing purified anthracene suspended in benzene and xylene in thin white glass bottles to the direct action of sunlight for some weeks during the summer of 1894. When paranthracene ceased to separate out, the mass was filtered, washed with benzene, and dried. It was then boiled in a flask connected with a reflux condenser, first with alcohol, then with acetic ether, and finally with benzene. The residue—a pure white crystalline mass—was dried and recrystallised from benzene. The pure product formed a beautifully white crystalline substance, melting at 242° – 244° to a light yellow liquid. This, on cooling, solidified to a white mass with a green colour by reflected light, and melting exactly at 213° . It was found that both anthracene and this substance (paranthracene), have the same percentage composition. The specific gravity of the former at 27° , compared with water at 1° , is 1.250; that of paranthracene, 1.265. The latter differs from anthracene also in its crystalline form and optical behaviour. To determine the molecular weight, the method of boiling points was used, and the number found for this was 357. The formula derived for paranthracene was $C_{28}H_{20}$, a result in complete accord with that obtained by Elbs. The authors consider *dianthracene* a preferable name. As regards the constitution, they give a formula which is very similar to the one suggested by Liebig. They, however, show that it is erroneous to assume that paranthracene contains a ring of four carbon atoms.—D. B.

The Petroleum Lands of Germany. O. Lang.
Chem. Ind. 18, 318–313.

THROUGHOUT the north-west of Germany occurrences of petroleum and allied substances are frequent, especially in the valley of the Aller, but oil has been obtained in workable quantity only at Wietze and Oelheim. Plentiful supplies of pitch also occur in the former locality. At Oelheim the surface rock consists of diluvial clays and boulder sands from 15 to 40 metres in thickness. The chief source of oil in the underlying strata is a zone of sandstone widening out from south to north. Another productive belt near by rests on middle Jurassic strata. A great deal of gas is frequently encountered, and the oil is struck at moderate depths (up to 80 metres), but is accompanied by such large quantities of brine (10 per cent. of oil to 90 per cent. of water is a high proportion) that the cost of production is great, and for 12 months (1883–1884) the industry was discontinued on account of the prohibitive restrictions imposed for the treatment of the brine, which was causing much damage to the agriculture of the district. The future of the Oelheim oil-field will depend on the advance of knowledge concerning the origin and storage of petroleum in the earth.

The Alsatian oil-field, the most important workings of which are at Pechelbronn, extends, according to Jasper and Werveke, for a distance of 40 by 15 kilometres in the plain of Lower Alsace, and the petroliferous strata lie at moderate depths, the five oil-sands penetrated at Pechelbronn occurring at 80–90, 120–150, 180–200, 230, and 335 metres. The only two wells extending to a greater depth than the last-named figure failed to strike any other source. An unusually productive well (No. 146) yielded 200 barrels of oil daily from 1882 to 1886 without pumping, and the quantity amounted to 10,000 kilos. per diem when a pumping shaft was sunk in 1888.

The productive borings in the Rhine plain vary from 13.6 to 222.8 metres deep, the depth decreasing as a rule the further south they are situated. To the westward again the average depth of 212 trial borings was 25 metres, but none of these yielded workable quantities of oil.

Alsatian oil in the crude state is, like that of Hanover, mostly dense and dark-coloured, and, north of the Zorn, is frequently associated with asphaltic substances. The most remarkable peculiarities noticeable in this district are the high percentage of bromine in the water accompanying the oil, and the unusually rapid, though irregular, increase of temperature with the depth (60° – 6° C. at 620 metres).

Petroleum Difficult of Separation from Water and Tar, New Distillation Process for. R. A. Ostrejko. Trudy. bak. otd. imp. russk. techn. obschtsch. 1895, 9, Pt. 6, 1.

This method is designed for the purpose of preventing frothing up when petroleum containing water is distilled, and consists in blowing superheated steam into the still through a large rose situated a little above the surface of the oil. The finely-divided jets of steam impinge on the boiling oil, break up the foam, and carry away the vapours to the condenser.

In the case of tar, low-pressure steam is used, but the temperature is gradually raised during the progress of distillation until, by the time nothing but coke remains in the still, the steam is at 228° or thereabouts.—C. S.

Petroleum. Influence of Sunlight and Air on Petroleum Products. Capacity of Petroleum for Absorbing Atmospheric Constituents. R. A. Ostrejko. Trudy. bak. otd. imp. russk. techn. obschtsch. 1895, 10, Pt. 2, 21.

On exposure to sunlight and air, ordinary Baku petroleum of medium quality deposits a yellow sediment and becomes strongly acid, giving off at the same time a penetrating smell. Part of the deposit is soluble in distilled water, a dark, tarry substance being obtained on evaporation, and the remainder is dissolved by ethyl alcohol and concentrated sulphuric acid. Several samples of oil exposed in clear glass bottles to air and sunlight became opalescent in 9 hours, and subsequently turbid, with formation of sediment; whereas when kept under the same conditions in green bottles, the oils became appreciably lighter in colour. Further tests revealed the fact that in vessels of clear and blue glass, with admission of air, the oil darkened considerably on exposure to light; whilst in orange-yellow and green bottles the colour became lighter in 48 hours; and in the case of clear glass, with exclusion of air, scarcely any change occurred. The percentage of acidity increased some fivefold in three days in the blue and clear glass vessels, but remained practically unaltered in the others.

Several distillates refined in different ways all showed that the amount of acidity resulting on exposure increases concurrently with the deepening of the colour.

The effect of light in facilitating the absorption of air by the oil is very marked, a sample in a tube, into which a single bubble of air was admitted, absorbing it completely; whereas in a second sample, similarly treated, but kept in the dark, no absorption occurred, the air bubble, on the contrary, appearing to have increased in size.

For the purpose of determining whether the degree of refining influences the absorptive capacity of the oil towards air, a number of vessels were filled with ordinary oil, and others with oil that had been exposed for some time to light and undergone a subsequent refining with excess of acid and alkali. To the vessels were affixed eudiometer tubes containing 5 c.c. of air, and the whole were exposed for 34 days, under various conditions—i.e., in some cases light was admitted to the eudiometer only, and others were kept totally in the dark. The alterations in the volume of air were noted daily, with the following results:—Ordinary distillate under the influence of light took up all the air in 10 days; distillate refined with excess of soda required 11 days; ordinary petroleum, 12 days; oil refined with excess of acid and alkali, 34 days. The oil treated with excess of acid only, absorbed but two-thirds of the volume of air during the full period, and the sample previously exposed to light and afterwards refined over again had taken up barely any.—C. S.

Petroleum Benzine and Coal-Tar Benzene, Distinguishing between. Mitt. k. k. Versuchsanstalten, Berlin, 1895, 13, [5], 232.

See under XXIII., page 53.

Phenol and the Three Isomeric Cresols. G. Jörgensen. Chem. Zeit. Rep. 1895, 19, 190.

See under XXIII., page 53.

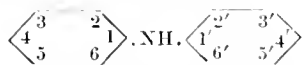
Petroleum Acids. Fuchs and Schiff. Chem. Zeit. 19, 1469.

See under XXIV., page 56.

IV.—COLOURING MATTERS AND DYES.

Toluene-azo-Phenols, Reduction of Ethers of. F. Düsterbehn, J. Klein, and G. Schkolnik. *Annalen*, 287, 161—183.

THE authors, continuing Jacobson's work (*Ber.* 26, 700) on the reduction of *p*-ethoxyazobenzene with stannous chloride and hydrochloric acid, which resulted in the discovery of the so-called "semidine" transformation, have examined the reduction products of the higher homologues, and certain of the compounds obtained, have formed the subject-matter of patents. The nomenclature employed is according to the following scheme:—



and a derivative of *o*-amido-diphenylamine is termed an *o*-semidine, whilst that of *p*-amido-diphenylamine is a *p*-semidine. In the case of *o*-toluene-azo-phenetol, the chief product is a *p*-semidine, 4-amido-3-methyl-4'-ethoxy-diphenylamine (*Ger. Pat.* 75,292, 1892) crystallising in needles melting at 82° C., whilst only small quantities of ultimate reduction products are obtained. With *m*-toluene-azo-phenetol, a mixture of *o*- and *p*-semidines and of other bases is obtained, whilst *p*-toluene-azo-phenetol gives principally decomposition bases, together with some *o*-semidine (*i.e.*, 2-amido-4' (or 5)-methyl-5 (or 4')-ethoxy-diphenylamine); and *p*-toluene-azo-phenol isobutyl ether, melting at 90° C., and the benzyl ether, melting at 128° C., give about 70—80 per cent. of decomposition products.

—T. A. L.

Toluene-Azo-Cresetols, Reduction of. E. Heber, F. Heinrich, C. Schwarz. *Annalen*, 287, 183—211.

THE six cresetols examined were prepared by combining the *o*- and *m*-cresetols with diazotised *o*-, *m*-, and *p*-toluidines and subsequent ethylation of the products obtained. On reduction, all the isomers give normal bases, and in addition either an *o*- or a *p*-semidine (see last abstract), or a mixture of the two; only the latter are here referred to. In addition to the melting points given, these compounds were further characterised by conversion into their formyl, acetyl, and thiourea derivatives, &c. 1. *o*-Toluene-*o*-azocresetol, melting at 36° C., gives a mixture of *o*- and *p*-semidines; the former, probably 2-amido-2',4-dimethyl-5-ethoxy-diphenylamine, melts at 78° C., whilst the latter melts at 86° C., and is 4-amido-2',3-dimethyl-4'-ethoxy-diphenylamine. 2. *m*-Toluene-*o*-azocresetol, melting at 47° C., gives an *o*-semidine melting at 91° C., which is probably 2-amido-3',4-dimethyl-5-ethoxydiphenylamine, whilst the *p*-semidine formed simultaneously, is 4-amido-2,3'-dimethyl-4'-ethoxy-diphenylamine, melting at 100° C. 3. *p*-Toluene-*o*-azocresetol gives an *o*-semidine, which is probably 2-amido-4,4'-dimethyl-5-ethoxy-diphenylamine, and melts at 76° C. 4. *o*-Toluene-*azo-m*-cresetol (melting point 64° C.) gives 4-amido-2',3-dimethyl-4'-ethoxy-diphenylamine, a *p*-semidine melting at 86° C. 5. *m*-Toluene-*azo-m*-cresetol, melting at 73° C., behaves similarly, giving a *p*-semidine melting at 96° C., which is 4-amido-2',2-dimethyl-4'-ethoxy-diphenylamine. 6. *p*-Toluene-*azo-m*-cresetol (melting point 64° C.) gives a very small quantity of an *o*-semidine, which was characterised by conversion into a stilbazonium base, $C_{30}H_{23}N_2O_2$, forming yellow needles melting at 179° C.—T. A. L.

m-Xylene-*azo*-Cresetol, Reduction of. G. Schkolnik. *Annalen*, 287, 211—212.

THIS compound was prepared by ethylating the oxy-azo-derivative obtained by combining diazotised xylylidine ($CH_3:CH_3:NH_2 = 1:3:4$) with phenol, which melts at 134° C., whilst the ethylated product melts at 97° C. The reduction products consist chiefly of xylylidine and phenetidine.—T. A. L.

Azophenetols, Reduction of. F. Meyer. *Annalen*, 287, 212—220.

THESE substances were obtained by diazotisation of the three phenetidines, combination with phenol, and subsequent

ethylation of the products. On reduction, they behaved similarly to the ethers of the toluene-azo-phenols described above, and the products obtained were characterised in a similar manner. 1. *o*-Phenetol azo-*p*-phenetol, melting at 78° C. (the corresponding phenol melts at 131° C.), gives, on reduction, principally a *p*-semidine, 4-amido-3,4'-diethoxy-diphenylamine, melting at 81.5° C., together with *o*- and *p*-phenetidine. 2. *m*-Phenetol azo-*p*-phenetol, the ether of the phenol melting at 106° C., melts at 71° C., and is converted on reduction for the greater part into a mixture of an *o*- and a *p*-semidine. With regard to the third isomeride, the combination of *p*-phenetidine (amidophenetol) with phenol has been described in *Ger. Pat.* 48,543, as a raw material for the manufacture of dyestuffs and phenacetin. It melts, however, at 126° C., and not at 104.5° C. The ethyl ether on reduction gives about 95 per cent. of *p*-phenetidine.

—T. A. L.

Corallin and Magenta, Chemistry of. K. Zulkowski. *Monatsh. für Chem.* 16, 358—493.

THE author arrives at the following conclusions:—

(1.) Certain colouring matters and other compounds of a phenolic character can be precipitated from their alkaline solutions by CO_2 , and this forms a ready means of assisting their purification. Such substances are Aurin, Rosolic acid, Phenolphthalein, &c.

(2.) Corallin, when prepared from pure phenol, contains, in addition to Aurin, two colouring matters of the formulae $C_{20}H_{16}O_4$ and $C_{22}H_{16}O_5$, which appear to stand in no definite relation to one another, and also two isomeric colourless substances of the formula $C_{10}H_{14}O_4$, *i.e.*, they contain one atom of oxygen more than Aurin, and may be designated α - and β -Aurin oxides.

(3.) Corallin, prepared from a mixture of phenol and cresol, contains all the above substances and in addition others, some of which appear to form a homologous series, but show no close relationship with Aurin. These are $C_{22}H_{20}O_4$ (Rosolic acid), $C_{22}H_{18}O_4$, $C_{20}H_{16}O_4$, and $C_{20}H_{16}O_5$, and may be called Rosolic groups.

(4.) By diazotisation of magenta free from para-magenta, there are formed several substances very similar to the above constituents of Corallin, and probably homologous with them. Such are $C_{23}H_{22}O_4$ (methylrosolic acid) and $C_{23}H_{20}O_4$.

The constitution of the triphenylmethane colouring matters, including Magenta and Corallin, is as yet but very imperfectly understood.—R. B. B.

Paranitrodiazobenzene Red. Oesterr. Wollen- und Leinen-Ind. 1895, 15, 401.

THE firm "Fabrique des Produits Chimiques de Thann et de Mulhouse," has again introduced paranitrodiazobenzene Red in consequence of the disuse of Mulhouse Red and Grenade. The fastness to light and to washing leaves much to be desired, but in this respect it compares favourably with its predecessor. The prepared colour keeps only a few hours in a cold room (without ice-cooling). The material is padded with a mixture of 400 grms. of β -naphthol, 400 grms. of soda solution of 40° B., $\frac{1}{2}$ litre of 50 per cent. Turkey-red oil, and 15 litres of water, dried in the hot flue, and immediately developed in a bath prepared as follows:—750 grms. paranitrodiazobenzene are mixed with 2 litres of water, and, after standing for half an hour, a solution of 60 grms. sodium acetate in 1 litre of water is slowly added, and the whole then diluted to 15 litres. Then follows washing in the open width, and soaping for half an hour in a vat containing 1 kilo. of soap and 1 kilo. of castor-oil soap in 700 litres, finally washing and drying. In printing with this colour, the material is padded with a mixture of 500 grms. β -naphthol, 500 grms. soda solution of 40° B., $\frac{1}{2}$ litre Turkey-red oil, and 12 litres water, dried in the hot flue, and printed with 560 grms. paranitrodiazobenzene powder, $4\frac{1}{2}$ kilos. dextrin-thickening, 50 grms. of sodium acetate, and $\frac{1}{2}$ litre turpentine, mixed cold. This mixture keeps sufficiently long (8—10 hours) at a temperature of about 30° C., so that no cooling is necessary. After printing, the goods are passed through soda and soap. The effects are equal to those obtained with paranitraniline, but the fastness to soap is poor. The paranitrodiazobenzene should be preserved in

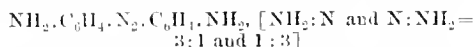
the form of its compound with α -naphthylamine monosodium sulphamate, from which hydrochloric acid liberates the diazo-compound ready for use.—A. C. W.

Metanitraniline, Alkaline Reduction of. R. Mehlola and E. R. Andrews. *Proc. Chem. Soc.* 1895, [157], 214—215.

On heating an aqueous solution of metanitraniline with alkaline reducing agents, such as sodium stannite, the azoxy-compound—



separates out on cooling. It forms yellow scales (from toluene) or needles (from boiling water or dilute alcohol), m.p. 146—148°. The diacetyl derivative (m.p. 251°), the disazimide (m.p. 86—85°), the disazo- β -naphthol derivative (m.p. 214°—245°), and the metadiiodoazoxybenzene (m.p. 118—119°) have been prepared from the diamidoazoxy-compound. The corresponding azo-compound, having the constitution—



has been prepared by the complete reduction of the azoxy-compound to a hydrazo-compound by the action of zinc dust and alkali, and subsequent reoxidation. This has been found the most effective way of obtaining the azo-compound in a state of purity. It consists of dull orange needles when crystallised from boiling water, m.p. 150°—151°. The diacetyl derivative (m.p. 272°), the dihenzoyl derivative (m.p. 281°—285°), the disazo- β -naphthol (m.p. 282°), and the oxalate of the base have been prepared, and are described in the paper. The constitution was confirmed by conversion into the metadiiodoazobenzene (m.p. 150°—151°) of Gabriel (*Ber.* 1876, 9, 1410). Both the azoxy- and azo-compounds are well-characterised bases forming diacid salts.

Writing Inks, Their Examination. G. Wisbar. *Papier Zeit.* 1895, 20, 3059.

See under XXIII., page 55.

PATENTS.

Azo-Dyes, Improvements in the Manufacture of, and in the Production of Black Shades on Cotton or other Vegetable Fibre, or on Silk. J. Y. Johnson, London. From "The Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 1002, Jan. 15, 1895.

The azo dyestuffs prepared by combining diazo compounds with 1,1',4 or 1,1',4'-amido-naphthol sulphonic acids (Eng. Pat. 7713 of 1891; this Journal, 1892, 514) have always contained a quantity of disazo dye, rendering the product impure. According to the present invention, these compounds can now be obtained in a pure state, and a method is also given for employing them in the production of dark green, or blue to black shades, on cotton or other vegetable fibre, or on silk. The improvement in the combination consists in carrying out the process in presence of an excess of a mineral acid and without the use of sodium acetate. This is more especially the case with the diazo compounds from aromatic amines containing substituting nitro or halogen groups, but the same precaution is necessary with α -naphthylamine, as the following example shows. About 286 kilos. of α -naphthylamine and 780 kilos. of 30 per cent. hydrochloric acid are diazotised in the usual manner with 140 kilos. of sodium nitrite and made up to 1,200 kilos. with sufficient water and ice. The diazo solution, which then contains 0.6 per cent. of free hydrochloric acid, has added to it 530 kilos. of 1,1',4-amidonaphthol sodium sulphamate in 10,000 litres of water. The mixture must be well stirred, and must react strongly acid to Congo-paper the whole time, until the whole of the diazo compound has been taken up, the dyestuff being finally separated in the usual way. The process for obtaining deep blacks consists in printing or padding the goods with a mono-azo dyestuff obtained from an amido-naphthol sulphonic acid, as

described, and subsequently developing them by immersion in a suitable diazo-solution. For instance, to obtain a black on cotton, the goods are padded with the azo-dyestuff from *p*-dichloro-aniline and 1,1',4'-naphtholsulphonic acid, and, so prepared, are worked in a solution containing about 1 per cent. of tetrazo-ditolyl acetate until a test portion of the material does not turn violet on immersion in hot 2 per cent. sodium carbonate solution. The goods are then washed, first with water, and subsequently with a hot solution of an alkaline soap in order to remove the second diazo group in the tetrazo-ditolyl, which does not react.—T. A. L.

New Basic Colouring Matters, The Manufacture and Production of. J. Y. Johnson. From "The Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 1352, Jan. 19, 1895.

These new colouring matters, which appear to belong to the acridine series, are obtained from certain substituted auramines by heating their hydrochlorides together with *m*-phenylene or *m*-tolylene diamine, either with or without a condensing agent, such as zinc chloride. The most suitable substituted auramines are the *m*-amidophenyl- and *m*-amido-tolylauramine, which may be regarded as derivatives of *m*-phenylene and tolylene diamine, and of tetramethyl or tetra-ethyl-diamidodiphenylmethane. About 40 kilos. of tetra-methyldiamidobenzophenone, 27 kilos. of *m*-phenylene-diaminedihydrochloride, and 9 kilos. of *m*-phenylenediamine are heated, with constant agitation, from 195° to 215° C. When a sample dissolved in dilute hydrochloric acid and boiled, retains its brownish-yellow colour, and no further increase in the amount of colour is produced by this treatment, the melt is allowed to cool and subsequently dissolved in 400 litres of boiling water and 20 kilos. of 30 per cent. hydrochloric acid. After cooling and filtering, the colouring matter is precipitated by adding salt and zinc chloride. The precipitate is filtered off, mixed with 20 kilos. of hydrochloric acid, and dried on the water-bath, when it forms a readily soluble salt. The colouring matter gives a brownish-yellow solution with a greenish fluorescence. It dyes cotton mordanted with tannin, and also gives brownish-yellow shades on leather.—T. A. L.

Alpha-amido-alizarin-sulphonic Acid, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Höchst-on-the-Maine, Germany. Eng. Pat. 1392, Jan. 21, 1895.

ONE part of α amido-alizarin is stirred into 10—15 times its weight of fuming sulphuric acid, containing 20—40 per cent. of anhydride, and heated at 100—140° C., until a sample dissolves, when boiled with water, to a bright carmine solution. After cooling, the melt is poured on to ice, and the whole is boiled until the characteristic red-coloured solution is obtained, when, after filtering, the sulphonic acid is separated by salting out with potassium or sodium chloride. The sulphonic acid is then washed till neutral, and dried, when it forms a blackish-brown powder, easily soluble in water to a carmine solution. It is an acid and also a mordant colouring matter, and dyes wool bluish-red from an acid bath, whilst it gives prune shades on a chrome mordant. It has been found that the first action of fuming sulphuric acid on α -amido-alizarin is the formation of an intermediate product sparingly soluble in cold water, which, on boiling with water or dilute acids, is converted into the α -amido-alizarin sulphonic acid. This intermediate product has probably the constitution of a sulphuric ether or of a sulphamic acid.—T. A. L.

Colouring Matters, Improvements in the Manufacture of [Red Basic Cotton Dyes]. H. H. Lake, London. From A. Leonhardt and Co., Mühlheim-on-the-Maine, Germany. Eng. Pat. 1414, Jan. 21, 1895.

THE process consists in alkylating the orange-red dyestuff obtained from formaldehyde and *m*-amido-*p*-cresol—



(Eng. Pat. 12,323 of 1893; this Journal, 1894, 722). Similar products are obtained by carrying out the process described in Eng. Pat. 13,217 of 1889 (this Journal, 1890, 934) by using formaldehyde and an alkylated *m*-amido-

p-cresol. The alkylation, according to the first process, is effected by means of ethylbromide in spirit at about 130°–140° C. for three hours, the colouring matter, after distilling off the spirit, being precipitated with salt. According to the second method, 15 kilos. of ethyl-*m*-amido-*p* cresol, 13 kilos. of 30 per cent. caustic soda lye, and 300 litres of water, are mixed with 3.7 kilos. of a 40 per cent. formaldehyde solution, the whole after some time being raised to the boil. When the formaldehyde has disappeared, a small quantity of acetic acid is added to precipitate impurities, and, after filtering, the diethyldiamidodihydroxyditolylmethane, which melts at 169° C., is precipitated by more acetic acid. In order to convert this product into the corresponding colouring matter, 1 kilo. is added to 3 kilos. of concentrated sulphuric acid, and the whole is heated on the water-bath until a complete solution is obtained. After some hours, dehydration is complete, and each kilo. of the melt is poured into 2 litres of water and 2 kilos. of brine, and oxidised at 90° C. by adding 1.3 kilos. of a ferric chloride solution of sp. gr. 1.14. The colouring matter separates as a crystalline precipitate, and is filtered off, washed with brine, and pressed. The colouring matters obtained by either of these processes are suitable for dyeing and printing on cotton, and give redder shades than those hitherto known.—T. A. L.

Para-amido-benzyl Alcohol, Improvements in the Manufacture and Production of, and Homologues and Analogues thereof and Derivatives therefrom. G. W. Johnson, London. From Kalle and Co., Bielefeld-on-the-Rhine, Germany. Eng. Pat. 1963, Jan. 28, 1895.

THE product referred to is obtained by the reduction of *p*-nitrobenzyl chloride in neutral or alkaline solution by means of ferrous hydrate or zinc dust. The new substance, which is entirely different from the *p*-amidobenzyl alcohol described by G. and O. Fischer (Ber. 24, 723), melts at 65° C., crystallises from benzene, and has the formula $H_2N \cdot C_6H_4 \cdot CH_2OH$. It possesses the properties of a primary amine and combines with benzaldehyde, formaldehyde, and benzoyl chloride, and can be diazotised, the diazo solution also combining with the undiazotised base to form a diazo-amido compound. When the new base is boiled with a small quantity of hydrochloric acid in aqueous solution, it is converted into an anhydride, and this substance can be obtained directly by reduction of the nitro compound by means of zinc dust in an acid solution. It can also be prepared, as well as its analogues and homologues, by the action of formaldehyde on aniline, *o*-toluidine, methyl- or ethylaniline, methyl- or ethyl-*o*-toluidine, *o*-anisidine, or *o*-amidophenetol by employing equimolecular proportions in presence of a mineral acid. When formaldehyde is employed, the anhydro derivatives of the amido bases may be made first, and subsequently transformed. About 30 kilos. of anhydroformaldehyde aniline are dissolved in 150 kilos. of strong hydrochloric acid. The new product gradually crystallises out, and, after dissolving in 500 litres of water, the whole mass is neutralised with caustic soda lye and the precipitated base is filtered off and washed. The following is another method employed:—A solution of 130 kilos. of aniline salt in 600 litres of water, is mixed, cold, with 25 kilos. of a 40 per cent. formaldehyde solution and allowed to stand until the whole is converted into a yellowish crystalline mass, when, after precipitation with soda lye, the free amido-benzyl alcohol is washed and dried.—T. A. L.

Colouring Matters, The Manufacture or Production of [Basic Reds]. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 2041, Jan. 29, 1895.

THIS is an extension of Eng. Pat. 9610 of 1894 (this Journal, 1895, 478), describing further processes for producing azine dyestuffs from phenylated or tolylated *m*-tolylene diamine (e.g., $CH_3:NH_2:NHC_6H_5 = 1:2:4$) by heating the azo derivatives of these substances in a suitable solvent together with primary, secondary, or tertiary amines of the benzene or naphthalene series. A further method is to oxidise these latter amines together with phenyl-triamidotoluene ($CH_3:NH_2:NHC_6H_3:NH_2 = 1:2:4:5$) or with *p*-

tolyl-triamidotoluene ($CH_3:NH_2:NHC_6H_2:NH_2 = 1:2:4:5$) in presence of suitable solvents or diluents:—5.7 kilos. of the azo compound from diazotised *p*-sulphanilic acid and phenyl-*p*-amido-*o*-toluidine, 1.4 kilos. of α -naphthylamine, and 20 kilos. of phenol are heated together, with agitation, at 90°–110° C. until the melt turns a pure red. An excess of hot dilute soda lye is then added, and, after cooling, the separated dyestuff is filtered off. In order to purify it, the press cake, after dissolving in hot water and filtering, is salted out with hydrochloric acid. The colouring matter so obtained is easily soluble in water, and dyes tanned cotton bright bluish-red shades. It is identical with the dyestuff obtained by the interaction of benzene-azo- α -naphthylamine and phenyl-*p*-amido-*o*-toluidine, according to Eng. Pat. 9610 of 1894. The following is another method for producing the same substance:—2.2 kilos. of phenyl-triamidotoluene (melting at 134° C. and obtained by reducing the azo compound from diazotised *p*-sulphanilic acid and phenyl-*p*-amido-*o*-toluidine), 1.8 kilos. of α -naphthylamine hydrochloride, and 20 kilos. of phenol are heated on a water-bath with free access of air until the melt turns a pure red. The dyestuff is then isolated according to the method already described.—T. A. L.

Colouring Matters Containing Sulphur, Manufacture of [Cotton Browns and Yellows]. J. Imray, London. From "La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis," Paris, France. Eng. Pat. 3414, Feb. 16, 1895.

THESE colouring matters are produced by the action of sulphur, or sulphur and alkaline sulphides, on acetylated diamines, or the corresponding acetyl nitramines. A mixture of 100 kilos. of acetyl-*p*-phenylene diamine and 200 kilos. of sulphur is heated for three hours to 200°–250° C. When the reaction has moderated, and the evolution of sulphuretted hydrogen has ceased, the melt is allowed to cool. The colouring matter so obtained is soluble in hot alkaline sulphides and dyes cotton directly a brownish-yellow. A yellow colouring matter for cotton is produced by heating to 300° C. for 3–4 hours a mixture of 100 kilos. of diacetyldinitro-benzidine, 100 kilos. of dry sodium sulphide, and 200 kilos. of sulphur until the reaction is complete. The product is soluble in water, alkaline sulphides, sulphites and bisulphites, but insoluble in acids. The new colouring matters are stable to ordinary reducing agents. In order to obtain bright shades, the dyed material should be passed through an oxidising bath—bichromate, ferric chloride, or an alkaline hypochlorite. The new products are termed "thioatechines," and when precipitated from their solution in soda or sodium sulphide by dilute acids, a paste is obtained which, on prolonged contact with alkaline sulphites or bisulphites, becomes soluble, and may be used directly for dyeing, or, after thickening, for printing.

—T. A. L.

Azo Dyes, Manufacture of [Blue-Blacks]. J. Imray, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 3515, Feb. 16, 1895.

ACCORDING to Eng. Pat. 7713 of 1891 (this Journal, 1892, 514), colouring matters are obtained by combining two molecular proportions of a diazo compound with one molecular proportion of 1.1'.4-amidonaphthol sulphonic acid of Eng. Pat. 9676 of 1890 (this Journal, 1891, 538), or with the 1.1'.4'-acid obtained by fusing with caustic alkali the naphthylamine disulphonic acid prepared by sulphonating the naphthylamine sulphonic acid 8 of Ger. Pat. 40,571. The methods hitherto employed have been to effect the combination either in an alkaline solution throughout, or else to perform the first part of the operation in an acid solution and the second in an alkaline one. The patentees have discovered that much more valuable products are obtained by carrying out the second combination in a faintly acid solution, the following being a typical example:—The diazo solution from 15 kilos. of α -naphthylamine is poured into an alkaline solution of 1.1'-amidonaphthol sulphonic acid. When the formation of the azo compound is complete, the solution is acidified with acetic acid and *p*-diazobenzene sulphonic acid from 19.5 kilos. of sulphanilic acid is stirred

is. After the combination is complete, the colouring matter is salted out, pressed, and dried. It dyes wool a greenish blue-black from an acid bath, whilst the combination with the same components carried out according to Eng. Pat. 7713 of 1891 gives violet-blue shades on wool.—T. A. L.

Azo Dyes, Manufacture of [Wool Blue-Blacks]. J. Imray, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 3416, Feb. 16, 1895.

It has been discovered that under certain conditions, 1.1'.4-amidonaphthol sulphonic acid will combine with three molecular proportions of a diazo compound, and, according to the components employed, varying tints and various degrees of solubility of the resulting dyestuffs may be obtained. The combination with the third component must be carried out in a faintly acid solution, and whilst this is an advantageous condition for the second combination, the first may take place in an alkaline solution. The diazo solution from 15 kilos. of α -naphthylamine is run into an ice-cold alkaline solution of 24 kilos. of 1.1'.4'-amidonaphthol sulphonic acid. After the combination is complete, acetic acid is added, and the same quantity of α -diazonaphthalene is run in. When the whole of the diazo compound has been taken up, the diazo compound from 24.5 kilos. of sodium naphthionate is added, sufficient free acetic acid always being present. After 2—3 days the whole is heated and the colouring matter salted out, filtered, and dried. It dyes wool blue-black from an acid bath.—T. A. L.

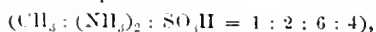
Compounds designed for Dyeing and Printing, Improvements relating to the Manufacture of. "La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis," St. Denis, and R. Vidal, Paris, France. Eng. Pat. 3612, Feb. 19, 1895.

The colouring matter "Laval Catechu," obtained by the action of sulphur and alkalis on various organic substances, and the dyestuffs produced from disubstituted aromatic compounds by the same reaction, according to Eng. Pat. 19,880 of 1893 (this Journal, 1894, 941), have all similar properties. They are all insoluble in the usual solvents and in dilute acids, but dissolve easily in alkalis and alkaline sulphides with a bottle-green colour, and dye unmordanted vegetable fibres very fast shades. In order to obviate the use of alkaline sulphides, the patentees have discovered that these substances can be rendered soluble by treatment with alkaline sulphites or bisulphites. For instance, the product obtained by the action of p -amido-phenol on sulphur and caustic soda at 180°C . is precipitated from its alkaline solution with dilute hydrochloric acid. The damp product, after filtering, containing about 15—20 per cent. of dry substance, is treated with crystallised sodium sulphite in the proportion of 45—60 kilos. of the salt to 100 kilos. of the paste. In about three days, complete solution is effected, and the product may be used in this form or dried down for convenience of transport.

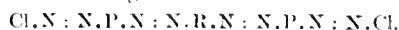
—T. A. L.

New "Coupled Tetrazo Compounds," Manufacture of, and of Complex Poly Azo Colouring Matters resulting therefrom [Cotton Blues and Blue-Blacks]. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 14,483, July 30, 1895.

The "coupled tetrazo compounds" are obtained by combining two molecular proportions of the same or of different tetrazo compounds with one molecular proportion of a component capable of so combining—as, for example, dihydroxy-naphtho-sulphonic acid (Eng. Pat. 14,161 of 1892; this Journal, 1893, 597), dihydroxy-naphthalene sulphonic acid G, 1.1'.3.3'-dihydroxy-naphthalene disulphonic acid, 1.1'.3.3'-amidonaphthol disulphonic acid, tolylene diamine sulphonic acid—



2.3.3'-amidonaphthol sulphonic acid, &c. The compounds so produced have the general formula—



where P is the radicle of a p -diamine and R is one of the components above alluded to. The compound so obtained can be further combined with two similar or different amines or phenols, or their derivatives. The following example illustrates the method employed:—The tetrazo compound from 18.4 kilos. of benzidine is poured into a cold alkaline solution of 16 kilos. of sodium 1.1'.3.3'-amidonaphthol disulphonate. The intermediate compound, which contains two free diazo groups, separates in black flakes. After standing 2—3 hours, the whole is added to an alkaline solution of amidohydroxy-naphtho-sulphonic acid and allowed to stand 12 hours, when, after heating, the colouring matter is salted out, filter-pressed, and dried. It dyes violet-black shades on unmordanted cotton, and, after diazotisation and development on the fibre with m -phenylene diamine, gives deep black shades. The following process yields a blue for cotton:—The tetrazo solution from 9.2 kilos. of benzidine is run into a cold solution of 16 kilos. of amidonaphthol disulphonic acid in presence of sodium acetate. After making the mixture alkaline, the tetrazo solution from 10.6 kilos. of tolidine is added to it. The formation of the intermediate product is complete in about 3—4 hours, and a solution of 32 kilos. of 1.1'.3.3'-amidonaphthol disulphonic acid is then added, the colouring matter finally being separated in the usual manner.

—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Paper Sails. J. Soc. Arts, 1896, 44, 146.

PAPER sails as used in the United States are said to be much cheaper than canvas sails, and it is affirmed that by special treatment of the materials they can be made as soft, flexible, and untearable. Bichromate of potassium, glue, alum, a solution of alkaline silicate and fat are added to the paper pulp, and a fairly thick paper is produced from this by means of a paper-making machine. Two strips of this are then pasted together, and passed through rollers under considerable pressure, the paper then being in the form of very thin, soft sheets. It is then passed, in an endless roll, through a weak solution of sulphuric acid, which converts the upper surface into a kind of parchment. The subsequent processes are washing with soda solution, dyeing, and glazing. In the manufacture, care is taken, when the strips of paper are fastened together, to leave the edges free, so that other strips can be added at the sides, and a sufficient breadth for sails thus formed. The paste which is used for fastening the strips together contains the same ingredients as those added to the paper pulp. The edging of the sail is formed by inserting cords or ribbons at the sides.

Singeing Fabrics. E. Schweitzer. Färber Zeit. 1895, 6, 309—311.

POIRRIER (Bull. Soc. Ind. de Reims, 1878) has shown that goods which have been well singed take up a deeper colour than unsinged or slightly singed fabrics; therefore if the singeing is not regular, flecks result. The use of bronze instead of iron plates for singeing goods is recommended, and the plates are preferably corrugated.

Gas-Singeing.—The chief objections to the older forms of gas-singeing machine (Tulpin) were (1) The production of streaks of more or less partially singed fibre between the various burners; (2) The production of flecks by sudden lighting of the flames. Tulpin's machine has been improved by various engineers, but two or three years ago, Descat-Leleux devised a form which gives a very accurate and regular result. In a metal case of hexagonal section, provided with a slit 6—8 mm. in diameter, coal-gas and compressed air, in the proportions necessary to form a non-luminous flame, are mixed and allowed to burn at the opening, which runs along the whole breadth of the machine. The whole arrangement is so contrived that it can be instantly removed from action on the fabric should a stoppage of the machinery occur. The length of the singeing surface can of course be modified by simply closing part of the slit, and the intensity of the flame is increased or diminished by regulating the supply of compressed air or of the gas. In order to prevent the smouldering

or burning of the goods by any sparks they may carry off, it is only necessary to pass them through damped rollers or into a steam-chest. The fabric, when passing through such a gas-singeing machine as that described, does not become heated, as a whole, to more than 100°C . and so long as there are no salts present which decompose at this temperature, it is in no way injured.—H. I.

Trades Waste, Treatment of. W. Naylor. Proc. Inst. Civil Eng. 1895, 123, [Part I.].

See under XVIII. B., page 46.

PATENTS.

Wood-Wool, An Improved Machine for. W. P. Thompson, Liverpool. From H. C. Toøglund, Christiania. Eng. Pat. 18,323, Oct. 1, 1895.

MACHINES for cutting shavings from planers into narrow strips, formed of two parallel shafts upon which are mounted two rows of thin cutting discs with their peripheries passing between each other, and provided with means for holding the discs tightly against one another, and with blades for keeping the discs clean, and with others for forming a feed-way for the strips.—R. S.

Saunt from Wool, Improvements relating to the Removal of, Recovering, or Separating Certain Constituents from the Saunt, and Obtaining Certain Valuable Products therefrom. H. E. Newton, London. From J. H. Wingfield, Montclair, N.J., U.S.A. Eng. Pat. 20,433, Oct. 29, 1895.

See under XII., page 40.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

New Mechanical Dye-Vat. E. Müller. Färber Zeit. 1895, 6, 345—346.

A wool dye-vat is described which differs from the ordinary form. There are two tanks, one inside the other, separated by a space of about 5 cm. in width. The inner vessel is perforated with small holes. Above both vessels runs the reel or winch, provided with blades which dip into the vat, and the liquors are heated by a steam-pipe in the space between the two vessels. In emptying the vat, the winch is raised by chains attached to a beam above and the vat tilted forwards, the wool being received on hooks. The author states that he has found these vats both economical of labour and as regards expense.—H. I.

Vegetable Colouring Matters, Behaviour of, towards Ammonium Persulphate. G. Eberle. Färber Zeit. 1895, 6, 512—514.

THE author examined the behaviour of logwood blacks and catechu brown matters towards ammonium persulphate, $(\text{NH}_4)_2\text{S}_2\text{O}_8$. This substance loses oxygen on heating to 70°C . in aqueous solution and forms ammonium sulphite. Logwood extract is turned yellow at ordinary temperatures by this substance, and on heating with excess, it is completely bleached. Fustic extract becomes darker in shade, and on cooling deposits a yellow-brown powder.

On dyeing hanks of cotton-yarn in American logwood extract (10 per cent. of the weight of the cotton), and fixing by means of a 2 per cent. bath of copper sulphate, it was noticed that the colour darkened 10 per cent. during the dyeing, mordanting, and drying processes; the colourless hæmatoxylin copper compound changing into the coloured hæmatein lake.

If the hanks be brought, immediately after the drying and fixing process, into a cold solution of 5—1 per cent. of ammonium persulphate, an instantaneous darkening of the colour is produced, which is more permanent the smaller the amount is of ammonium persulphate present; $\frac{1}{2}$ to $\frac{1}{4}$ per cent. will suffice, on heating, to change the colour of copper hæmatoxylin lake into a blue-grey and finally into a brown (colours often noticed in old blacks).

American fustic extracts of a pure yellow-brown are preferable to those of a red-brown colour. The former give on alumina- and chrome-mordanted cotton a vivid yellow or

olive colour, whilst the latter give a dull reddish-yellow tone. The clear yellow fustic extract, on heating in contact with air for some time, is changed into the other variety. If cotton dyed with the former extract (10 per cent.) and 2 per cent. of alum, be treated with 1—8 per cent. of ammonium persulphate, colours resembling these obtained from the red-yellow extract are obtained. The intensity of the colour of wool dyed with fustic extract (5 per cent.) and bichrome is reduced 10 per cent. by persulphate (1 per cent.). The extract-maker should therefore take care that his liquors are as much as possible excluded from the oxidising action of the air in evaporating down. Cotton hanks (10 grms.) were heated for $\frac{1}{2}$ hour in a solution of catechu, and, after cooling, taken out of the bath. The hanks were treated with ammonium persulphate, 15—22 per cent., and gradually heated; at 70° the colour began to appear, and at 90° a yellow shade was produced. After heating $\frac{1}{2}$ hour, the hanks, on drying, had a pure yellow-brown colour such as has not been previously obtained with catechu. That the bichrome-dyed catechu fabric contained chromium as a lake-forming agent was rendered probable by the fact that the persulphate-dyed catechu yellowish-browns are changed into the characteristic bichrome catechu browns by treatment with chromic salts. Curiously enough, the bichrome catechu browns are converted into yellowish-brown by the action of ammonium persulphate.—H. I.

The Dyeing Process, The Nature of. The Distribution of Methylene Blue between Water and Mercerised Cellulose. G. v. Georgievics and E. Löwy. Monatsh. für Chem. 16, 345—350.

AS stated by one of the authors in a previous paper (this Journal, 1895, 653), a larger proportion of colouring matter is taken up by fibres from dilute than from concentrated solutions. If Cw be the amount of dyestuff in 100 c.c. of dye-liquor after the process, and Cf the amount of colour taken up by 100 grms. of fibre, it would appear that the

distribution of colouring matter follows the law $\frac{\sqrt[3]{Cw}}{Cf} =$

constant. In the former paper was ascertained the value of this constant in the case of indigo extract dyed upon silk, and further researches have been made to discover how far the value of the law depends on the chemical nature and physical structure of the dyed material. With this object, the behaviour of cellulose in the two forms of fibre and powder has been studied. If cotton is precipitated from its solution in ammoniacal copper hydrate by an acid, the precipitated cellulose contains much hydrocellulose, which has a greater affinity for basic colouring matters than cotton. In order to obtain materials of more similar composition, both were subjected to mercerisation. After this treatment, the proportion of water in each was:—Mercerised cotton, 10.08 per cent.; mercerised cellulose in powder, 15.25 per cent.

Dyeing took place at a temperature of 14° — 17°C ., and a series of experiments was made similar to those described in the previous paper, each trial being repeated at least twice. The result gave in each case a constant value for

the ratio $\frac{\sqrt[3]{Cw}}{Cf}$. The law $\frac{\sqrt[3]{Cw}}{Cf} = \text{constant}$, holds good

therefore for cotton as well as silk, and f may represent material of other than fibrous structure. The actual value,

however, of the constant $\frac{\sqrt[3]{Cw}}{Cf}$ is greater for mercerised

cotton than for mercerised precipitated cellulose, i.e., the latter would appear to have taken up more colouring matter than the former. This appears to contradict results of former experiments (this Journal, 1894, 945), but the difference depends entirely on the temperature at which dyeing takes place. At 100°C . the powdered form takes up much less colour than the fibrous; at low temperatures the reverse is the case. In the latter case, the increased attraction is due to the greater surface area of the powdered cellulose, but owing to this same cause the powder offers less resistance to the increased solvent power of the water at high temperatures, and thus loses colour more readily than the fibre.

In all the above results, the author perceives confirmation of his view that the dyeing operation is due to "surface-effects" or "absorption-phenomena" similar to the absorption of gases by carbon, &c., and rejects the chemical theory and "solid solution" in favour of "mechanical affinity."—R. B. B.

Colours on Cotton, Fading of. W. N. Ogloblin. J. russ. phys. Ges. 1895, 27, 80.

SAMPLES were exposed to sunlight in (1) Air, (2) Dry carbon dioxide, (3) Moist carbon dioxide. In the latter indifferent gas, the fading was greater in the presence of moisture, but was far greater in damp air. The action of red, yellow, green, blue, and violet light on the coloured fabric was investigated by exposing it covered with glasses of these colours. The colours fade most completely in light which is most nearly of the colour complementary to their own.—A. C. W.

Trades Waste, Treatment of. W. Naylor. Proc. Inst. Civil Eng. 1895, 123, [Part 1.].

See under XVIII. B., page 46.

PATENTS.

Thickeners or Vehicles for Colours, Mordants, and the like, Improvements in and relating to. W. W. Horn, London. From W. Maybury, Los Angeles, California, U.S.A. Eng. Pat. 22,276, Nov. 17, 1894.

THE application is claimed of the mineral, known as soap-rock, as a thickening, filling, or finishing agent for textile tissues, yarns, and paper, and as a thickening agent for tissue and paper printing.

The mineral in question is largely found in New Zealand and the Western States of North America. It has approximately the following percentage composition:—Silica (64.76 parts), alumina (16.87), ferric oxide (4.62), magnesia (3.45), lime (trace), phosphoric acid (1.22), water (5.01), and grit and dirt (1.63).

It is prepared for use by breaking or grinding into small pieces and washing with dilute hydrochloric acid (1° Tw.) or alum solution (0.5° Tw.), to remove part or all of the iron and water. The washed clay is then left for three to five days in contact with five times its weight of water, by which time it will have formed a "fine, plastic paste of a greasy nature," which can be further thinned with water if desired. The paste thus obtained is, lastly, strained to remove the grit it contains.

As a thickening agent, soap-rock is stated to possess the following advantages, amongst others, over organic thickening agents:—It is not liable to be attacked by mildew or to ferment; it does not become thin in time; and it is unaffected by oxidising agents, such as potassium permanganate and chromic acid, and can therefore be employed to thicken solutions of them.—E. B.

Machinery for Dyeing Loose Cotton, Wool, and other Fibres, Improvements in. E. Heppenstall and E. Sykes, Turbridge. Eng. Pat. 693, Jan. 11, 1895.

THE improvements relate to the dyeing machine devised by Weldon (Eng. Pat. 18,973 of 1889; this Journal, 1890, 175), and consist in causing the dye-liquor to circulate by means of a centrifugal pump. The liquor enters the vat at the bottom and is distributed through perforated branch-pipes into the vat. Thence it is drawn, either from the top or the bottom, back to the pump. Finally, when the dyeing is completed, it is run into the drain or is pumped into a storage-tank for use again.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Potassium Chlorate, Manufacture of. K. J. Bayer. Chem. Zeit. 1895, 19, 1453—1455.

By the method hitherto employed in the manufacture of potassium chlorate, only one-sixth, and frequently less, of the chlorine was obtained in the form of potassium chlorate, the remaining five-sixths being converted into calcium chloride, which is of practically no commercial value.

Although magnesia was substituted for lime with the intention of obtaining a marketable product in the chloride of magnesia, or otherwise to reconvert the same into chlorine or hydrochloric acid, this process was never very widely introduced, as the slight advantage gained was more than neutralised by the difficulty in manipulation, and expensive plant.

Better results, it is said, are obtainable if, instead of lime or magnesia, an oxide be used, like oxide of zinc, yielding a chloride, for which there is a large demand.

To carry out the process, chlorine is passed into zinc oxide suspended in cold water, when, as in the case of lime, at first oxychloride of zinc and hypochlorite of zinc are formed, the whole finally going into solution according to the equation, $2\text{ZnO} + 4\text{Cl} = \text{ZnCl}_2 + \text{ZnCl}_2\text{O}_2$.

The conversion of the hypochlorite into chlorate takes place quantitatively in the presence of the necessary potassium chloride, or if the potassium chloride be added to the zinc oxide at the beginning, the temperature being maintained at 90°—95° C.

These solutions are of about 30° B., and, in cooling, fairly pure crystals of potassium chlorate are obtained. On concentrating the mother-liquor to about 60° B., the greater part of the remaining potassium chlorate crystallises out, and the mother-liquor, now containing only very little potassium chlorate, is treated with hydrochloric acid and then evaporated to dryness to obtain the chloride of zinc.

The apparatus varies very little from that now in use for the manufacture of chlorate by the lime process; the evaporation of the zinc chloride solution being carried out in iron vessels, preferably in a vacuum, as traces of iron are not detrimental for most purposes.

The advantage claimed in this process is a better yield of chlorine as chlorate, and in obtaining the whole of the chlorine as a marketable product.

In the following, comparisons of the cost of production are made:—

According to K. Jurisch, the cheapest method of manufacturing chlorine is by the Hurter-Deacon process, and, taking this as a basis, the chlorine necessary for the production of 1,000 kilos. of potassium chlorate would cost M. 270.04, the total cost being M. 1,234.73 for 1,000 kilos. of potassium chlorate and 4,000 kilos. of zinc oxide.

The Hurter-Deacon process has only been chosen for the sake of comparison, and it is not the intention to use dilute chlorine for this process, but rather concentrated chlorine, obtained by a process which would probably be M. 50 per 1,000 kilos. potassium chlorate—cheaper than the Hurter-Deacon process.

The chloride of zinc which is obtained, is very pure, but may contain a little potassium chloride, which, however, would hardly be detrimental for manufacturing purposes.

By the lime process, according to K. Jurisch, the total costs for 1,000 kilos. of potassium chlorate amount to M. 800.70.

To compare the two processes, it is necessary to take half of the costs of manufacture for the potassium chlorate, and half for the chloride of zinc. We then find the cost for manufacturing 1,000 kilos. of potassium chlorate amounts to M. 617.36, as against M. 800.7 by the lime process, and the cost for manufacturing 4,000 kilos. of chloride of zinc, to M. 617.36, or for 1,000 kilos., M. 154.34.

At the present time it is hardly possible to make a comparison with the electrolytic chlorate of potassium, as too little is known about the cost. However, a comparison might be made by calculating the cost to produce chlorine in the electrolytic manufacture of caustic soda and bleaching-powder, as has been done by C. Häussermann. In this case, from the total cost of producing caustic soda and bleaching-powder, the lime, packages, &c., for bleaching-powder and the caustic soda are deducted.

This chlorine is sufficient for about 2,200 kilos. of potassium chlorate; therefore 1,000 kilos. would cost M. 307.84, or about 14 per cent. more than that obtained by the Hurter-Deacon process.

The total advantages gained are said to be as follows:—

1. A 25 per cent. cheaper production of potassium chlorate when compared with the lime process.
2. Obtaining chloride of zinc as secondary product.

3. Better yield of potassium chlorate.
4. Advantage of being able to manufacture sodium chlorate by substituting sodium chloride for potassium chloride.
5. From a sanitary point of view, the non-contamination of water with waste calcium chloride.—J. R.

Potassium Cyanide, Synthetic Methods of Manufacturing.
N. Caro. Chem. Ind. 1895, 13, 244—246; 14, 287—293.

The attempts to make potassium cyanide directly from its elementary components without the use of animal refuse as raw material, may be classified in three groups, viz.:

1. Methods in which ammonia and fire are used; 2. Those in which atmospheric nitrogen and fire are employed; and 3. Wet methods.

1. Manufacture of Potassium Cyanide by Ammonia and Heat.—These methods are dependent upon the old yellow prussiate process. Liebig was the first to show that the yellow prussiate of potash was not formed until the fused mass was lixiviated. On treating the fused mass with water, the potassium sulphide formed therein by reduction of the sulphate, dissolves iron readily, forming the double compound FeK_2S , which, in solution with potassium cyanide, yields potassium ferrocyanide. Liebig further assumed that part of the potassium combined with cyanogen to form potassium sulphocyanate, which in the presence of iron became desulphurised, yielding potassium cyanide.

Karmrodt in 1857 first proved the truth of Liebig's views, and also some other important facts, viz., that the best yield of yellow prussiate was obtained by the use of about 50 per cent. of carbonised horn, and that the ammoniacal gases which are evolved when raw animal matter is used in the operation only form small quantities of cyanogen. His experiments showed that when carbonate of ammonia was led over potash, only about one-fifth of the theoretical yield of cyanogen was obtained. He proposed to lead the ammoniacal gases from animal matter over red-hot carbon impregnated with potash, and in this way to save at least one-fifth of the cyanogen, which would be otherwise lost.

In recent times, Beilby (this Journal, 1892, 747 and 1004) has patented a process in which the materials are brought into intimate contact by adding to the mixture at the beginning 20 per cent. of potassium cyanide, by which the mass is rendered readily fluid, and is then allowed to drop from one sieve to another in a columnar apparatus, meeting at the same time an upward stream of ammonia.

Barr and MacFarlane (this Journal, 1893, 602) believe that the fixed alkali in these various processes only plays the part of a "contact substance," and that the formation of cyanide compounds is due to the reaction as stated by Langlois, $\text{CO} + 2\text{NH}_3 = \text{NH}_4\text{CN} + \text{H}_2\text{O}$.

Siepermann, however, has proved that the formation of alkaline cyanides can be produced by two distinct operations: by the action of ammonia upon potassium carbonate (which is mixed with barium carbonate in order to increase the surface exposure), and in the absence of carbon the products are potassium cyanate, water, and potassium hydrate, $\text{K}_2\text{CO}_3 + \text{NH}_3 = \text{KOCN} + \text{H}_2\text{O} + \text{KOH}$. If now the potassium cyanate be heated with carbon, potassium cyanide is formed. These two operations are reduced to one when, as is usually the case, alkaline carbonates are heated to redness with carbon in a stream of ammonia (H. Grüneberg, H. Flemming, and W. Siepermann. Eng. Pat. 13,697, 1889; this Journal, 1890, 860).

Looking at the above-described methods in the light of Siepermann's reactions, we draw the following conclusions, which have been fully confirmed in practice:—Karmrodt's process failed because the excess of potash in his mixture melted and surrounded the particles of carbon, thus preventing the reduction of potassium cyanate to cyanide. Beilby succeeded in producing a more intimate contact among his materials, but no substance could be found of which to make sieves and towers which would not be rapidly destroyed by the hot alkaline mixture; whilst the methods of Lucas and Johnson (in which charcoal or coke is impregnated with alkali) do not provide a sufficient

surface contact between the ammonia and the potassium carbonate; Siepermann's process arrives at this at the cost of making the mass infusible (viz. by the addition of barium carbonate). The experience that has been gained with this last process seems to show that with suitable apparatus, e.g., a revolving furnace, the reaction can be carried out perfectly.

Other processes that the author mentions, but does not specially criticise, are those of Beilby (this Journal, 1882, 744), and of Grouven (Ger. Pat. 3881, 1878), who uses peat or Greenland moss, and of Harrez (Dingler's Polyt. J. 195, 535), in which an intimate contact between the potash, carbon, and ammonia is obtained by calcining suit with charcoal.

II. Production of Potassium Cyanide by means of Atmospheric Nitrogen.—The formation of potassium cyanide by the intervention of the atmospheric nitrogen was first noticed in the blast furnace. In 1835, Dawes pointed out the presence of this substance, and its formation from the atmospheric nitrogen was fully proved by Bansen and Playfair (Report of the B. Assoc. 1845, p. 185). Lewis Thomson; 1839, made the first real attempt to prepare cyanogen compounds from atmospheric nitrogen. The first patent was taken out by Newton in England in 1843, and Possoz and Boissière were the first who carried out the process on a commercial scale. At their works at Grenelle, near Paris, in 1843, they manufactured 15,000 kilos. of yellow prussiate of potash; but in 1844 they removed to Newcastle-upon-Tyne, where they made 1,000 kilos. of yellow prussiate daily at the cost of 2 francs per kilo. In 1855, their works were closed on account of insufficient demand and the too high cost of production. By their process, a stream of air was passed over charcoal impregnated with 30 per cent. of potash, and heated to a white heat. The apparatus was in the form of a cylinder, and was continuous, being fed at the top, whilst the charcoal, charged with potassium cyanide, was taken away at the bottom. On the removal of the works to Newcastle, an improvement in the apparatus by Bramwell was adopted, by which the fire gases which heated the cylinder were led through the cylinder itself, so that the same volume of air served both for heating and for making cyanogen. Many modifications of the process have been devised. Armengaud in 1846 took out a patent in France for making yellow prussiate from atmospheric nitrogen, which differed from others in that he mixed water vapour with the air. Margueritte and De Soudreval found that baryta transformed the nitrogen of the air into cyanogen compounds much more readily than potash and soda. They ascribed this to the fact that it was porous, and did not melt, and that it was also less volatile. Their process was abandoned because it could not compete with the ordinary fusion process for making yellow prussiate.

Weldon, in 1878, observed that the formation of cyanide by the action of nitrogen upon alkali and carbon proceeded more rapidly at lower temperatures than it had been customary to use. He found the best heat to be one of bright redness, and not of whiteness.

Von Adler found that the alkalis and alkaline earths were readily converted into cyanogen compounds when a mixture of the former with carbon was heated in an atmosphere of nitrogen to which hydrocarbons or carbon monoxide had been added; and, further, that the action was assisted by the presence of iron, manganese, nickel, or other metal which had a tendency to combine with carbon.

Readman likewise uses alkaline earths and carbon, which he heats in an electrical furnace in a stream of nitrogen.

Mond, in 1882, took out a patent for a mixture of carbon, barium carbonate, and magnesia, which he formed into blocks, and heated at a high temperature in the presence of nitrogen.

All the methods described depend upon the same principle, viz., the action of nitrogen upon a heated mixture of alkali and carbon. Nevertheless the reactions are not yet fully understood. It was, and is still, generally held that they are the same as those Liebig propounded for the ordinary yellow prussiate process, according to which the nitrogen combines with the carbon to form cyanogen, which in its turn combines with the base to form a cyanide. Apart

from the objection that in the ordinary prussiate process the nitrogen is not free and therein differs from this process, there is the further objection that carbon and nitrogen in the free state do not combine even at the highest temperatures. Morren, however, states that they combine when an induction spark passes between carbon points in an atmosphere of nitrogen, and that a direct combination at a bright red heat only takes place under great pressure. A consideration of the thermo-chemical data for the formation of KCN from its elements shows that the heat of formation amounts to +32,500 cals., whilst the formation of KCN from K and CN produces +65,350 cals. (Thomson), and that H + CN produces 7,800 cals. It, therefore, is possible for C and N to combine directly to form cyanogen in the presence of potassium, it follows that their combination will take place with much greater difficulty in the presence of the more difficultly reducible sodium and barium bases, and, further, that the presence of water vapour can only serve to make the reaction slower. Possioz has, as a matter of fact, shown that when soda is used, the formation of cyanogen is more difficult to effect than when potash is used; but, on the other hand, Marguerite, Mond, and others have proved, that with baryta it proceeds much more readily than with soda; and Armstrong has further shown that the presence of water vapour is in no way injurious; and these facts are in direct contradiction of the assumed theory of the direct combination of carbon and nitrogen.

The experience gained in carrying out these various processes also indicates that the formation of potassium cyanide is not due to the combination of potassium with cyanogen; for if this were the case, an elevation of the temperature would be favourable to the process, whereas Weldon and others have shown that the opposite is the case. Further, a prolonged contact of nitrogen with the carbon would be desirable in order to produce cyanogen, but experience has shown that the length of time of contact between the nitrogen and the carbon is of little consequence, but that an intimate mixture of the materials is of great importance. This last consideration also excludes the hypothesis that the formation of cyanogen is dependent upon the formation of a nitride of the alkali used, for then the success of the reaction would be influenced by the time of action of the nitrogen upon the mixture.

The author then argues in favour of the formation of cyanide being due to the production of an alkaline carbide, a view which would explain the more energetic action of barium than that of potassium and sodium, which, owing to their greater volatility, are more readily withdrawn from the sphere of action of the carbon, and therefore form carbides with much greater difficulty than do calcium, barium, and strontium. The theory of the formation of carbides in the cyanide process was put forward by Berthelot in 1869. He showed that acetylene combined with nitrogen to form hydrocyanic acid under the action of the silent electrical discharge, from which he inferred that in a mixture of carbon and potassium carbonate K_2CO_3 was formed, which then absorbed nitrogen and produced potassium cyanide.

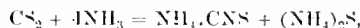
The theory of a carbide formation also satisfactorily explains De Lambilly's process (this Journal, 1892, 604 and 1006), which consists in heating a mixture of the carbonates of potassium, barium, or sodium with carbon and lime in a cylinder until CO ceases to be evolved, and then a mixture of equal parts of nitrogen and illuminating gas, poor in hydrogen (or a mixture of 10 parts of carburetted illuminating gas, 2—3 parts of nitrogen, and 1 part of ammonia), is led through the cylinder under a pressure corresponding to from 10—15 c.e. of mercury, the temperature being raised nearly, but not quite, to a white heat. It is also an advantage to add about 50 parts of iron filings to every 100 parts of alkali used. The gases which are evolved consist chiefly of hydrogen. For the new process by J. Young, see this Journal, 1894, 1196.

III. Wet Methods of making Cyanides.—The synthetic methods of making cyanides from ammonia or atmospheric nitrogen have as yet not proved commercially successful; but some success is to be recorded in wet methods of making cyanides.

Wurtz found that methylamine was decomposed at a red heat into ammonia, hydrocyanic acid and hydrogen; Wilm,

Ortleib, and Müller found that trimethylamine was decomposed at a red heat into ammonium cyanide, hydrocyanic acid, and hydrocarbons, and these facts have been carried into practical working at the factory of the Croix Company, who manufacture cyanides from commercial trimethylamine obtained from beet-root molasses.

Of greater importance is the formation of cyanides by the desulphurisation of sulphocyanates. Zeise first pointed out that ammonium sulphocyanate was formed by heating carbon bisulphide and ammonia in alcoholic solution—

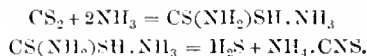


and Gélis patented a process founded upon this reaction, which obtained the prize medal at the international exhibition in London in 1862. In Gélis's process, carbon bisulphide is mixed in the cold with ammonium sulphhydrate, whereby sulphocarbonate is formed (poor yield). It is then converted into potassium sulphocyanate. The process failed practically, partly owing to the difficulty of desulphurising the potassium sulphocyanate (the difficulty which is common to all methods of making cyanides from sulphocyanates), but also to the poor yield. The reaction between ammonium sulphhydrate and carbon bisulphide is expressed as follows:— $CS_2 + NH_4.HS = CS.NH_3.SH + H_2S$, that is to say, free dithiocarbamic acid and sulphuretted hydrogen are formed. The free dithiocarbamic acid is, however, readily resolved again into ammonia and carbon bisulphide—



and only so much is obtained as combines with the excess of ammonia present to form the ammonium salt, which is not so readily decomposable.

The process of Tscherniak and Günzburg, which is now being worked in Hamburg by Gröhlich and Wichmann, obviates this last drawback in the Gélis process by the use of ammonia instead of ammonium sulphhydrate—



The ammonium sulphocyanate is then converted into calcium sulphocyanate, and this, by treatment with potassium sulphate, into potassium sulphocyanate, which is then desulphurised by iron.

With regard to the question of desulphurisation of the sulphocyanates, which in the old smelting process for making yellow prussiate was also a weak point, the loss is due partly to oxidation, partly to incomplete desulphurisation. The first source of loss can be overcome by the addition of carbon when fusing with iron; the second source has only lately been overcome. It has been found by Nöllner that by a proper method of lixiviating the fused mass under rigorous analytical control, very good results can be obtained with iron. Sternberg has further found that a very satisfactory desulphurisation with iron takes place when double the theoretical amount of iron in the form of iron filings is heated with the sulphocyanate to 110°—120° under pressure, 80 per cent. of the theoretical yield of yellow prussiate being obtained.

These processes would probably have come into practical use if Playfair (this Journal, 1892, 14) had not discovered that an almost perfect desulphurisation was obtained by the use of zinc or lead instead of iron. Playfair proposes to make sodium sulphocyanate instead of the potassium salt. This is then desulphurised in graphite vessels by smelting with zinc and powdered carbon.

The author draws the conclusion that the processes reviewed under sections 1 and 2 of this paper can only prove successful when the reactions involved are fully understood and the necessary conditions required have been ascertained, and that the use of ammonia has more promise of success than the use of the more inert nitrogen. Further, that the process of Tscherniak and Günzburg deserves full recognition, and that, combined with a good desulphurising method, such as Playfair's, together with cheap ammonia, it will probably be able to compete with the old yellow prussiate process.—H. S. P.

Calcium Chloride from the Ammonia-Soda Process, Utilisation of. H. Schreib. Chem. Zeit. 1895, 19, 1181—1182.

THE author suggests that crystallised calcium chloride might be produced from the end-liquors of the ammonia-soda process, and used as a refrigerating agent. Current prices are prohibitory for this purpose, but the calculated cost of production is not excessive; thus:—Under normal working conditions the end-liquors contain per cubic metre 60 kilos. of sodium chloride and 60 kilos. of CaCl_2 , i.e., 120 kilos. $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$. To evaporate the remaining 900 kilos. of water, there will be needed 130 kilos. of coal, taking the average evaporative duty as 7 kilos. of water per kilo. of coal. Allowing for loss, an output of 110 kilos. of $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ and 55 kilos. of NaCl may be expected. The items of cost are:—Coal for evaporation, 130 kilos. at M. 1.20 = M. 1.56; coal for power, 10 kilos. at M. 1.20 = M. 0.12; labour, M. 0.20; repairs, M. 0.15; interest and depreciation, M. 0.20; the whole amounting to M. 2.23. Allowing the lowest price for the common salt recovered, 100 kilos. of $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ would not cost more than M. 2, and this amount could be reduced by the use of multiple-effect apparatus for concentration.

Having regard to the fact that 1 kilo. of ice in melting absorbs 80 cals., and that 1 kilo. of crystallised calcium chloride in dissolving in water absorbs only 23 cals., it is evident that the latter, to compete with ice on an equal footing, must not cost more than M. 0.5—0.6. But for many purposes calcium chloride would be preferable to ice, even though dearer, because it can be transported in well-closed vessels without loss of efficiency, even under such conditions of temperature as would make the carriage of ice difficult and costly. Moreover, the reduction of temperature which can be attained by the use of calcium chloride is greater than that which can be reached by ice alone, which is necessarily fixed at 0°C . The freedom of calcium chloride from micro-organisms is also an advantage. —B. B.

Calcium Chloride from the Ammonia-Soda Process, Utilisation of. N. Caro. Chem. Zeit. 1895, 19, 1233. (See preceding abstract.)

It having been suggested that the end-liquors from the ammonia-soda process might be used to produce crystallised calcium chloride capable of employment as a refrigerating agent, the author points out that the alleged freedom of calcium chloride from micro-organisms (one of the advantages claimed), is of no significance, because it would in any case only be used in closed circulatory apparatus, and would not replace ice, which is added directly to the material to be cooled. He further considers that the cost of concentration could be lowered by systematic evaporation, as in a spray-column apparatus.—B. B.

Potassium Cyanate, Detection of Small Quantities in Potassium Cyanide. E. A. Schneider. Eng. and Mining J. 1895, 489.

See under XXIII., page 31.

United States Chemical Imports. Eng. and Mining J., Jan. 4, 1896, 20.

See under Trade Rep., page 58.

Soda Production in the United States. Eng. and Mining J., Jan. 4, 1896, 20.

See under Trade Rep., page 58.

PATENTS.

The Decomposition of Common Salt in the Production of Sulphate of Soda, or for Analogous Purposes, Improvements in Apparatus for Use in. W. Thomson and P. J. Worsley, Bristol. Eng. Pat. 21,945, Nov. 13, 1894.

IN the improved apparatus described, there is a combination of a pot or pots (into which part of the salt is charged) with a furnace or roaster (into which the remainder of the salt is charged). Thus, in the manufacture of sulphate of soda, a uniform stream of dry or nearly dry hydrochloric acid gas is obtained from the pot, and the same from the

furnace. In the claim there is specially set forth "the combination of a furnace or roaster, and a pot or pots, such as described in detail and illustrated." Both pot or pots and furnace are provided with mechanical stirring gear. —E. S.

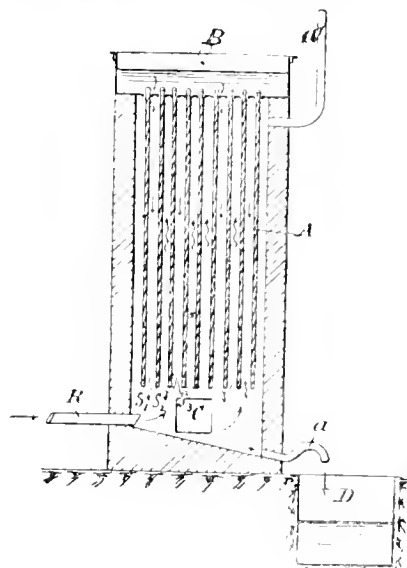
Utilisation of Waste or Spent Acid Pickle from Galvanising Works or other Works where Iron is Treated by Acid, and in the Treatment (for the Recovery or Obtainment of Chlorine) of other Products containing Chlorine, Improvements in. T. Parker, Tettenhall, near Wolverhampton. Eng. Pat. 24,859, Dec. 21, 1894.

THE free acid in hydrochloric acid spent pickle is neutralised by digestion with scrap-iron, and the resulting solution of ferrous chloride is evaporated to dryness in a covered vessel. The dry ferrous chloride is heated in a current of air to obtain chlorine and ferric oxide. When the pickling is effected by sulphuric acid, the spent pickle (ferrous sulphate solution) is treated with calcium, magnesium, or sodium chloride, and the corresponding sulphate formed is separated, if calcium sulphate, by filtration, or if magnesium or sodium sulphate, by crystallisation. The ferrous chloride solution is then treated as before described. Chlorine may also be obtained from waste calcium chloride, such as that occurring in the soda manufacture by the ammonia process, by treating it with ferrous sulphate to obtain ferrous chloride, which is applied as before. Similarly, chlorine may be obtained from sodium chloride or magnesium chloride. The ferrous sulphate needed may be obtained by roasting iron pyrites.—E. S.

The Separation of Salts from their Solutions, Process and Apparatus for. C. Kellner, Halluin, Austria. Eng. Pat. 25,368, Dec. 31, 1894.

ADVANTAGE is taken of the diminishing solubilities of certain salts with increasing temperatures to separate such salts from others of which the solubility increases as the temperature rises. Sodium carbonate, for instance, is more soluble in water at 36° than at 100° , whereas sodium chloride increases slightly in solubility within the same range of temperature. Hence, if a hot solution containing caustic soda and common salt be carbonated and further heated, evaporation going on meanwhile, the sodium carbonate separates, when suitable proportions of the two salts are present, as in the cathode liquid obtained in the electrolysis of common salt.

The apparatus for carrying out this process consists of a crystallising tower A, with a vessel B at the top, receiving the solution to be treated, with ropes or chains $s^1 s^2 s^3$ hanging freely from perforations in its bottom, on which ropes the crystals form. The inlet pipe R admits fire gases



from a furnace, which supply the necessary carbonic acid gas, and by their heat, effect concentration of the liquid. The crystals as they fall are withdrawn through the side opening C, whilst the mother-liquor flows through the outlet pipe A, into the receptacle D, whence it may be returned for re-treatment if necessary. The inflowing gases escape by the outlet a^1 .—E. S.

Gold Solvents, Improvements in the Manufacture of. J. J. Hood, London. Eng. Pat. 882, Jan. 14, 1895.

See under X., page 37.

The Preparation of Sulphocyanides, An Improved Process for. Dr. A. Goldberg, Chemnitz, and Dr. W. Siepermann, Elberfeld, Germany. Eng. Pat. 993, Jan. 15, 1895.

This is a process for preparing sulphocyanides of the alkalis, of ammonia, of magnesia, and of the alkaline earths, and for the direct preparation of sulphur by heating carbon bisulphide with ammonia and the sulphites or hyposulphites (thiosulphates) of the base, the sulphocyanide of which it is desired to prepare.—E. S.

Pure Concentrated Nitric Acid from Dilute or Impure Solutions, Improvements in Obtaining. Dr. F. Valentiner, Leipzig, Germany. Eng. Pat. 19,192, Oct. 12, 1895.

This process consists in redistilling dilute or impure nitric acid, first mixed with concentrated sulphuric acid, in vessels partially or entirely deprived of air. Apparatus applicable for the process is described in Ger. Pat. 63,207.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Ceramic Clays of the United States. K. Langenbeck, Thonind. Zeit. 1895, 19, 242.

CERTAIN so-called "flint-clays" occur in hard, rock-like masses, which absorb water greedily without noteworthy rise of temperature, and disintegrate, but without becoming workable even after a year's weathering. When ground with water, however, these clays yield a good plastic product. A typical composition is: True clay, 82.85 per cent.; quartz, 16.58 per cent.; felspar, 1.35 per cent. Suitable glazes are of the formulae: 11PbO ; $0.2\text{Al}_2\text{O}_3$; 2SiO_2 ; and 0.8PbO ; 0.1CaO ; $0.1\text{K}_2\text{O}$; $0.2\text{Al}_2\text{O}_3$; 2SiO_2 .—B. B.

Gray Under-Glaze. Sprechsaal, 1895, 28, 526.

A mixture of 772 parts oxide of tin, 76 parts felspar, 76 parts of crystallised borax, 76 parts of antimonium diaphoreticum (potassium antimonate), well powdered, mixed, and calcined in an earthenware kiln, is said to have resisted well the higher glazing temperatures, and not to have turned blue.—A. C. W.

PATENTS.

A Combination of Wire and Glass, Machinery for. F. Shuman, Philadelphia, U.S.A. Eng. Pat. 16,959, Sept. 10, 1895.

Glass is rolled on to a wire network arranged to travel on a ribbed inclined plane, kept cool by a water-jacket.—B. B.

Glass, Improvements in the Manufacture of. Mewburn and Ellis, London. From Max Hirsch, Radeberg, Saxony. Eng. Pat. 17,931, Sept. 25, 1895.

The inventor finds that selenium, used either as element or in its compounds, has the power of decolorising glass. For a quantity of glass, in the manufacture of which 100 kilos. of sand have been used, about 1 to 5 grms. of selenium are sufficient.—V. C.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Common Mortar, Strength of. Beschetzniek. Thonind. Zeit. 1895, 19, 311.

VARIOUS kinds of lime were tried, all being slaked and then allowed to mature for a week. Mixtures of the lime thus treated and ordinary building sand were prepared and tested after 1, 3, and 12 months. As a result it was found that "poor" limes set more quickly than "fat" limes, but that the strength of the latter was relatively greater when the mixtures used were poor in lime. Thus, 1 : 5 mixtures of fat lime had nearly the same strength as 1 : 4 mixtures of poor lime.—B. B.

PATENTS.

Cements, Improvements in and relating to the Manufacture of, for Making Mortars suitable for the Production of Artificial Stone. E. Weekwarth, Lima, Peru, and Max Hoett, Berlin. Eng. Pat. 21,731, Nov. 10, 1894.

HIITHERTO albuminous cements have been made with the albuminous material in its natural wet or adhesive state, a condition which has rendered it difficult to obtain uniform mixture. In the present process, the albuminous material is dried and brought to a floury consistency. The substances may be mixed in aqueous or alkaline solution. Besides albumin: potash, lime, potash alum, borax, and plaster of Paris are used.—V. C.

Sifting Cement, Improvements in Apparatus for. C. H. Watson, W. Bartholomew, W. Holden, Greenhithe. Eng. Pat. 25,152, Dec. 27, 1894.

CEMENT falls from the stones on to a horizontal sieve, to which is given a reciprocating motion by a connecting-rod and eccentric. The suspension of the sieve is arranged so as to traverse the material sifted from one end to the other. Loosely-suspended rods, against which the sieve strikes in its travel, afford a vibratory effect.—B. B.

Blast-Furnace Slag and other Slag, Improvements in the Manipulation and Treatment of, and in Apparatus therefor. T. Hydes, London. Eng. Pat. 465, Jan. 8, 1895.

THE economic application of blast-furnace slag has hitherto been hindered by the cost of disintegrating the large blocks in which it is customarily allowed to form. In the present invention the molten slag is caused to run in small streams down inclined surfaces, whereby it breaks up into globules. By the rapid chilling of these globules, the resulting material becomes very brittle, so that it can be readily pulverised (as is required in the manufacture of cement); and, on the other hand, by allowing the globules to cool gradually, a very tough material may be obtained which is suitable for making roads.—V. C.

X.—METALLURGY.

Improved Ten-Ton Chlorination Barrel. Eng. and Mining J. 60, 1895, 370.

THE apparatus, which is lined with lead, was devised for use in the chlorination of gold ores, but it is suitable for use in other cases where ores have to be agitated with acid solvents. Where cyanide is to be used as a solvent, the joints of the shell should be well caulked and the lining omitted. The barrel, which revolves horizontally, is 15 ft. in length, by 5 ft. 2 in. in diameter. The heads are flanged spherical segments $\frac{1}{2}$ in. thick. To the shell are fastened manholes or charging-hole castings and the carrying flanges that support the tires on which the whole revolves. All joints of the shell are butt-jointed, with cover-plate, and are double-riveted; all rivets and bolts have countersunk heads on the inside, to leave a smooth surface.

The tires are heavy cast-iron rings, bolted to the carrying flange. Two manholes are provided for charging and discharging pulp. The shell is calculated to stand a working pressure of 60 lb. per sq. in.

The lead lining, when the harrel is used for chlorination, is of 18-lb. chemical sheet lead. It is put in, carefully dressed back against the shell, and bolted in place with a large number of flat-headed bolts. Flanges tapped for 2-in. pipe are fastened with tap bolts to the shell at top and bottom, for the inlet and outlet of wash water and solution; also holes are bored for the inside filter frame.

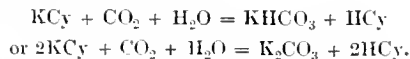
The tires revolve in a set of trucks carrying four rollers, two of which serve as the friction-driving rolls, and are keyed to a shaft, to which is also keyed the large spur-driving gear; the other two rollers are keyed to gudgeons, and revolve free. The speed of the revolving cylinder is about $8\frac{1}{2}$ revolutions per minute.

The total weight of the machine, as estimated, is about 28,000 lb.; the weight of the heaviest piece, the cylinder with lead lining, being about 14,000 lb.; without the lining, about 9,100 lb. The harrel is fitted with a sand-filter of the kind described in the Eng. and Mining J. for September 21st, 1895, 273.—J. H. C.

Cyanide Process for Gold Treatment, Contributions to Chemistry of. E. A. Schneider. Eng. and Mining J. 1895, 489, 514.

To determine the absolute effect of oxygen on cyanide solutions, a series of small-scale experiments was tried, from which it was found that oxygen oxidises cyanide to cyanate, but less energetically than is frequently assumed, and more readily in dilute than in strong solutions; which accords with Maclaurin's observation that the weaker solutions absorb the larger volume of oxygen. But the loss of cyanide observed with 50 c.c. of a 0.25 per cent. solution of KCy, kept in contact with 250 c.c. of oxygen for a week in a closed bottle, and exposed to sunlight, was only 2.78 per cent.; whilst a similar solution left for a week in the dark lost only 1.13 per cent. Stronger solutions lost less in the sunlight, and were unchanged in the dark. The presence of cyanate was determined by a reaction described in a separate abstract (page 51).

Experiments with carbon dioxide showed that when cyanide solutions of varying strengths were exposed in shallow dishes to the air, the weaker solutions suffered relatively most, but absolutely least, alteration; but when a constant weight of potassium cyanide was dissolved in varying volumes of water, the most dilute solution was least affected, both absolutely and relatively, by the carbon dioxide of the air. The range of decomposition was from 28 to 66 per cent. in one day. But solutions of uniform strength, exposed so that the depth of column varied, lost practically the same amount, per unit of time, in all cases, showing that the layer of solution affected by the carbonic acid is of practically constant depth. Agitation of the solution is equivalent to increasing the depth of the layer. A covering film of coal-oil, estimated at 0.04 mm. in thickness, was observed practically to prevent the decomposition of the cyanide. By treating cyanide solutions with a large excess of pure carbon dioxide in closed bottles, and examining the residue, it was found that either of two equations might be correct:—



The resulting mixture of potassium carbonate or bicarbonate with hydrocyanic acid was found to be an excellent solvent for gold, provided that oxygen was present.—W. G. M.

Composition for Polishing Metal. W. A. Rayner, Kimberley, Cape of Good Hope. Eng. Pat. 17,321, Sept. 17, 1895.

"An ounce of aqueous ammonia" is diluted with 3 oz. of water, coloured with 3 grains of orange dye, and made up to 6 oz. by the addition of prepared chalk. The product is rubbed on the metal to be polished, until dry.—B. B.

Zinc, Technical Analysis of. H. Nissenon and B. Neumann. Chem. Zeit. 1895, 1624.

See under XXIII., page 52.

PATENTS.

Alloys, Improvements in, for Anti-Friction Purposes. M. Wagner, London. Eng. Pat. 22,199, Nov. 16, 1894.

ACCORDING TO THIS improvement, the alloy is prepared of lead, tin, and antimony, with the addition of a small quantity of either barium, cesium, calcium, cerium, didymium, lanthanum, potassium, rubidium, strontium, tellurium, thorium, zirconium, or an admixture of any of them. All the metals are fused separately, and the molten lead well washed with sal-ammoniac, after which the molten tin is poured into the cleansed lead; then the antimony is added and well stirred. A small quantity of one or more of the above-mentioned metals is then added, the proportion varying according to the nature of the work required of the bearings. The alloy is usually composed as follows:—80 lb. lead, 15 lb. antimony, 5 lb. tin, and for light-running shafts, from 0.25 to 0.50 per cent. of either of the other metals; or for heavy-running shafts, 0.5 to 1 per cent. The compound is poured into moulds, and when cold and set, the working surface is dressed ready for fitting.—G. H. R.

Producing Magnetic Oxide on Wrought or Cast Iron, An Improved Method of. P. H. Bertrand, Paris. Eng. Pat. 23,855, Dec. 7, 1891.

See under XIII. B., page 40.

Gold Solvents, Improvements in the Manufacture of. J. J. Hood, London. Eng. Pat. 882, Jan. 14, 1895.

A CRUDE alkali cyanide is freed from sulphides by any known process, as by agitation of the solution with white lead or litharge; and a mercury compound, "such as the chloride," is added, and the mixture is evaporated to dryness; or it is concentrated until a double salt crystallises out. Varying proportions of the constituents may be used, as two parts of mercury chloride to one of potassium cyanide, or equal weights of each. Caustic alkali may be added, in which case suitable proportions are: mercury chloride, 5 parts; alkali cyanide, 10 parts, and caustic alkali, 1 part. Instead of mercury chloride, a lead compound may be taken, obtained by boiling litharge with caustic soda solution, to which the inventor adds "varying quantities of potassium or sodium cyanide, or mixtures of these," and evaporates to dryness. It is claimed that the preparation of these solvents avoids the losses contingent on the evaporation of a simple alkali cyanide solution.—E. S.

The Utilisation of Liquors from Chlorination-roasted Ores or Tailings, Improvements relating to. H. Brewer, Duisburg, Germany. Eng. Pat. 1348, Jan. 19, 1895.

THE liquor obtained by lixiviating "chlorination-roasted" zinc ores, with or without pyrites or iron oxides, and containing sodium sulphate and chloride, zinc chloride, iron sulphate, and salts of manganese, cobalt, nickel, and silver, is treated with calcium chloride, preferably that occurring as a by-product in the ammonia-soda process, and the calcium sulphate precipitated, is separated. After precipitation of any silver present, the ferrous salt is oxidised by air, and thrown down as ferric hydroxide by calcium carbonate. Cobalt, manganese, and nickel are precipitated by chlorine or bleaching-powder, and the liquor, now containing substantially zinc, sodium, and calcium chlorides, is evaporated; the sodium chloride that salts out is removed for application in the chlorination process, and the mother-liquor is electrolysed to obtain zinc and chlorine.

When the chlorination-roasted ores are cupreous, the silver and copper may be separated from the liquor either before or after the treatment with calcium chloride. The copper can be separated by iron or by electricity with simultaneous elimination of chlorine, or by both processes.

—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Carbon, Transformation into Plumbago. J. Reyval. L'Éclairage Électrique, 1895, 4, 451; Proc. Inst. Civil Eng. 1895, 123, 78.

Messrs. Girard and Street have devised several special kinds of electric furnaces for the purpose of transforming carbon into graphite. The author thus describes these furnaces and the process:—The carbon rod to be converted into graphite is passed through a block of refractory material, having a small heating chamber in the centre.

A second carbon enters this chamber at right angles to the first carbon, and an arc is maintained between the two. The speed at which the first carbon is caused to pass through the chamber is regulated in accordance with the temperature to which it is to be raised. In the case of circular carbons for arc-lighting, the carbon rod to be converted is given a motion of rotation as well as of translation. The effect is then as follows:—The action of the arc leaves a spiral trace on the carbon to be converted. Its size on a 0.55-in. diameter carbon with a 40-ampere arc, was $\frac{1}{16}$ in. broad and about $\frac{1}{16}$ in. in depth, and this represents the carbon converted into graphite.

By regulating the speed with the temperature the whole surface of the carbon can easily be converted. In this process the carbon to be treated was connected to the positive pole. The alterations effected were as follows:—The electrical conductivity of the carbons is increased in the ratio of 1 to 4, and the conductivity to heat in about the same proportion. The density of the untreated carbon of 0.55 in. diameter was 1.98, and after treatment was increased to 2.6. The proportion of carbon converted into plumbago was in this case 85 per cent. of the whole. The carbon so treated is being used in arc-lamps, for the brushes of dynamos, and as electrodes in the electrolysis of alkaline salts.

PATENTS.

Carbon for Electrical and other Purposes, Improvements in the Manufacture of. C. P. Shrewsbury, F. L. Marshall, and J. Cooper, London, and J. L. Dobell, Modbury, Devon. Eng. Pat. 15,782, Aug. 18, 1894.

See under II., page 25.

Saccharine Syrups or Liquids, Improvements in the Method of and Apparatus for Purification of. G. Gin, Paris. Eng. Pat. 22,568, Nov. 21, 1894.

See under XVI., page 42.

Gas Batteries, Improvements in. H. T. Barnett, London. Eng. Pat. 23,590, Dec. 3, 1894.

The inventor proposes the use of a carbon electrode of numerous short outstanding filaments in contact with a suitable conducting support. Carbonised velvety fabrics are claimed. The object is to increase the occlusive power for the gas in which such an electrode is employed.

—J. C. R.

Primary Batteries, Improvements in. E. M. Levetas, H. Levetas, and W. Rowbotham, Birmingham, England. Eng. Pat. 107, Jan. 2, 1895.

The object of this invention is to utilise the increase of temperature which takes place in the working of a cell, to provide for the circulation of the electrolyte in order to diminish polarisation, and relates to that class of battery in which carbon is the positive, whilst iron or other suitable metal is the negative element. The cell is divided into four or more compartments by the plates, which are placed near to one another, and are provided with circulation openings at the top and bottom, so that the heated fluid between the carbon and the metal plates can rise and flow into the outer compartments.—G. H. R.

Oxygen into Ozone, Apparatus for Transforming. M. Otto, Paris, France. Eng. Pat. 748, Jan. 11, 1895.

The apparatus consists of a rectangular box of wood coated internally with a protective varnish, and standing on insulating feet. The box contains a series of parallel elements, each consisting of two glass plates having perforations at their one end, and having between them a sheet of aluminium or other conducting material, stopping short of the perforations, which are arranged alternately at the lower end of one element and at the upper end of the next one. The end plates are only provided with one opening for the entry and egress respectively of the gas to be ozonised. The glass plates are separated by thin strips of asbestos, and the end plates rise above the others, the trough-like space thus formed being filled in with suitable cement to seal the box hermetically. The alternate conducting plates are connected to one terminal, whilst the remaining plates are connected to the other pole of a Ruhmkorff coil or high-tension alternating current generator. The electrical discharge takes place across the spaces between the successive elements, whilst the current of oxygen to be ozonised flows in a zigzag course through the apparatus.—G. H. R.

Electrical Storage Batteries, Improvements in. J. B. Marchant and J. Woolley, London. Eng. Pat. 1676, Jan. 24, 1895.

These improvements relate to the construction of electrodes for secondary batteries of lead shot, solid or hollow, retained in either metallic or non-metallic, perforated or non-perforated vessels.—J. C. R.

Electric Accumulators, Improvements in and relating to. O. Pirsch, Liège, Belgium. Eng. Pat. 1717, Jan. 24, 1895.

The plates are constructed of a thin metal plate surrounded by a frame of similar metal, the core of which is provided with projections, protuberances, or rents in the metal, which are so arranged that their curved outer extremities hold the active material in contact with the metallic core. The plate is filled up to the depth of the frame with active material, which is loosely compressed, and is maintained against the core by the claw-like protuberances. It is claimed that this construction allows the electrolyte to penetrate throughout the mass, and renders the whole active, whilst the numerous protuberances ensure good conductivity.—G. H. R.

Primary Batteries, Improvements in and relating to. W. Rowbotham and H. S. I. Levetas, Birmingham. Eng. Pat. 7600, April 16, 1895.

This relates to single-fluid primary batteries, and has for its object the circulation of the exciting fluid for reducing polarisation. This is effected in a battery of cells by suitable openings for the flow of the electrolyte, arranged alternately at top and bottom of the dividing walls. Where iron and carbon form the couple, the following is given as the electrolyte:—Bichromate of soda, 1 part; sulphuric acid, 5 parts; water, 25 parts. Eng. Pat. 107 of 1895 is referred to (see Col. 1).—J. C. R.

Primary Batteries, Improvements in and relating to. W. Rowbotham and H. Levetas, Birmingham. Eng. Pat. 13,730, July 18, 1895.

The essential features of these improvements are in the direction of circulation of the electrolyte and the construction of the carbon elements in the form of tubes having their upper ends open to the atmosphere.

An iron electrode is enclosed in a bag or covering of flannel. The battery solutions consist of bichromate of soda and dilute sulphuric acid for the carbon elements, and sulphuric acid and water for the iron elements.—J. C. R.

Galvanic Batteries, Improvements in. R. W. Gordon, Massachusetts, America. Eng. Pat. 13,900, July 20, 1895.

In the improved cell the positive element is formed of zinc, which is preferably fluted, while the negative element is copper or iron, and the depolarising agent black oxide

of copper, the exciting fluid being a solution of caustic soda. The elements are contained in a jar provided with a tightly-fitting cover which has a central opening closed by a plug of insulating material, from which the zinc is suspended. The negative element is arranged concentrically around this, and is suspended from the cover. It consists of a receptacle formed of concentric perforated inner and outer walls, closed at the bottom by an annular plate, the space between the walls being filled with black oxide of copper.—G. H. R.

Primary Batteries, Improvements in and relating to. W. Rowbotham, Birmingham. Eng. Pat. 14,158, July 25, 1895.

THE claim here is for a primary cell in which the carbon elements consist of porous carbon tubes which are open to the atmosphere at both ends (see foregoing abstract of Eng. Pat. 13,739, above).—J. C. R.

Primary Batteries, Improvements in and connected with. W. Rowbotham, Birmingham. Eng. Pat. 15,371, Aug. 15, 1895.

A PRIMARY cell is claimed in which the carbon elements consist of plates of porous carbon or graphite having passages extending through them from edge to edge and open to the atmosphere (see page 39).—J. C. R.

Galvanic Dry Cells, Improvements in. C. E. C. Jungnickel, Altona, Germany. Eng. Pat. 17,259, Sept. 16, 1895.

TO avoid the bursting of the seal, or closure of the cell, or even the cell itself, by interior evolution of gas, in the case of dry cells, the inventor applies a gas regulator in the shape of an inverted closed tube or chamber of glass placed in the cells. At the bottom of this "regulator" is a small aperture. If gases are generated inside the cell and not able to escape with sufficient rapidity, they will force the electrolyte through this small aperture into the regulator, the air in which will be more or less compressed and so act as a regulator.—J. C. R.

Electric Batteries, Primary, Improvements in. M. M. Bair, Paris, France. Eng. Pat. 17,603, Sept. 20, 1895.

THE claim is for an electric battery, the negative electrode of which has "agglomerate" (peroxide of manganese and carbon) blocks, or pieces, secured thereto by screw bolts, studs, or pins.—J. C. R.

Galvanic Batteries, Improvements in Tubular. E. S. Boynton, Brooklyn, U.S.A. Eng. Pat. 20,214, Oct. 26, 1895.

THIS invention relates to galvanic batteries in which all the cells or elements are merged or combined into the form of a common receptacle for the liquid electrolyte. One of the electrodes (carbon) forms a fixed part of said receptacle (shown as a cylinder), and the other (zinc) being removable.—J. C. R.

(B).—ELECTRO-METALLURGY.

The Nickel-plating of Wood, Processes for. Dingler's Polyt. J. 298, [3], 72.

THE articles to be nickel-plated must first of all be coated with metal; for this purpose the following three solutions are employed:—I. $1\frac{1}{2}$ grms. of caoutchouc slices are dissolved in 10 grms. of carbon bisulphide, and 4 grms. of melted wax are poured into the solution. A mixture which has been prepared beforehand, consisting of 5 grms. of phosphorus in 60 grms. carbon bisulphide, with 5 grms. turpentine and 4 grms. of powdered asphalt, is then added, and the whole shaken. II. 2 grms. of silver nitrate are dissolved in 600 grms. of water. III. 10 grms. of chloride of gold are dissolved in 600 grms. of water. The conducting wires are attached to the article, which, after being immersed in the first solution, is allowed to dry. The second solution is poured over it, and it is kept suspended until the surface has a dark lustre, when it is rinsed with water and treated

in a similar manner with the third solution. The surface has now a yellowish sheen, and the wood is sufficiently prepared for electrolytic deposition.

Langbein's dry process consists in quickly pouring over the article a colloidal solution of potassium iodide, diluted with an equal volume of ether-alcohol; when the layer is just about to set, the wood is laid in a weak solution of silver nitrate, light being excluded. As soon as a yellow colour appears, the wood is rinsed, exposed to sunlight, and covered with copper, prior to being nickel-plated.

Wooden handles for surgical instruments may be treated by immersion in an ethereal solution of paraffin or wax, and when the ether has evaporated, fine graphite is powdered over them, or the wax is covered with bronze powder, and all unevenness of surface removed. When the articles are to be electrolytically coated with copper, they are placed in a bath, the composition of which varies with the current employed; generally, it consists of 30 litres of 18 per cent. copper sulphate solution, and $1\frac{1}{2}$ litres of 66 per cent. sulphuric acid. When a sufficient amount of copper is deposited, the articles are ground, polished, and nickel-plated in a bath composed of 500 grms. of ammonium nickelous sulphate, 50 grms. of ammonium sulphate, and 10 litres of distilled water. If blue litmus paper be quickly reddened by this solution, the acidity is reduced to such a point by addition of ammonium chloride, that the reddening is only slowly developed.—J. L. B.

PATENTS.

Metallic Alloys, Process for the Treatment of certain, for the Manufacture of Elements for Voltaic Batteries and Caustic Alkalis or their Derivatives. L. P. Halin, Modane, France. Eng. Pat. 23,198, Nov. 29, 1894.

ACCORDING to this process, the alloys employed are those described in Eng. Pat. 23,117, Nov. 28, 1894 (this Journal, 1895, 1049), and it is preferred to construct the electrodes by casting an alloy of barium and lead round a lead grid, but a support of any metal less fusible than the alloy, such as copper, may be used; and the alkali metal forming the alloy depends on the nature of the alkali to be produced. The castings are arranged in a series of troughs alternately, between carbon plates of the same sign, and the spongy plates are arranged in a second series, all the plates of like sign being connected together in each series. The metal plates of the first series are then connected to the carbon plates of the second, whilst, correspondingly, the spongy plates of the second series are connected to the carbon plates of the first. The first series of troughs, which contain the plates of alloy, are filled with a cold solution of alkaline nitrate, sulphurous acid, or sulphites, according to the by-products required; whilst the second series of troughs, in which the plates are to be peroxidised, are filled with a dilute solution of sulphuric acid.—G. H. R.

Zinc and Lead, Process and Apparatus for the Production of, by Electrolysis of the Melted Chlorides. R. O. Lorenz. Eng. Pat. 25,074, Dec. 24, 1894.

THE object of this invention is to effect the working of ores or residues, or alloys containing zinc and lead, by converting them into chlorides and subjecting them to fractional electrolysis at a temperature of from 450° C. to 680° C., with the addition, as may be required, of small quantities of litharge, red lead, peroxide of lead, zinc oxide, or other metallic oxides or peroxides, or of common salt, potassium chloride, magnesium chloride, calcium chloride, sodium fluoride, or similar fluxes for preventing frothing and for regulating the process. The ores or residues are lixiviated by means of hydrochloric acid or acetic acid, with precipitation, if required, of the lead and silver chlorides by the addition of concentrated hydrochloric acid, or introduction of hydrochloric acid gas. The electrolysis is effected in an inclined trough of porcelain or fireclay, which is enclosed in an iron casing, and has an air-tight cover through which the electrodes are passed. Suitable means for charging and for leading off the gas are provided, and at the lower end is a depression or pocket connected with a pipe through which the metal produced during electrolysis can be drawn off. Both the electrodes are made of carbon, and given the form

of a grating, so that the gas generated on the under side of the anode can freely rise, whilst the metal deposited on the cathode can fall through to the bottom of the vessel. The anode is placed about the middle of the vessel, and above the cathode.—G. H. R.

Aluminium, A New Process for the Electrolytic Preparation of. A. Roger, Paris, France. Eng. Pat. 6131, March 28, 1895.

The process consists in the electrolysis of an alkaline solution prepared from bauxite, in an ebullite vat, the bottom of which is covered with a layer of mercury, which forms the cathode. The anode is prepared from finely powdered bauxite and crude petroleum mixed in suitable proportions to form a thick paste, which is rolled into a conical shape, and then calcined at a high temperature in a closed jar. Suitable means are provided for stirring the electrolyte whilst the process is in operation, and for withdrawing the amalgam formed. The aluminium prepared in this way contains 2 per cent. of sodium, which is stated to be an advantage, as it protects the aluminium from oxidation when it is cast into ingots.—G. H. R.

XII.—FATS, OILS, AND SOAP MANUFACTURE.

Lard, Analysis of. A. Goske. Chem. Zeit. 1895, 19, 1043.

See under XXIII., page 53.

PATENTS.

Vegetable Fibre Soap. E. Uebrig, Berlin. Eng. Pat. 18,017, Sept. 26, 1895.

In place of the pumice powder often added to soaps in order to increase their detergent properties, the inventor uses sawdust, "wood flour," ground wood, &c.—F. H. L.

Suint from Wool, Improvements relating to the Removal of, Recovering or Separating Certain Constituents from the Suint, and Obtaining Certain Valuable Products therefrom. H. E. Newton, London. From J. H. Wingfield, Montclair, N.J., U.S.A. Eng. Pat. 20,433, Oct. 29, 1895.

The solvent employed in this process for treating the wool, consists of a heavy petroleum oil (sp. gr. 0.837–0.878) at a temperature of 120° F. On cooling the resulting liquid to about 70° F., the cholesterol of the suint separates out as a heavy deposit, while the "glycerides" remain in solution. This solution is found to be an efficient substance for the scouring of the wool, leaving it in a condition suitable for the subsequent carding, &c. The wool is treated with the petroleum oil in an ordinary wool-scouring bowl fitted with pressure rollers. One-half to one gallon of solvent is employed per lb. of wool, and after about 20 minutes' action, the greater part of the liquid is drawn off, the operation being repeated if necessary. The wool is treated with water or neutral soap, rinsed, pressed, and dried. After filtration, the liquid is cooled, the deposit removed, and the clear solution used over again. The latter may also be employed as a lubricant, or for use on leather, and, containing no free fatty acids, it is much better adapted for either purpose than the analogous mixture of dégras and petroleum oil.—F. H. L.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

PATENT.

Drying and Packing White Lead and the like, Improvements relating to. E. J. Read, St. Albans. Eng. Pat. 24,746, Dec. 20, 1894.

The lead is dried in a flat metal pan, heated from below, over which a traveller works on rails. The traveller carries

a number of stirrers extending to the bottom of the pan, and also an ejecting device, which, every time the traveller reaches the end of its stroke and arrives at the edge of the pan, pushes a certain amount of the material into a shoot leading to the casks to be filled. The whole apparatus is covered with a movable hood connected with a chimney.—F. H. L.

(B.)—RESINS, VARNISHES.

PATENTS.

Producing Magnetic Oxide on Wrought or Cast Iron, An Improved Method of. P. H. Bertrand, Paris. Eng. Pat. 23,855, Dec. 7, 1894.

ONE part of manganese peroxide is boiled with 99 parts of "oil" until it is converted into sesquioxide. The resulting varnish is applied to the iron after cleaning, and the articles are heated to 800°–1,000° C. for about 20 minutes. Further decomposition occurs, the manganese being converted into Mn_2O_3 , whilst the iron becomes coated with a film of the similar (magnetic) oxide. The manganese may also be used in the form of a 3 per cent. aqueous solution of the acetate, or the moulds in which the iron is cast may be varnished with the above material.—F. H. L.

Metal Glazing Bars, Enamelling or Varnishing. E. B. and J. H. Podmore, Brighouse, Yorkshire. Eng. Pat. 25,241, Dec. 29, 1894.

THE "glazing bars" of the roofs of greenhouses, &c., are coated with a mixture of anise, poppy-seed oil, carbolic acid, and turpentine.—F. H. L.

Protecting Bright Metals, Improved Varnish for, and Solvent for Removing such Varnish when required. H. Crowther, Leeds. Eng. Pat. 2196, Jan. 31, 1895.

THE varnish consists of dammar dissolved in benzene or similar liquid; and the solvent, of nitrobenzene (1 part) and crude benzene, &c. (3 parts).—F. H. L.

(C.)—INDIA-RUBBER, &c.

African India-Rubber. A. Dewèvre. Ann. Soc. Scient. de Bruxelles, 1895, 19.

THE following are the most important species of *Landolphia* found in Africa from which rubber is obtained:—*L. Petersiana*, *senegalensis*, *lucida*, *ovariensis*, *tomentosa*, *kirkii*, *madagascariensis* (in Madagascar). The widespread *L. comorensis* var. *florida*, however, yields a product of little value, used only to adulterate saps of better quality.—A. C. W.

PATENT.

Plastic Rubber Compounds (Old Rubber Goods), Improvements relating to the Treatment of. H. H. Lake, London. From W. Cable, Boston, U.S.A. Eng. Pat. 1948, Jan. 28, 1895.

IN working up old articles made of rubber, it is usual to pass the material through a roller mill which produces a sheet of about $\frac{1}{16}$ in. in thickness, in order to be able to see and pick out the impurities. According to this patent, the mill is fitted with three rollers arranged vertically over one another, the top pair running at about equal speeds in contrary directions, and being set at the required distance apart. The rubber is made to pass between them, then over the middle roller, where it is inspected, and the foreign matters removed. It then travels to the third roller, geared at half the speed, and set at double the original distance from the middle one. By this construction, the sheet thickens up again, and can be caught by a small delivery roller without fear of tearing it—an accident that frequently happens to the calenders of ordinary construction, involving the stoppage of the machine.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Disinfection of Hides in the United States. Board of Trade J., Jan. 1896, 62.

A DESPATCH, dated 12th December last, has been received from the Foreign Office, inclosing copy of a circular issued

by the United States Treasury Department, containing the following revised regulations for the disinfection of hides:—

"Representations having been made that the process promulgated on November 14, 1895 (this Journal, 1895, 1052), for the disinfection of hides of neat cattle intended for shipment to the United States, is attended with injury to the hides, the following method, suggested by the Department of Agriculture, is adopted hereby, and will be required in all cases of shipments of such hides, when not dry-salted or arsenic-cured, from the countries of Europe, Asia, Africa, Australia, and South America, viz.:—

"Dry hides which have not been salted or arsenic-cured should be disinfected. Disinfection with sulphur dioxide may be accepted in case a room is provided which can be tightly closed, and also in case the bundles of hides are undone and each hide suspended separately from the ceiling in such a manner that there may be free circulation of the sulphur fumes, and that all parts of the surface may be acted upon. There should be at least 4 lb. of sulphur burned to each 1,000 cubic feet of air space, and the room should be kept closed and the hides subjected to the sulphur dioxide for six hours; or the dry hides may be immersed in a 4 per cent. solution of carbolic acid, or a 1 to 1,000 solution of bichloride of mercury, until they are thoroughly wet with the disinfectant. Fresh or moist hides, whether salted or not, should be disinfected by immersion in a 5 per cent. solution of carbolic acid, or a 1 in 1,000 solution of bichloride of mercury.

"It should be understood that the regulations herein provided do not in any way modify or affect any regulations concerning disinfection issued under the quarantine laws of the United States."

Agricultural Value of Leather Waste. Lindsey. Agric. Science, 1894, 8, 98.

See under XV., page 41.

Oak - Wood Extract, Analysis of, by the Hide Powder Method. F. Cerych. Der Gerber. 1895, 21, 241—243.

See under XXIII., page 54.

Trades Waste, Treatment of. W. Naylor. Proc. Inst. Civil Eng. 1895, 123, [Part I.].

See under XVIII. B., page 46.

PATENTS.

Marbled Leather, Improvements in the Manufacture of. R. Haddon, London. From J. Scholl, New York, U.S.A. Eng. Pat. 16,493, Sept. 3, 1895.

THE skins are tanned, preferably with sumach, stretched and dried, scraped on the flesh side, and nailed to boards. To effect the marbling, the oil colour (aniline colours are not suitable) is dropped on to the surface of a solution of salt in a vat and caused to form any desired configuration by imparting to the water an appropriate movement, either by fanning it or stirring it, or by dissolving a small quantity of potassium carbonate in the water. If more than one colour is to be used, each is added in turn. The skin, nailed to its board, is now introduced in an inclined direction, so that the surface of the skin takes up the colour or colours floating on the water. The coloured skins are dried in a heated room, removed from the boards, and passed through slightly heated calendering rolls. Excess of colour is removed by a soft brush and the skin again calendered. The dried skin is next polished with a solution of shellac in alcohol, on the coloured surface, and finally rendered pliable by scraping its back with a suitable knife.—A. G. B.

Raw Hides, An Improved Process and Apparatus for the Treatment of. A. F. Diehl, Weimar, Germany. Eng. Pat. 18,178, Sept. 28, 1895.

THE improvement is in the liming process. Instead of being laid away in a pit containing milk of lime and periodically withdrawn for the purpose of plunging the pit, the hides are suspended, by means of hooks, in a vertical position in the pit, and the milk of lime is kept in

rotatory and upward movement by the revolution of a vertical shaft, which carries four radial blades at the bottom of the pit. Two of these blades are set at an angle so as to cause the upward movement of the liquor. It is claimed that the softening of the hair roots is much expedited by this movement, and that the hides benefit from not being exposed to the air. The system may be applied to any unhairing process in which a liquid is used.

—A. G. B.

XV.—MANURES, Etc.

Leather Waste, Agricultural Value of. Lindsey. Agric. Science, 1894, 8, 98.

LEATHER is less soluble in pepsin than dried blood, but is rendered more soluble by steaming or treating with hot sulphuric acid; 1,000 lb. of sulphuric acid (50° B.), 300 lb. of powdered leather, 400 lb. of water, and 1,350 lb. of raw phosphate are the quantities recommended for the preparation of a manurial mixture. The presence of leather in a manure is best detected by testing for tannic acid.

—D. A. L.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Progress in, for the Third Quarter of 1895. Dingler's Polyt. J. 1895, 298, [4], 88—95; [5], 114—115.

SOME years ago Sidersky published, for the determination of the density of masscutes, a method based upon the specific gravity of a solution of 20 grms. of syrup in 100 c.c. of water, the apparent dry substance being calculated from a table. This table is incorrect, as it was founded on Balling's old table constructed for Mohr cubic centimetres. This author (Bulletin de l'association des chimistes, 1895, 12, 565) has now, with the aid of the tables of Scheibler and Sidersky, constructed one in which the true cubic centimetre is the unit employed.

According to K. Farnstener, in a paper entitled "*The Weighing of Copper as Cupric Oxide in the Gravimetric Estimation of Sugar*" (Forsch. über Lebensmittel und ihre Beziehung zur Hyg. 1895, II. 235), the Allihn tube can be used for the oxidation of cuprous oxide. The pressure tubing (5 mm. internal diameter) connecting the filtration flask with the pump, is cut through at some convenient place near the former, and a piece of glass tube with drawn-out ends inserted. After the cuprous oxide has been filtered and washed in the usual manner, the connecting piece of glass tubing is withdrawn, the filter flask removed, and the narrow end of the Allihn tube introduced into the pressure tubing. The tube is then carefully heated, the pump still being in action, until the asbestos and cupric oxide commence to glow. After cooling in a desiccator, it is weighed. The author states that the method gives satisfactory results: a further examination seems desirable, since the usual troublesome reduction with hydrogen is avoided.

Studies on Alkalinity.—L. Jesser (Oesterr.-ungar. Zeits. f. Zuckerind. und Landwirth. 1895, 24, 497) has continued his extensive investigations on this subject. The results of his work show that complete control of temperature, time of separation, and quantity of lime added is necessary in the first as well as in the second saturation. The temperature must be regulated in every vessel, and reserve means of heating should be available.

According to Grobert's communication on *The Use of Surface Condensation for Vacuum and Evaporation Apparatus, System A. Schaad and E. Schiegl* (L'alcool et le Sucre, 1895, [3], 642), this system works well, notwithstanding the difficulties which usually beset innovations. Surface condensation is used to prevent the vapours from the syrup, containing volatile oils and other organic matter, coming into contact with the cooling-water. Pollution of the water by organic matter does not occur, and the volume employed is considerably less than when condensation is effected by injection. The tubes do not become incrustated

in the Schaad and Schiegel system: for although the water is hard, calcium salts are not precipitated, as the rise in temperature of the effluent water is gradual, and at no time reaches the temperature of the steam. This system is carried out in the Rossitz Sugar Manufactory (Moravia), and, from the results obtained, Grobert foresees—I. A simplification of the effluent question of sugar factories, as the volume of water used is less and its purification easier. II. More efficient condensation; thereby an increased vacuum. III. The condensation water is at a relatively high temperature, and, being absolutely free from sugar, it can be employed again for feeding the boilers, for diffusion purposes, and especially for the recovery of sugar from defecation-muds.

Use of Wood in Evaporating Apparatus.—Claassen (Dingler's p. J., 1895, 297, 184) has recommended for increasing the efficiency of the evaporating apparatus, a diminution in the cross section of the tubes by suspending suitable staves of wood (Rouleauxstäben) in a fixed position. The use of these staves in a triple-effect apparatus has been studied by Battut (Journal des fabricants de sucre, 1895, 35, No. 22) during the last campaign, and he found that although the evaporation was increased, and the formation of incrustation diminished, there were the following objections:—After the second usual cleansing of the triple-effect, a peculiar brown colouring of the syrup was noticed, an appearance considerably increased after the third cleaning, in which a boiling with potash-lye was included. The syrup from the thick-juice boiler contained appreciable quantities of invert-sugar, and the alkalinity had decreased. The staves were found to contain invert-sugar, colouring matter, and free hydrochloric acid; the latter was not removed by the alkaline treatment, and the result of its presence was the inversion and colouring of the juice during heating. Claassen (Zeits. des Ver. f. die Rübenzuckerind. des Deutsch. Reiches, 1895, 45, 517) states that Battut's (*loc. cit.*) objections are due to a different method of cleansing, and also to the fact that he placed staves in all three bodies of the triple-effect, when he (Claassen) advised they should be placed only in the first. Experiments have shown that hydrochloric acid does not penetrate quicker into used than into unused staves. Staves can be employed if they are confined to two bodies of a triple-effect; the whole apparatus should be cleansed by boiling first with soda, then, for a short time, with dilute hydrochloric acid ($\frac{1}{2}$ per cent.), and finally by careful rinsing out with water.

Details are given (Die deutsch. Zuckerind. 1895, 20, 1346) on the use of wood in a Yaryan apparatus at the Makaweli Factory (Hawaii).

Steam Engines in the Sugar Factory.—Strakoseh (Oesterr.-ungarische Zeits. Zuckerind. und Landwirth. 1895, 24, 524) states that the most important question in this direction is the replacement of the full-pressure steam engines still frequently found in sugar factories by those of the economical modern expansion type.

Lach (Oesterr.-ungarische Zeits. f. Zuckerind. und Landwirth. 1895, 24, 703) has carried out Soxhlet's refining process on a manufacturing scale, and was able to work with nearly saturated sugar solutions. For an input of 1,000 meter-centners, a filtering surface of 150 sq. m. of filter press and 75 sq. m. of Swoboda filter was required. According to the quality of the input, the filtration takes from 6—18 hours. The filter medium consists of kieselguhr and sawdust, which can be easily cleaned and used again, thus reducing expense to a minimum. Low-quality sugars may be worked up by repeatedly passing the "cleare" through mechanical filters.

The Use of Tollen's Formaldehyde Lamp in the Sugar Industry.—Tollens (This Journal, 1895, 592), having constructed a simple lamp which, by the incomplete combustion of methylalcohol, produces formaldehyde, Herzfeld (Zeits. des Vereins f. die Rübenzuckerind. des Deutsch. Reiches, 1895, 45, 529) has made some experiments with refined sugar solutions, and is of opinion that the lamp would be of service in disinfecting storing-places where sugar has gone bad, and in preventing the inversion of sugar solutions by fungoid growths.

The Purification of Effluent Water by Oxidation, and its Sterilisation by Light.—Grobert (L'alcool et le Sucre,

1895, 3, 110) divides his process into purification and sterilisation; the former takes place in two stages—preliminary cleaning, and oxidation. The water is conducted into convenient reservoirs and mixed with milk of lime (in combination with a metal salt in some cases, especially in sugar factory effluents) until feebly alkaline. The clear water is removed by filtration or decantation, and is then ready for oxidation, which must take place quickly and in the cold. Permanganates are best suited for this purpose, as they give no poisonous deposit, are easy to work, and comparatively cheap. The water containing the products of oxidation in suspension, is well aerated and allowed to settle in a reservoir. For the purposes of separation it is best to lead the water into a basin provided with a filtering dam. The centre of this dam consists of vertical layers of different-sized gravels held together by fascines and piles; the head is prepared of beaten earth or turf. Working with this system, it is possible to filter 10 sq. m. in 24 hours on each cubic metre of the basin. The filtered water is clear, only slightly alkaline, and free from lime. The dead micro-organisms are left behind in the deposit, but to ensure their complete absence the author exposes the water to the action of direct or reflected sunlight in shallow basins, the superficies being changed as frequently as possible. The appliances being the same as for the above-mentioned aeration.—J. L. B.

"Greying" of Raw Sugar. Munier. D. Zuckerind. 1895, 20, 1744.

The author considers that this coloration is caused by the presence of double sulphate of iron and potassium, and that the sulphur of this double salt principally arises from decomposed albumin. It is therefore of importance that the albumin should be completely precipitated.—J. L. B.

Sugar Beet, Manuring with Potash Salts. H. Bodenbender and N. Rydlewski. Blatt. f. Zeckerrübenbau. 1894, 1, 259—262.

The manuring with potash salts exerted no effect either on the yield of sugar beet or on the quantity of sugar therein, hence it is inferred that potash was not required on the soil of the experimental plots. More alkaline chlorides were found in the beet heavily manured with kainite; but no relationship was observed between the proportion of alkaline chlorides and the quantity of sugar in the roots.

—D. A. L.

Sugar, Volumetric Estimation of, by Means of Ammoniacal Copper Solution. Z. Peska. Rozprawy české akad. 1895, 5, Cl. II. [19].

See under XXIII., page 54.

Sugar, Production of, in Germany. Board of Trade J., Jan. 1896, 78.

See under Trade Rep., page 58.

Glucose, Production of, in Germany from August 1st, 1894, to July 31st, 1895.

See under Trade Rep., page 59.

PATENTS.

Saccharine Syrups or Liquids, Improvements in the Method [Electrolytic] of and Apparatus for Purification of. G. Gin, Paris. Eng. Pat. 22,568, Nov. 21, 1894.

The process consists in purifying the syrup by the addition of (preferably) basic aluminate of calcium containing 4—6 equivalents of calcium, at about 80° C., to precipitate albuminoids, cellulose, pectin bodies, certain organic acids, and phosphoric acid, magnesia, iron oxides, &c. The syrup is then passed through a series of electrolysing troughs, wherein the dissociation of the impurities is effected by the aid of neutral electrodes. In the upper portion of each compartment, a separation and removal of the dissociated bases and acids is brought about by the passage of an electric current, partly through soluble anodes and partly through neutral anodes. It is found economical to divide this separation process into two operations, the acid liquid

from the soluble anodes being employed as re-agent in the second operation. Finally, the eliminated liquids are subjected to electrical osmosis for the recovery of the small portion of syrup that had diffused through the diaphragms in the preceding stages. Polarisation of the electrodes is obviated by blowing a current of air at intervals over the face of the electrodes to remove accumulations of gas and solid deposits.—C. S.

Boiling and Concentrating Apparatus [Sugar, Gums, &c.], *Improvements in*. T. Moore, Bristol. Eng. Pat. 23,396, Dec. 3, 1894.

This apparatus is designed for boiling and concentrating solutions of sugar, gums, mucilages, and the like by means of superheated steam, the superheating being effected preferably by the aid of molten metal surrounding the steam pipes. In order to counteract back pressure, an exhaust condenser or pump is employed to draw the steam through the liquid. The steam may be generated in a boiler or in the superheater, and may be passed through a coil or jacket in the boiling pan or be blown direct into the solution.—C. S.

A Carbonaceous Absorbent, An Improved Manufacture of. H. Albert, Biebrich-on-Rhine, Germany, and London. Eng. Pat. 138, Jan. 2, 1895.

SAWDUST, quinine waste, vine twigs, grape cake, or generally any suitable vegetable matter or by-product, is carbonised *in vacuo* at a stated high temperature, and the product, after being washed, is put through filter-presses and dried. This product is stated to have certain advantages over kieselguhr as an absorbent. 100 parts of it absorb 225 parts of phosphoric acid of 60° B., or 235 parts of sulphuric acid at 60° B., to form a solid mass. The absorbent charged with phosphoric acid, when used to precipitate albuminous matter from syrup, retains the colouring matter, leaving a "sugar solution as clear as water."—E. S.

Drying Waste Vegetable Substances, Improved Process for [Fodder]. P. Schottländer, Breslau. Eng. Pat. 2440, Feb. 4, 1895.

MAKING use of the osmotic properties of the vegetable cell, the inventor proposes to replace the superfluous moisture in waste vegetable substances by solid matters (in solution) of a suitable nature for increasing the value of the substance as fodder. The dissolved matters are made to circulate through successive vessels containing the substance under treatment, on the counter-current system, and when complete saturation has taken place, the excess of liquid is removed by pressure.—C. S.

Sugar, Improvements in the Manufacture of. W. P. Thompson, Liverpool. From H. A. J. Manoury, Paris. Eng. Pat. 3049, Feb. 12, 1895.

THE idea on which this invention is based is to regulate the composition of the massecuite, by means of added molasses in such quantity that, when all the water has been evaporated (except the 7 per cent. requisite for maintaining sufficient fluidity to allow of easy treatment in the centrifugal machine), the liquor surrounding the crystals has the same or a lower quotient of purity (0.69 for beet-root molasses, and as low as 0.40 for cane sugar syrup) than that of the molasses, a condition indicating the removal of all extractible sugar. Owing, however, to the necessity of centrifugal treatment at a lower temperature than that of the boiling pan, it becomes essential to increase the amount of added molasses by a quantity sufficient to redissolve the precipitate resulting on the cooling of the massecuite.—C. S.

Pure Saccharates, Improvements in and connected with the Production of. P. B. Hårje, Örtöfta, Sweden. Eng. Pat. 16,017, Aug. 26, 1895.

To obviate the waste resulting from the ordinary process of washing saccharates, and improve the quality of the finished product, the inventor proposes to substitute for the usual washing liquid a saturated solution of pure saccharate of the alkaline earth containing 0.1–1 per cent. of sugar,

and 0.3–1 per cent. of lime (CaO). In the case of barium and strontium saccharate, the proportions will be 0.2–1 per cent. of sugar, and 3–8 per cent. of barium hydrate, or 0.2–2 per cent. of sugar and 6–14 per cent. of strontium hydrate. The washing liquid is economised by using it over again, the final washings being effected by the purest liquid.—C. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

Isomaltose. E. Fischer. Ber. 23, 3024–3028.

SOME years ago the author found (Ber. 23, 3687) that a disaccharide (isomaltose) resulted from the action of strong hydrochloric acid on glucose. It was characterised by means of its osazone. Subsequently, Lintner announced that he had found isomaltose in beer, and he also described its presence amongst the products which result by the hydrolysis of starch, a statement which has recently been refuted by Ling and Baker, and Brown and Morris. Ost asserts (this Journal, 1895, 877) that the synthetic isomaltose is impure maltose.

The author has again examined the disaccharide, and finds that it differs in a very marked manner from maltose in its unfermentability by yeast, and in its stability towards the yeast enzymes.

Isomaltose was freed from glucose by fermentation with beer yeast, and the resulting product purified by dialysis. It gave an osazone, which on crystallisation from ethylic acetate, yielded nodular yellow aggregates of crystals, melting at 158°, and which, when dried at 100°, contained 10.27 per cent. of nitrogen, an amount which is about 0.5 per cent. below the calculated.—J. L. B.

Fermentation Industries, Advances in Biological Control of, by the Aid of the Microscope. P. Lindner. Journ. Fed. Inst. Brewing, 1, 547–557.

AFTER giving a historical survey of this subject, the author describes the following modification of Hansen's fractional culture method for yeast analysis and for the examination of air and water. Drops of a culture, which has been conveniently diluted with wort or sterilised water, instead of being introduced into flasks containing wort, are caused to fall upon the dry inner surfaces of two sterilised Petri's dishes. 50 drops are placed in each, and the dishes brought together with their inner surfaces facing. At the end of two days yeast spots may be found in the drops. These can be examined with medium powers, and it is only in the case of very small cells that culture in a special microscopic preparation is necessary. They moreover dry up quickly when exposed to the air, and furnish a preparation which lasts for months and can be used at any time for examination. In the case of wild yeasts, free aëration in the drop cultures often causes sporulation similarly to culture on gypsum blocks. The flocculent races of yeast are easily distinguishable from the non-flocculent varieties.

In order to determine the kind of growth of a beer on the lager vat, the author employs the method of "small drop cultures." A sharp-pointed, sterilised pen is dipped into the sample of beer. From 30–40 fine strokes 2 mm. long are drawn side by side on a sterilised cover glass, which is then placed over the well of the slide glass, a layer of vaseline being smeared round the glass ring, so that the junction is air-tight. The cells soon commence to germinate on the cover glass, and on the following morning round each mother cell may be seen some 20 daughter cells. If these are left undisturbed, they rarely become detached from their original position, and consequently the growths seldom become mixed. By examining the strokes, the author is able to count how many groups of wild yeasts there are in comparison with the normal yeasts. In such a culture, cultivated yeasts exhibit large, healthy, completely circular cells, with granular contents; the exhaustion of nourishment causing hardly any diminution in the size of the younger cells. The cells of the secondary yeasts are, however, smaller, and there is in them a lack of uniformity; although the nutrient solution is almost exhausted, daughter cells still continue to develop, whilst immature

and weak cells are cast off by the mother cell. The author also describes the examination of tun worts and pure water.—J. L. B.

Bacterium Aceti Hansen and Bacterium Pasteurianum Hansen, the Influence of Temperature on the Growth of. F. Lafar. *Centr. bl. für Bact.* 1895, 1, 129

EXPERIMENTS are here described which show that *B. Aceti* can grow at temperatures of 8–10° C., *B. Pasteurianum* giving no sign of activity at this temperature. The former can grow at still lower temperatures, and indeed flourished vigorously at 4° C.—A. L. S.

The Removal of Wild Yeasts from an Infected Pitching Yeast by the Natural Method of Pure Yeast Cultivation. A. Munsche. *Wochenschr. f. Brauerei*, 12, 1895, 598–601.

THESE experiments were carried out in a brewery.

A pitching yeast was prepared of eight parts of brewery yeast and one part of wild yeast. The wort was pitched at 7° R.; after well rousing, a sample was taken and examined by Lindner's method of drop cultivation, and the yeast was found to contain 14.3 per cent. wild yeast.

After standing 42 hours, the wort was pumped into another vessel, allowing the sediment to remain behind. The fermenting wort was then heated to 10° R. and three large glass vessels were immersed in it which were removed for examination on the second, third, and fifth day.

The yeast in the first contained 0.5 per cent. of wild yeast, that in the second was 16 mm. high, of which 6 mm. corresponded to that in the first vessel; the remainder contained 1.5 per cent. of wild yeast. The yeast of the third dish contained in the upper 2 mm. 5.5 per cent. of wild yeast. It is thus evident that a separation has already taken place.

The yeast from the bottom of the vat was collected, and on examination was found to contain 4.3 per cent. of wild yeast. This yeast was suspended in water and allowed to deposit, when the water was drawn off. This was repeated six times. A vat was pitched with this purified yeast; after well rousing, the wort was examined and the yeast was found to contain only 0.9 per cent. of wild yeast. The pitching temperature was 7.5° R. and rose to 9.5° R. in four days. After drawing off the fermenting wort, the sedimentary yeast was found to contain absolutely no wild yeast.

Another experiment confirmed these results.—A. L. S.

Diastase, Chemical Nature of. T. B. Osborne. *J. Amer. Chem. Soc.* 1895, 17, 587–603.

DIASTASE prepared by the usual methods contains the greater amount of the proteid matter of the malt, together with a large amount of carbohydrates and salts. The author precipitated the diastase and proteids by saturating an aqueous malt extract with pure ammonium sulphate. This precipitate was dialysed in water until most of the sulphate had been removed and the proteid largely dissolved. The insoluble residue, consisting chiefly of globulin, was filtered off, and the filtrate saturated with ammonium sulphate; the resulting precipitate was dialysed in water, whereby most of the globulin was separated, and after filtration, the filtrate was dialysed into an equal volume of alcohol of sp. gr. 0.84. After 24 hours, precipitate 1 had separated and was filtered off. The filtrate was dialysed into alcohol of the same strength and precipitate 2 obtained. Precipitate 3 resulted by dialysing the filtrate into stronger alcohol, and precipitate 4 in a similar manner. The filtrate from this, on the addition of a large quantity of absolute alcohol, yielded precipitate 5.

Precipitate 1 was not wholly soluble in water. The soluble portion was dialysed in water, then in strong alcohol, when it yielded a substance with a diastatic power of 30 on Lintner's scale. The insoluble portion was extracted with a sodium chloride solution, filtered, and the filtrate dialysed; it then had the properties of globulin, and a very low diastatic power. Precipitate 2 was treated with water, dialysed in the same medium, and then in alcohol, for 24 hours. The proteid, when precipitated with strong alcohol, was soluble in water, and had a diastatic power

of 75. The portion insoluble in water was similar to the residue of 1. Precipitate 3 was subjected to the same treatment; it had a diastatic power of 222. Precipitate 4, similarly treated, yielded a substance dissolving to almost a clear solution in water, and having a diastatic power of 600. Its composition was: Carbon, 52.59 per cent.; hydrogen, 6.72 per cent.; nitrogen, 16.10 per cent.; sulphur, 1.90 per cent.; oxygen, 22.78 per cent. Precipitate 5 was completely soluble in water, had a diastatic power of 60, and consisted chiefly of proteose. The author concludes that diastase is a true proteid, and is therefore either an albumin, a combination of albumin with a proteose, or a proteose. Inasmuch as those precipitates consisting of proteose have only a slight diastatic action, it would appear that the diastatic enzyme is most closely related to albumin.—J. L. B.

Sulphured Hops, Disadvantages of. *Wochenschr. f. Brauerei*, 1895, 912–913.

THE influence of sulphuring on hops is by no means properly understood by the average brewer; some, indeed, consider hops to be improved by the process, and purchase sulphured hops accordingly. The advantages, however, are entirely on the side of the dealer, enabling him to palm off an inferior article at a superior price. The disadvantages (to the brewer) may be summed up as follows:—

1. Sulphured hops are sent out in a much moister condition (10 per cent. more water) than is permissible in the case of properly cured unsulphured hops.

2. The process is employed to hide real and serious defects. Musty, discoloured hops are renovated and restored to a semblance of good fresh hops.

3. Hops from various sources, no matter how different in colour, &c., may be mixed and made apparently uniform by sulphuring.

4. The sulphur abstracts from hops a portion of their fine aroma, whilst the sulphuric acid formed by slow oxidation, unfavourably influences the fermentations and the delicate flavour of the beers.

The brewer is, therefore, strongly recommended to purchase his hops direct from the grower, and not to lay too much stress on a fine, uniform appearance of the article—too frequently merely the result of sulphuring.—H. T. P.

Pasteurisation of Beer. Can Beer be rendered Practically Sterile without Alteration in Flavour and Composition? H. van Laer. *Le petit J. du Brasseur*, 1895, 391.

THIS question is answered in the affirmative, provided suitable conditions be adhered to. The temperature and duration of pasteurisation required, depend on the nature of the beer, the number and nature of the organisms contained in it, and on the time the beer is to remain sound afterwards. In general, however, a temperature of 60° C. suffices to render beer practically sterile. In case of bottom-fermentation beers, this temperature should be reached in about 20 minutes, and maintained for 15 minutes longer before cooling, &c. As regards top-fermentation beers (pale ale), the heating should be more gradual (to 60° C. in about 50 minutes). The essential point, however, is that the beer must contain a good excess of carbonic acid. The following *modus operandi* is, therefore, suggested:—

1. Saturation of the beer with artificial carbonic acid.
2. Filtration.
3. Transfer to the steriliser under isobarometric pressure.
4. Pasteurisation and cooling.
5. Transfer to casks, &c., under isobarometric pressure.

In addition, any pipes which the beer must traverse after pasteurisation should be steamed. As regards sterilisation of storage vessels, it suffices to wash bottles with water at 80° C. Casks, if freshly enamelled, may be used straight away; with others, treatment with steam or hot water is believed to be sufficient. It must be mentioned that the author employed in his experiment a steriliser *silver-plated* internally. This was filled with beer to within 2 per cent. of its volume, and *hermetically* closed during the whole duration of pasteurisation.—H. T. P.

Formaldehyde in the Brewery, Its Use as a Germicide.
Windisch. Wochenschr. f. Brauerei, 1895, 909—910.

CERTAIN results (Amer. Brewers' Rev. No. 2, Aug. 1895) are quoted, according to which the use of "formalin" (a strong solution of formaldehyde in water) must be entirely condemned, "partly on account of its poisonous properties, partly because it produces in beer, even when added in small proportions, gluten-turbidity, and an objectionable flavour." The author points out that the above conclusion is misleading, since the legitimate function of formaldehyde is that of a disinfecting agent. Formaldehyde vapour (this Journal, 1895, 379—380), even when largely diluted with air (as obtained by the incomplete combustion of methyl alcohol), exerts a powerfully destructive action on germs in general, and on mould-spores in particular; and affords a cheap and ready means of disinfecting storage cellars, cooler and refrigerator rooms, plant, &c., from which the vapour is afterwards readily removed by ventilation or washing. In this connection, Trillat suggests that the atmosphere over coolers and fermenting tuns should be sterilised by means of formaldehyde vapour, in order to preserve the worts from infection. In solution, formaldehyde appears to lose much of its power, and, according to Trillat, at least 10 grms. per hectolitre must be added to beer to check the development of the lactic and butyric ferments. Its use as an antiseptic is, therefore, evidently beyond question.—H. T. P.

"Flour Dressing" in its relation to Beer. T. A. Glendinning. Journ. Fed. Inst. Brewing, 1, 558—570.

DIASTATIC dressing continues the conversion of the starch products formed during mashing. It has been stated that flour dressing exerts a mechanical action upon the yeast produced. To show that this assertion is not correct, the author carried out the following experiment:—Two similar worts were fermented under the same conditions; the first was dressed with wheat flour, the second with a filtered aqueous extract of an equal weight of the same flour. The fermenting worts were well roused, and the following conclusions drawn from the analytical results:—The rate of attenuation was about the same in each case, the two yeast crops were almost identical, whilst the quantity of sludge left in the fermenting vessels after racking did not materially differ. Flavour, brilliance, and condition were alike in the resulting beers, and analyses made after racking showed them to be the same in composition. If dressing be added at an early period of primary fermentation, the beers tend to rack at lower gravities than do non-dressed beers. A considerable difference is noticed in the behaviour of dressed and non-dressed beers when subjected to the "forcing test." If any fermentable matter be present, both classes of beer begin to ferment vigorously at 75°—80° F. When this action ends, only a slight fermentation, which soon ceases, is observed in dressed beers; the non-dressed beer ferments steadily, and will continue to do so after the expiration of the usual time for forcing. There are marked differences in the deposits from the forced beers, the yeast cells from a dressed beer being small and shrivelled, and the number of bacteria greater than in a deposit from a non-dressed beer.

In a discussion which followed the reading of this paper, J. Heron said that he had found flour dressing useful in arresting boiling fermentations, more especially those in which the attenuation of the fermenting wort ran down very low. This was not explained by the author's statement that the effect of dressing was to hydrolyse the unfermentable constituents of the wort. E. R. Moritz stated that there were two kinds of boiling fermentation, one arising from under- and the other from over-saccharification. In both cases the action of dressing was beneficial; in the first because the diastatic action reduced the viscosity and made the composition of the wort normal with regard to starch transformation products; in the second, because the effect of the dressing was to aerate the wort, and to cause the expulsion of carbon dioxide, consequent upon the rousing-in of the dressing.—J. L. B.

Refrigerating Machinery, New Improvements in.
Wochenschr. f. Brauerei, 1895, 12, 602—604.

See under 1., page 22.

PATENTS.

Drying Waste Vegetable Substances, Improved Process for.
P. Schottländer, Breslau. Eng. Pat. 2440, Feb. 4, 1895.

See under XVI., page 43.

Charging Liquids [Beer, &c.] with Gas, and Apparatus therefor, Improvements in or relating to. A. J. Boulton, London. From A. M. Hofmann, Chicago, U.S.A. Eng. Pat. 2039, May 17, 1895.

The salient points of this invention are the charging of beer and other liquids with carbonic acid gas (previously incorporated with a portion of the liquid) in a mixing chamber situated between the pumping and storing apparatus. The latter contains air or gas under a counter-pressure for preventing the escape of the gas imprisoned in the charged liquid, and the vessel is not only completely filled, but surcharged with the liquid so as to cause an actual compression of the same, equivalent to the production of about 150 lb. pressure in the holder. In racking off the contents of the holder, both the latter vessel and the racking apparatus are connected with a low tension back-pressure reservoir to keep the gas from escaping during the process.—C. S.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY AND WATER PURIFICATION, DISINFECTANTS.

(A.)—CHEMISTRY OF FOODS.

Naphthol Yellow in Vermicelli, Macaroni, &c., Detection of. F. Schaffer. Chem. Zeit. 1895, 19, 216.

See under XXIII., page 53.

PATENTS.

Preservation of Perishable Produce, such as Meat, Game, Fish, and the like Articles, A New or Improved Method or Process and Apparatus for. P. N. Jenkins, Melbourne, Victoria. Eng. Pat. 17,823, Sept. 21, 1895.

The articles of food are first enclosed in a chamber of suitable construction, they are then submitted to a preliminary treatment by injecting an anti-septic gas or vapour, such as sulphur dioxide, into the chamber, and finally, by means of an air pump, the chamber is exhausted as completely as possible and hermetically sealed.—L. A.

Cereal Food or Bread and the Manufacture of the same, Improvements in and relating to. H. D. Perky, Boston, U.S.A. Eng. Pat. 19,368, Oct. 15, 1895.

WHOLE wheat or other cereal, after being thoroughly washed, is boiled for about one hour to cook it and remove the outer siliceous coating and adherent foreign matter. It is seasoned with salt. It is then allowed to dry for several hours in rotating wire gauze barrels until the soft starchy interiors of the grains have acquired about the same consistency as the outer layers. Finally, by compression between rollers, the whole is reduced to a homogeneous mass, which is discharged by means of combs or scrapers in the form of light porous threads or filaments ready for immediate consumption.—L. A.

(B.)—SANITARY CHEMISTRY.

Germ-free Drinking Water, Preparation of, by means of Chloride of Lime. Dr. Bassenge. Zeits. für Hygiene, 1895, 227; Proc. Inst. Civil Eng. 1895, 123, 33—34.

THE disinfecting properties of chloride of lime have been frequently investigated, and a brief account is given of the opinions expressed by those who have previously dealt with this subject. Traube has pointed out its probable value for the production of a germ-free drinking water, and has proved its utility by practical experiments. His tests, however, were not conducted with pathogenic germs, though he concluded from his experiments that this substance, used in the proportions which he advocates, would be fatal to all kinds of bacilli.

The author sums up the facts established by him as follows:—

(1.) In order to render water which is highly polluted with pathogenic bacteria germ-free, it suffices to add to it for 10 minutes 0.0978 gram. of active chlorine per litre, which is about equivalent to 0.15 gram. (three parts per 20,000) of commercial chloride of lime. If the time under treatment be extended, say, to two hours, 0.0108 gram. of active chlorine is sufficient.

(2.) The superfluous chlorine not needed for the disinfection can be reduced by means of calcium bisulphite, which leads to the formation of a scanty precipitate of calcium sulphate. Water treated in this way is quite innocuous, acquires no unpleasant taste, but increases in hardness. It can be partaken of throughout lengthened periods without injury to health, since, for the foregoing chemical treatment, no substances are added beyond such as are usually present in potable waters.

(3.) It does not require any chemical test to determine whether all the chlorine has been removed, since this fact can readily be ascertained by taste and smell.

(4.) This process of safely preparing by chemical means a germ-free drinking water can be easily carried out, and possesses from certain aspects a most important practical significance.

Trades Waste, Treatment of. W. Naylor. Proc. Inst. Civil Eng. 1895, 123, [Part 1.].

Methods of treating the waste liquors from the following industries are described:—(1) Calico-bleaching, -dyeing, and -printing. (2) Wool-washing and -scouring. (3) Paper-making. (4) Tanning. (5) Alkali- and soap-making, and (6) Iron-galvanising.

Calico-bleaching, -dyeing and -printing. The analyses given below indicate the general nature of the various effluent liquors from a calico-bleachworks, in which the lime and soda-ash process of bleaching is followed.

	Dissolved Solids.			Suspended Solids.			Total Solids.	Acidity. Normal NaOH required.	Alkalinity. Normal H ₂ SO ₄ required.	Volume.
	Mineral.	Volatile.	Total.	Mineral.	Organic.	Total.				
	Parts per 100,000.							Parts per 100.		Gallons.
Water supply from reservoir	8.0	10.3	18.3	Nil	Nil	Nil	18.3	Neutral		..
First wash or steep	42.9	145.1	188.0	16.4	55.9	72.3	260.3	0.2	..	20,000
Waste lime-liquor (from keir)....	134.3	613.8	748.1	9.0	105.0	114.0	862.1	..	1.4	1,600
Wash out of lime keir.....	22.8	25.7	48.5	6.8	9.7	16.5	65.0	..	0.3	20,000
First (or grey) sour.....	288.9	131.4	420.3	8.8	55.9	64.7	485.0	32.7	..	1,600
Wash out of grey sour	42.7	22.0	64.7	3.4	10.7	14.1	78.8	1.5	..	10,000
Waste soda-ash liquor (from keir)	802.1	556.4	1358.5	{ Included with the dissolved solids. }			1358.5	..	10.1	1,400
Wash out of ash keir.....	30.7	20.2	50.9	3.0	9.0	12.0	62.9	..	2.0	20,000
Waste "chromic".....	114.3	29.8	144.1	8.6	11.5	20.1	164.2	..	0.5	1,600
Second (or white) sour.....	126.5	47.5	174.0	1.2	7.1	8.3	182.3	10.9	..	1,600
Final wash	8.2	12.1	20.3	2.9	11.2	14.1	34.4	0.3	..	20,000

The plant now generally used for dealing with these liquors consists of settling tanks and filters. That designed and constructed for Stanning and Sons, of Leyland, has been in successful operation some time. The bleach- and dye-liquors, along with all the wash-waters, enter the mixing-channel together and are treated with lime and aluminoferric sulphate. Thence they pass to the precipitation-tanks, in which subsidence of the suspended matters takes place. The ferric and aluminium hydroxides, besides inducing the deposition of suspended matters, assist in clarifying the effluent liquors by combining to some extent with some of the colouring matters present.

A continuous flow of the liquors into the tanks is found to give the best results, this being probably due to the fact that the suspended matters in bleach- and dye-liquors aggregate when slightly agitated.

The almost clear liquor is conducted away from the top of the tanks by floating-arms, and the sludge is removed by a Shone ejector, into which it gravitates. A volume of 500,000 gallons is dealt with daily, this being the combined capacity of the tanks. The nearly clarified liquors are generally run into the river direct, but if required for further use, they are collected in a storage reservoir. In the latter case, they are pumped from the sump on to cinder-filters, which deliver the water into the reservoir. Thence pipes convey it from a well to the various departments of the works.

The filter-beds are about 5 feet deep and are made of furnace-clinkers. The dissolved solids are largely eliminated by them, as is shown by the following analyses:—

	Dissolved Solids.			Suspended Solids.			Total Solids.		
	Volatile.	Mineral.	Total.	Organic.	Mineral.	Total.	Mineral.	Organic.	Total.
	Parts per 100,000.								
Untreated liquor.....	41	86	130	24	12	36	98	68	166
Tank liquor.....	40	92	132	..	..	..	92	40	132
Filtered liquor.....	10	56	66	..	..	..	56	10	66

The quantity of aluminoferric sulphate used per day amounts to 166 lb. About 17 tons of sludge, containing 95 per cent. of water, are produced, but of this only about 33 tons are retained, the remainder passing away in the liquors.

The wet sludge is lifted by the ejector into earth drying-pits, from which it is carted away when dry.

Dried at 100°, the sludge consists (per 100 parts) of:—Organic matter (19.6 parts), silica, &c. (38.5), calcium carbonate (31.1), alumina (3.2), ferric oxide (7.3). It has no value as either fuel or manure.

The Mather-Platt system of softening water (this Journal, 1891, 511) has been extended to the treatment of dyers'

and bleachers' waste waters. Its principal advantages are:—The quick and intimate intermixture effected by it of the precipitants and liquors under treatment; the ease and accuracy with which precipitants can be used and their results tested as regards alkalinity, acidity, or neutrality; and the reduction in the amount of precipitant required owing to the clarifying action of the sludge already formed.

The Candy tank is well adapted for the economical removal of suspended matters from liquors which are only slightly polluted, and which do not require filtering. The liquors are fed into the tank at the bottom by down-pipes, the inlets being laid at semi-tangents to avoid disturbance

of the sludge already deposited. The tank has a flat bottom, from which the sludge is siphoned off by a perforated pipe, moved over its surface by a winch. The sludge is delivered about 2 feet below the level of the water in the tank and is of a satisfactory consistency.

Indigo-dyeing.—At the works of the Pincroft Dyeing and Printing Company, Adlington, Lancashire, the waste liquors containing indigo in suspension are passed into precipitation-tanks, receiving on the way between 10 and 15 grains of lime per gallon. The precipitated indigo is raised by an ejector from the bottom of the tanks, and blown into the dye-vats for use again. The liquors contain, before treatment, 0.4 part of indigotin per 100,000, and are of a deep blue colour; after treatment they are clear, and contain little objectionable organic matter.

Wool-washing.—At the works of Thomas Biggart, of Dalry, Ayrshire, the recovery of the grease and potash from the liquor produced in wool-scouring is effected in the following manner:—The suds from the first bowl, containing about nine-tenths of the grease and potash, after standing about 12 hours to ensure deposition of the sand, are evaporated in a pan until the liquid attains a syrupy consistency. The resultant liquid is then cooled in shallow iron trays, the grease which collects on the top being removed at intervals. The semi-liquid residue is calcined in a brick oven, the heat produced from it being used to assist in the evaporation. A crude carbonate of potash is thus produced, which after being completely carbonated, is boiled to dissolve out the potash salts. The solution is concentrated to 100° Tw., the potassium sulphate and chloride crystallising out on cooling. The quantity of fuel required is about 1 ton for 1,500 gallons. The potassium carbonate and grease obtained are sold.

In a recent type of machine, that of Emile Richard-Lagerie, of Roubaix, the wool is subjected successively to the action of liquors of diminishing strengths, the last being clear water. The liquors, after having passed through the wool, are pumped for re-distribution into tanks, until they attain a density of 1.07, when they are evaporated, and the residues calcined for the manufacture of potassium carbonate. Each machine is capable of dealing with about 8 tons of wool per 24 hours. The furnaces consume 1 cwt. of coal per cwt. of potash produced.

The grease is extracted from the suds at the works of Alf. Matte and Co., Roubaix, by a mechanical process of "battage." The suds are, by means of a rotary agitator, beaten into a froth, which carries to the surface the fatty matters. The latter are skimmed off into conduits by a mechanical scraper, and are forced by a steam extractor into a wooden tank, in which they are heated to 60° and treated with sulphuric acid in the proportion of 1 lb. to 100 gallons. The acid is then removed by washing and the grease is filter-pressed.

Wool-scouring.—In the establishment of Thomas Fox, at Wellington, Somerset, the soapy liquors are led into six acidifying tanks and treated with sufficient acid to liberate the fatty acids, which on separation along with the wool-fat, are drained on sawdust filters. They are afterwards taken off and purified by distillation for conversion into soap again.

The dilute acid from the acidifying tanks is pumped into intermediate storage tanks for further settlement, after which it gravitates into the precipitation tanks, and is treated with the general waste waters from the works by aluminio-ferrie sulphate and lime.

Paper-making.—The effluents from paper mills are effectually purified by the same methods and means as cotton bleachers' effluents. When treated with ferrous sulphate and lime, deposition of solids takes place quickly, and a clear, supernatant liquid is obtained.

At Peebles' Mill, Church, Lancashire, the precipitate obtained with aluminio-ferrie sulphate and lime is collected and pressed, and, owing to its containing a considerable amount of fibre, is used, after being washed, for the manufacture of the coarser brown, or shop, papers.

Since the introduction of imported wood pulp, the volumes of waste liquors from paper mills have decreased largely.

Tanning.—Waste liquors from tanneries form probably the worst manufacturing pollution, containing, as they do, much organic, putrescent matter, which cannot be precipitated by ordinary means, if at all.

The plant in use at the works of W. and J. Sagar, of Colne, consists of two sets of tanks, along with screens and filters. The first set of tanks receives the washings of hides and the fermentation refuse liquors. From them the liquor passes, after settlement, through fibre-screens to a series of precipitation tanks, and thence, through an oxidising filter, to the river.

The second set of tanks receives the waste liquors from the lime pits. These, after settling, are filtered through layers of earth and ashes, which are so arranged as to enclose as much air as possible.

Alkali Works' Refuse.—In addition to the Chance sulphur recovery process, various expedients have been devised for the treatment of the immense quantities of tank waste lying about the country.

One of these consists in pumping the drainage liquors from subterranean channels on to a filter of iron oxide, then clarifying the more or less oxidised liquor by subsidence in tanks, and again filtering through iron oxide.

Another method, which is advantageously adopted where large volumes of waste liquor have to be dealt with, is to treat the liquor with a ferric salt and then to filter through sand or gravel.

Iron Galvanising.—The waste from this industry consists of either iron sulphates or chlorides, with free sulphuric or hydrochloric acid.

In the case of the iron sulphate waste, treatment with lime is adopted, the precipitated iron oxide being sometimes collected and used as a pigment.

In the case of the mixed ferrous and ferric chloride waste, excellent results are obtained with the Turner recovery process. The solution is evaporated, and the residue strongly heated, decomposition into ferrous-ferrie oxide, chlorine, and hydrochloric acid taking place. The chlorine is mixed with steam as it passes over the fire-bridge of the furnace, and is transformed into hydrochloric acid. This, along with that evolved as such, is led into a tower and condensed for use again. The recovered acid contains, on an average, 8.8 per cent. by weight of ferric chloride which volatilises with it from the decomposing furnace. The iron oxide obtained is of some value as a fettling for puddling-furnaces, for which it is sold.—E. B.

Coal-Gas Flames, On the Alleged Escape of Carbonic Oxide and Unconsumed Carbon from. Lewis T. Wright. J. Gas Lighting, 66, 1895, 1023—1024.

See under II., page 24.

PATENTS.

Filtering Apparatus [Water], Improvements in or connected with. J. Pinfold, Aston, Birmingham. Eng. Pat. 695, Jan. 11, 1895.

The filter consists of a tank charged with filtering material to about one-third of its height, and special arrangements are made for collecting the filtered water, and for washing out or for sterilising the bed. The filtered water is collected by a number of gathering tubes placed at the bottom of the tank connected to a main duct leading to a discharge valve. The gathering tubes are provided on their top surface with a number of conical nozzles screwed therein, each nozzle having a convex fine wire gauze cover, and an internal spherical distributor or distributing plate. Instead of gathering tubes, a detachable chamber may be used, divided from the filtering tank by a plate having holes through which the screwed nozzles pass. When it is desired to wash out or sterilise the apparatus, the filter is run dry and water or steam passed upwards through the bed by means of the collecting tubes and nozzles, and the water passes away through openings in the tank just above the filter-bed to an annular pocket surrounding the vessel, and provided with a discharge valve. During the washing-out process the bed is agitated by vertical or inclined progs carried by a horizontal shaft joined to a vertical one, driven by worm-gearing from the exterior.—R. S.

Sewage Precipitation, New or Improved Method in. G. C. Purvis, Edinburgh. Eng. Pat. 20,366, Oct. 29, 1895.

THE sewage is first treated with carbon dioxide, or, if there be sulphuretted hydrogen present, with a mixture of that gas and sulphur dioxide, and then lime is added in very small excess, sufficient to render the liquid faintly alkaline to test papers.—L. A.

(C).—DISINFECTANTS.

PATENTS.

Diseases of the Vine and other Plants, A Composition for Treating. J. Y. Johnson, London. From L. Lasmolles and E. Fréchet, Paris. Eng. Pat. 360, Jan. 5, 1895.

COPPER sulphate, aluminium sulphate, and sodium bicarbonate are mixed together in suitable proportions. When the mixture is brought into contact with water in a suitable apparatus, carbon dioxide is generated, by the pressure of which the liquid containing in suspension basic carbonate of copper and alumina is sprayed on to the vine.—L. A.

Antiseptic and Disinfecting Compounds, applicable also for Washing Sheep and other Animals, and for the like purposes, An Improved. A. Pickles, Wakefield. Eng. Pat. 14,305, July 27, 1895.

THE first is a liquid mixture of castor oil, soap, and pyridine and the second is a powder made by mixing pyridine with powdered gypsum, chalk, or the like.—L. A.

Disinfectant Compound which may be used for Dipping Sheep, also as an Antiseptic for Purifying, Disinfecting, and General Detergent Purposes, An Improved. J. L. Wale, London. Eng. Pat. 18,223, Sept. 30, 1895.

COAL-TAR creosote, 40 parts; rosin, 20 parts; cresylic acid, 5 parts; olive acid, 5 parts; caustic potash solution (25° B.), 20 parts; eucalyptus oil, 5 parts; naphthalene, 5 parts; blended by heat.—L. A.

Disinfectant or Composition for Antiseptic, Disinfecting, Sanitary, and other Purposes, An Improved. H. Hiscott, London. Eng. Pat. 19,418, Oct. 16, 1895.

THE improvement consists in the preparation of a disinfectant in which phenols are present together with soluble fluorides, silicofluorides or borofluorides. Thus, any form of crude phenol is first mixed in the usual manner with melted rosin and a strong solution of caustic alkali, so as to form a clear fluid, a little cotton seed or cocoa-nut oil soap being added if required. The hot solution of the fluoride, silico-fluoride or boro-fluoride is then stirred in, not less than 10 parts of fluoride or 15 parts of silico- or boro-fluoride being added for every 100 parts of phenols.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Retail Paper Trade in Relation to Composition and Permanence of Writing Papers. Mitt. k. k. Versuchsanst. 1894, 12, 295; 1895, 13, [5], 219.

THE paper-testing work of the German Government Testing Institution at Charlottenburg has, as is well known, resulted in a systematic classification of papers according to composition and physical qualities, which classification, officially adopted, now regulates in an important and increasing degree the general practice of the manufacturing and wholesale trade. Whilst it has been easy to enforce the adoption of papers of specified composition in State and public offices, it is pointed out that the general public (in Germany) employ paper entirely "at haphazard," even in writing documents of official and permanent value. With the view of forming a public opinion on this matter, the Institution has undertaken an investigation of the practices prevailing in the retail selling and buying of papers. The scope of the inquiry may be outlined as follows:—Writing papers were bought at 35 of the leading stationers of Berlin, under recognised descriptions, such as good writing paper, best foolscap, best official note, good "lasting" paper, &c.—all implying the requirement of paper of high quality.

They were bought in quantities of 10–12 sheets, and at the same time the price was obtained for the paper in quantities of 1,000 sheets.

The papers were then analysed and classified according to the standards of the Institution. The results are given in tabular form.

At the same time also the question of selling price was investigated, the papers purchased being independently valued by three experts, the valuation being set out in tabular form, and a column giving the ratio of selling price to the mean figure calculated from the valuations.

The tables given do not admit of abstraction, but the main results tabulated lead to the following conclusions:—Of the papers purchased as "of lasting quality," 17 per cent. only conform with such specification; of the remaining 83 per cent., 29 are papers which could be guaranteed for a few years' "life," under ordinary conditions of storage, and 54 are of the classes suitable only for ephemeral purposes.

The results of the investigation in reference to selling prices were even more surprising. They show unaccountable variations, the figures lying for the most part between from 2 to 80 per cent. in excess of the estimated "fair" price.

The Institution then carried out some months later a second investigation, which was an exact repetition of the first. The results, which are given in the 1895 vol., 222, substantially confirm those already obtained, i.e., about 70 per cent. of the papers purchased were altogether inferior to the specification of the purchaser. It is noted also that three of the papers contained "mechanical" wood pulp, and seven contained more than 15 per cent. of mineral (ash) constituents.

Again, a similar investigation was carried out on the retail paper trade of Leipzig, and the results were closely similar to the above.

The author (Herzberg) sums up the work of this self-appointed commission in the laconic remark: "the probability of obtaining on demand a high-quality paper is, in the better class of stationers' shops in Berlin, about 1 in 5."—C. F. C.

Paper-testing, Reports on. Mitt. k. k. Versuchsanst., Berlin, 1895, 232.

A. MAINLY an account of controversies which have arisen upon reports furnished by the Institution. Results of analyses having been called in question, the samples in question have been further investigated, and in all cases the original finding confirmed.

B, C, D, E. These sections likewise contain no matter of fresh import.

F. Is a note upon "Oxidising Constituents of Papers." In investigating a wrapping paper prepared by impregnating an ordinary thin paper with a mixture of volatile and non-volatile hydrocarbons (Ger. Pat. 74,180), the presence of an active oxidant was revealed. Papers treated with linseed-oil varnishes have given similar results, viz., the liberation of iodine from a solution of potassium iodide; and the oxidant has been identified as hydrogen peroxide (Nördlinger). It appears that either a drying oil or turpentine, which was probably used in the former case, can occasion the formation of hydrogen peroxide.—C. F. C.

Trades Waste, Treatment of. W. Naylor. Proc. Inst. Civil Eng. 1895, 123, [Part I.].

See under XVIII. B., page 46.

The Wood-Pulp Industry of Canada. Board of Trade J. 1896, 40.

See under Trade Rep., page 57.

Paper Mills in India. Board of Trade J., Jan. 1896, 78.

See under Trade Rep., page 57.

Paper Sails. J. Soc. Arts, 1896, 44, 146.

See under V., page 30.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Narcotic Extracts, their Preparation and Alkaloid-Content. F. Ranwez. Chem. Zeit. Rep. 1895, 19, 190.

In the preparation of extracts generally from fresh plants, very different results are obtained according to the mode of procedure. A brown or green product is obtained according as the plant extract is, or is not, filtered before evaporation, the former containing much more alkaloid than the latter. The degree of concentration to which the extract is evaporated before the addition of alcohol also largely influences the result; the smaller the yield of extract, the larger is the quantity of alkaloid.—A. C. W.

Phellandrene. O. Wallach. Lieb. Ann. 287, [3], 371—384.

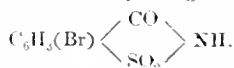
Two modifications of phellandrene occur in nature—dextrophellandrene in eucalyptus oil and levo-phellandrene in oil of bitter fennel. Phellandrene combines with nitrous acid to form a nitroso-nitrite, which Wallach prepares as follows:—The raw Australian eucalyptus oil is distilled under reduced pressure, whereby polymerisation is prevented, and the fraction containing the largest amount of phellandrene is dissolved in petroleum spirit and treated in a freezing mixture with dilute sulphuric acid, followed by the gradual addition of sodium nitrite solution. Care must be taken that the temperature does not rise above + 4° C. The nitroso-nitrite separates, is strained off from the liquid, washed with ice-water, and dried between filter-paper. It is finally purified by washing with methyl-alcohol, solution in chloroform and precipitation by a mixture of ether and alcohol, when it is obtained in snow-white woolly masses of crystals, melting at 165° C., and in the pure condition it is fairly stable.

Sodium ethylate converts it into Peci's "nitro-phellandrene," $C_{10}H_{15}NO_2$ (Gazz. Chim. 1886, 16, 227), and by reduction in alcoholic solution with sodium, an amido compound, $C_{10}H_{19}NH_2$, a ketone, $C_{10}H_{15}O$, and an alcohol, $C_{10}H_{19}O$, were obtained.

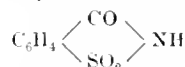
By mixing the corresponding derivatives of the dextro- and levo-phellandrene, racemic inactive mixtures resulted, which proved to be identical with similar derivatives prepared by the author from Carvenone (Wallach, Ann. 277, 130—137). These reduction products are active modifications of tetrahydrocarvone, $C_{10}H_{17}O$, tetrahydrocarveol, $C_{10}H_{19}O$, and tetrahydrocarvylamine, $C_{10}H_{19}NH_2$.—H. I.

p-Bromaniline Sulphonic Acid and a New Method of Preparation of Benzoic Sulphinide [Saccharine]. H. Kreis. Annalen, 286, 377.

By modifying the method of sulphonation of *p*-bromacetanilide, the author has prepared the *p*-bromaniline sulphonic acid. By a second modification—heating with 50 per cent. of its weight of ordinary sulphuric acid at 170°—180°, a quantitative conversion into the *o*-sulphonic acid is realised. The latter was converted by Sandmeyer's reaction into *p*-bromcyanobenzene-*o*-sulphonic acid; this into the anhydrochloride, from which the sulphonamide was obtained and readily converted into the corresponding benzoic-sulphinide—



An exactly parallel synthesis of the sulphinide—



was carried out by first debrominating the *p*-bromaniline-*o*-sulphonic acid and proceeding as indicated above.

—C. F. C.

Saccharine, Preserving Action of. Burkard and Seifert. Chem. Zeit. 19, 1895, 220.

The antiseptic power of absolutely pure saccharine was shown to be five times less, and that of the so-called "saccharinum purum" (300 times sweeter than sugar)

eight times greater, than that of salicylic acid. This, however, is of little importance in connection with its preserving properties. For instance, 3 grms. of salicylic acid are added to 1 hectol. of beer to prevent after-fermentation. The corresponding addition of 15 grms. of "absolute saccharine" would make the beer unpalatable through extreme sweetness.—J. R.

Drimys granatensis, L., Bark and Leaves of. O. Hesse. Annalen, 286, 369.

FROM observations of Schuchardt recently cited in the Pharm. J. and Trans. [3], 24, 169—170, this plant is described as "cotoin-yielding." After investigating the bark, the author concludes that it contains no cotoin whatever. He succeeded only in isolating an inert substance, Drimin, $C_{13}H_{14}O_4$.

From the leaves an alcoholic compound was extracted, with an empirical formula, $C_{25}H_{35}O_2$, which the author names Drimol. It melts at 73° 5'; yields an acetate— $C_{25}H_{37}(C_2H_3O)_2$ of m.p. 42° 5'; and an iodide, $C_{25}H_{37}IO$ on boiling with hydriodic acid (1·7 sp. gr.).—C. F. C.

Poisonous Vanilla. K. F. Töller. Pharm. Central-Bl. N.F. 1895, 16, 450.

THE author considers that ptomaines may be the cause of the poisonous results recently observed to follow the use of vanilla. The method of packing in tightly-bound moist bundles would, without doubt, favour decomposition. He recommends that the vanilla should be dried by desiccating agents, as in his cold-drying apparatus, and then preserved in air-tight glass cylinders. The aroma is retained by this treatment.—A. C. W.

Citric Acid, A Reaction of. L. Stahr. Nordisk. pharm. Tidskrift, 1895, 2, 141.

See under XXIII., page 53.

PATENTS.

Vanilline, Improvements in the Manufacture of. J. Y. Johnson, London. From F. von Heyden's Nachfolger, Radebeul, Germany. Eng. Pat. 1624, Jan. 23, 1895.

VANILLINE may be prepared by the electrolytic oxidation of an alkaline solution of iso-eugenol in a divided cell. The anodic compartment is charged with 15 per cent. iso-eugenol solution in excess of caustic lye, and the cathodic compartment contains 10 to 20 per cent. soda solution. The electrolysis proceeds best at 60° C., a current of about 6 amperes being passed, with an E.M.F. of 5 volts. The anodic liquid, on completion of the oxidation, is acidified, extracted with the ether, and the vanilline separated from the ethereal liquid by agitating with alkaline bisulphite.

J. W.

Saccharin or Compounds thereof, Improvements in Manufacture of, and in Production and Treatment of Materials for Use therein. C. Fahlberg, Salbke-Westerhüsen, Germany. Eng. Pat. 10,955, June 1, 1895.

THE methods for the manufacture of saccharine hitherto employed were attended with considerable loss of material, from the fact that the para-toluene sulphonic acid, formed simultaneously with the ortho-toluene sulphonic acid, had to be subjected to several costly operations along with the latter. It is now found that the two isomeric acids may be largely separated by means of their magnesium salts, the para-compound being much less soluble than the ortho-compound. The magnesium ortho-toluene sulphonate is treated with sodium carbonate, the sodium salt being thus formed, and the magnesium carbonate simultaneously produced being available for the formation of more magnesium toluene sulphonates. The solution of the sodium salt is now oxidised with potassium permanganate, the liquid concentrated, and the acid sodium sulphonybenzoate— $COOH.C_6H_4.SO_3ONa$, precipitated by means of hydrochloric acid. The precipitate, after being dried, is converted into the ester $COOR.C_6H_4.SO_3ONa$ by the aid of alcohol and gaseous hydrochloric acid. This ester, on treatment with phosphorus pentachloride or oxychloride, yields the ester-chloride: $COOR.C_6H_4.SO_2Cl$, which, on treatment with gaseous ammonia and ammonium carbonate, and subsequent

saponification with an alkaline carbonate, yields an alkaline salt of benzoic sulphinate together with some alkaline para-sulphamino-benzoate. After all the ammonia has been expelled, the concentrated solution is treated with a small quantity of potassium permanganate to brighten the colour, and the para-sulphamino-benzoic acid is removed according to Eng. Pat. 22,787, 1891.

The para-toluene sulphonate of magnesium of the original operation is converted into toluene and acid magnesium sulphate by means of sulphuric acid and superheated steam. —J. W.

Acetophenonephenetidine. Preparation of. F. Valentiner, Leipzig-Plagewitz, Germany. Eng. Pat. 19,040, Oct. 10, 1895.

Acetophenone and paraphenetidine are heated in molecular proportions in a reflux distillation apparatus, with or without dehydrating agents. On cooling, acetophenonephenetidine crystallises out, and may be purified by recrystallisation from alcohol. It melts at 88° C., and is an antipyretic. —J. W.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photography in 1895. G. F. Jaulert. *Monit. Scient.* 1895, 46, 813—822.

For the preparation of "orthochromatic" plates, a number of new dyes have recently been suggested, and it has been found that the rhodamines possess several advantages over Erythrosin and Rose Bengal. Rhodamine 3 B [B] yields an emulsion, the maximum sensitiveness of which falls between the Fraunhofer lines D and E, extending halfway between D and C; while the hydrochloride or the ethyl ester of tetrachlorotetra-ethylrhodamine renders the plate sensitive almost up to the line C; all the rhodamine compounds giving better results in the blue than those of the first-mentioned dyestuffs. For the green portion of the spectrum, acridine yellow and orange are excellent, it being possible with the former to obtain all the lines from the orange into the violet: it should be useful, therefore, in taking negatives for the three-colour process. Alizarin blue S produces a film particularly sensitive between A and C, surpassing all other dyestuffs for the reproduction of the infra-red rays. The addition of a small quantity of silver nitrate to the usual ammoniacal solution of the blue, makes the plates even more rapid, but they will not keep.

For the avoidance of halation, Prestwich has devised an emulsion—bromide or citro-chloride—containing 1 to 2 parts of arrowroot to 3 of gelatin. Experiments on the influence of temperature on the rapidity of plates, show that between 0 and 30° C. there is little difference in speed, but beyond these limits considerable changes occur, an orthochromatic emulsion giving, at very low temperatures, a negative resembling one on an ordinary plate.

Phenylhydroxylamine (this Journal, 1895, 385) in 1 per cent. solution, mixed with 3 parts of sodium sulphite, makes a good developer, but addition of alkali is apt to cause fog. From recent work on the thiosulphates, it appears that the addition of free sulphurous acid to the ordinary fixing-bath should be avoided for fear of the production of sulphuretted hydrogen; but acid salts, such as bisulphites, may be advantageously employed. When using an acid fixing-bath after alkaline development, it is suggested to add a little aurin solution, as an indicator, to the "hypo," in order to show when the acid requires renewal. The addition of acetate of sodium or ammonium to the acid fixing bath to prevent the deposition of sulphur, and of common salt to hinder the decomposition of the silver thiosulphate, has also been recommended; a suitable formula being sodium acetate 3 parts, chloride 5 parts, thiosulphate 15 parts, water 200 parts. *Anthion* (potassium persulphate, this Journal, 1895, 298) in 0.5 per cent. solution, has proved a very efficient "hypo eliminator," surpassing the hypochlorites, as it has no action on the film; but, not being permanent when dissolved, it should be kept in the solid state.

A new "reducing"-agent for positives consists of an ordinary fixing-bath to which 0.2 per cent. of ammonium bichromate has been added. It is curious that "bromide" prints are not attacked by this solution, and in the case of chlorides produced by partial isolation followed by development, the bichromate, even if considerably strengthened, is only able to remove that amount of silver which has been deposited during the action of the light itself. This bath, accordingly, becomes a means of distinguishing between positives prepared by "printing-out" and development processes. A number of matt-surfaced gelatin papers are on the market at present, the dull surface being obtained by the addition of a little starch to the citro-chloride emulsion. To imitate platinum tones on these papers, it is advisable to expose them under the negative till they are of about half the required depth of tint, developing to the desired intensity with quinol (hydroquinone), washing very thoroughly, finally toning them in a bath made at least eight days beforehand. When toning the new colloidal-chloride papers by means of potassium platinoous chloride, the use of a 10 per cent. solution of acid sodium phosphate, mixed with an equal volume of 5 per cent. potassium oxalate, is recommended, to avoid any yellowing of the high lights. Experiments on metals other than silver have shown that many of the compounds of molybdenum, tungsten, and vanadium are more or less sensitive to light.

Further investigation of the diazo printing process (this Journal, 1895, 595), points to the compounds of α - and β -naphthylamine as the best to use; on development with sodium acetate the former yield a brownish-grey and the latter a reddish-brown print. The exposures required are about 2 to 3 minutes to direct sunlight, or 8 to 12 minutes to diffused light, and the process appears to work best on fabrics.

A new method of obtaining coloured photographs on silk has been worked out. It consists in producing on the material ordinary silver prints, after the manner of the albumin process. They are then finished in coloured pastels, the chalks being finally fixed by the action of a spray of caoutchouc dissolved in benzene.—F. H. L.

PATENTS.

Photographic "Process" Engraving, An Improved Method of Producing Negatives for. A. W. K. Bryan, Rochdale. Eng. Pat. 23,052, Nov. 28, 1894.

THE inventor claims, in the production of negatives for photographic "process" engraving, a special reticulated negative for the purpose of producing reticulations, by exposure, upon the surface of the photographic sensitised plate.—J. C. R.

Production of Prints by Photography, Improvements in. W. Friese-Greene, Chelsea. Eng. Pat. 1075, Jan. 16, 1895.

THE original specification and drawings must be consulted for details of the apparatus employed for "printing or reproducing, by means of photography, a number of copies from the same negative or negatives, by causing a band of sensitised material to travel intermittently through a chamber in which a negative or negatives are placed, and temporarily exposing a fresh section of the said sensitised band and the negative or negatives to the light in the said chamber after each intermittent movement of the sensitised band, the band being steadied during the exposure, whereby a photograph from the negative becomes reproduced upon the said section." Arrangements are also described whereby the sensitised material passes successively through two chambers, in the first of which it is printed on the one side, and in the second on the other.—W. M.

XXII.—EXPLOSIVES, MATCHES, Etc.

PATENTS.

An Improved Explosive for Producing Motive Power, and Apparatus to be used in connection therewith. T. Hawkins, Upton Park, London. Eng. Pat. 24,898, Dec. 21, 1894.

The improved explosive consists of a mixture of sodium nitrate, 6 parts by weight; sugar or syrup, 4 parts by weight; water, 36 parts by weight; potassium bichromate, 1 part by weight; potassium chlorate, 1 part by weight.

This mixture is converted into a fine spray in a special device described and illustrated in the specification, and introduced into an explosion-chamber forming part of the cylinder of the engine, or into a separate chamber serving as a pressure-generator, in either of which chambers it impinges against a heated metal plate kept hot by an external gas-flame or by electricity, when the explosive mixture is converted into gas, which, by valves, is allowed to act on a piston, as in an ordinary gas-engine.—W. M.

Igniferous Fuses, Improvements in the Manufacture of. J. Watson, London. Eng. Pat. 25,958, Dec. 24, 1894.

This invention relates to safety fuses made from a plastic mass containing nitrocellulose and nitroglycerin, with or without the addition of oxidisers, and the object is to diminish the sensitiveness to concussion, and liability to parting or breaking of the fuse core. The fuse core material is formed by pressing through dies, so as to leave a hollow central space; or the outer surface may have longitudinal grooves, so that when a textile covering has been spun around it, air channels will be covered in and be in direct communication with the fuse core. A textile cushion in the heart of the fuse core may be made by introducing some threads as the hollow core issues from the press. The central threads keep the fuse core from breaking, and the cushion of air outside or inside minimises the risk of accidents from concussion.—W. M.

Manufacture of Explosives (Perforation), Improvements in. H. Maxim, London. Eng. Pat. 16,861, Sept. 9, 1895.

The inventor prepares rods or strips of gelatinised explosives, with perforations parallel to each other, but at right angles to the longitudinal axis of the rod or strip.

—W. M.

Matches, An Improvement, or Improvements in, or connected with. J. I. Williams, Rnabon, North Wales. Eng. Pat. 18,575, Oct. 4, 1895.

The object of this invention is to enable ordinary matches, wood or wax, to be readily converted into fuses. For this purpose, collars or ferrules of the flaming composition, but without any fulminating composition, are prepared. One of these rings can be slipped up over the stem of the match until it jams on the head, the aperture in the collar being slightly conical, thus forming a fuse, or by removing the collar an ordinary match is available.

—W. M.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC CHEMISTRY.—QUALITATIVE.

Bromine and Iodine, the Halogen Derivatives of Sulphonamides as a New Reagent for. J. H. Kastle. Amer. Chem. J. 17, 1895, 704–708.

In the course of an investigation on the nature of the halogen derivatives of acid amides, the author prepared a number of di-halogen derivatives of the sulphonamides, two of which, the dibrom- and the dichlor-derivative of benzenesulphonamide, were found to be of exceptional beauty as regards crystalline character. It is shown that, as in the case of the halogen derivatives of benzamide, the amide itself is the final product of almost all the reactions. It is further shown that the dichloro-derivative of benzenesulphonamide decomposes metallic bro-

mides and iodides with formation of the metallic chlorides, and the corresponding bromo- and iodo-derivatives of the amide, and that when this decomposition is effected in the presence of carbon bisulphide or chloroform, the latter solvents are coloured yellow and violet, just as they are with bromine and iodine. On testing this new compound as a reagent for bromine and iodine, it was found possible to recognise 0.0000127 gm. of iodine in the presence of 0.04 gm. of bromine. The reagent is best prepared by dissolving benzenesulphonamide in the smallest possible quantity of caustic soda (1 in 10), and passing chlorine into the solution. A white precipitate is produced containing much unchanged amide. This is filtered off and the filtrate treated with more chlorine. The second precipitate consists chiefly, if not entirely, of the dichloro-derivative. It is filtered off and partly purified by heating with water and decanting. The dichloro-derivative, melting at 70°, and being nearly insoluble in hot water, is thus separated as a light yellow oil, which solidifies on cooling, and may be further purified by solution in alcohol and precipitation with water.—D. B.

Cobalt, Detection of, by the Nitroso-β-Naphthol Method. M. Hlinski. Chem. Zeit. 1895, 19, 1421.

The author combats the view that a mistake is likely to occur in the use of the nitroso-β-naphthol method for the detection of cobalt on account of the separation of small quantities of the reagent simulating the precipitation of the cobalt compound. The bright red colour of the cobalt precipitate is not to be confounded with the brown colour of the reagent. Figures are given showing that the method in question is more delicate, especially in the presence of nickel, than the reaction with potassium nitrite in acetic acid solution. The nitroso-β-naphthol reaction is best carried out by making the solution to be tested slightly acid with hydrochloric acid, then adding an equal volume of alcohol, and warming the mixture; fresh solution of nitroso-β-naphthol in 50 per cent. acetic acid is poured in, and the whole is brought to the boil. A voluminous purple-red precipitate of cobalti-nitroso-β-naphthol is produced, and can scarcely be confused with any other substance. When only a trace of cobalt is present, the cobalt compound remains in solution in the alcohol, and it is necessary to work with an aqueous solution. (Distilled water allowed to stand on nitroso-β-naphthol dissolves about 1 part in 5,000 in the cold.) The reagent should always be in excess, as a part of its function is to oxidise the cobalt to the cobaltic state. Even when only a colour is first produced, long standing will cause the separation of the characteristic red precipitate.—B. B.

INORGANIC CHEMISTRY.—
QUANTITATIVE.

Potassium Cyanate, Detection of Small Quantities in Potassium Cyanide. E. A. Schneider. Eng. and Mining J. 1895, 489.

By suitable modification of conditions, Blomstrand's colour reaction of potassium cyanate with cobalt acetate may be made very sensitive. The cyanide solution to be tested should be as strong as possible; it is decomposed, preferably in the German "Zehnkugelhöhren" (ten-bulb tubes), by means of a rapid stream of carbon dioxide, which is passed until all hydrocyanic acid has been expelled. Three grms. of KCy in a 10 per cent. solution may be thus decomposed in 45 minutes. To the residual liquid sufficient 95 per cent. alcohol (in some cases absolute alcohol) is added, to precipitate the potassium carbonate that has been formed. The carbonate is filtered off; the filtrate is slightly acidified with a few drops of acetic acid, and tested with cobalt acetate. The intense blue of the double cyanate of cobalt and potassium renders it possible thus to detect the presence of from 1 to 0.35 per cent. of potassium cyanate in the cyanide. If the quantity of cyanate be very small, a larger amount of the cyanide must be taken, which is dissolved in the smallest possible volume of water; the excess of cyanide is then precipitated out by means of absolute alcohol, and filtered; and the filtrate is treated with carbon dioxide, and tested as before.—W. G. M.

Zinc, Technical Analysis of. H. Nissenson and B. Neumann. *Chem. Zeit.* 1895, 1624—1626.

Of the various processes available, practically the only two which, for reasons quoted, are used in works' laboratories are Schaffner's sodium sulphide, and Galetti's potassium ferrocyanide volumetric methods. The latter is exclusively used in America, whilst the former, in a more or less modified form, is employed in Germany, Belgium, France, Spain, and Sardinia. In the Schaffner process, the titration is made in an ammoniacal solution, and the indicator may be ferric hydroxide suspended in the solution, or ferric chloride (Streng), nickel chloride (Kunzel), cobalt chloride (Deuss), alkaline lead tartrate (F. Mohr), lead acetate (Fresenius), sodium nitroprusside (C. Mohr), thallium nitrate (Schroder), or lead carbonate or "polka paper" (Schott) used by the drop method with paper. But of all these, only the first- (freshly precipitated ferric hydroxide) and the last-named are generally used. In the analysis of blende, 1 grm. of the ore (or 0.5 grm., if it contain more than 25 per cent. of zinc) is heated in a flask with 12 c.c. of strong hydrochloric acid, until all hydrogen sulphide has been driven off; the solution is then peroxidised with 3 c.c. of nitric acid, and after a short time 7 c.c. of (1:2) sulphuric acid are added, and the whole is evaporated until sulphuric acid fumes are observed. After cooling, the liquid is diluted and filtered. If cupriferosus, the solution is boiled before filtration with 5—7 c.c. of sodium thiosulphate solution (1:10) until no more smell of sulphur dioxide can be detected. The precipitate which contains the silica, lead, and copper is filtered off, and the filtrate is peroxidised with bromine water, and then treated with 25 c.c. of ammonia (sp. gr. 0.925) for the separation of iron, manganese, and alumina. After boiling and filtering, the precipitate is redissolved in hydrochloric acid (or in aqua regia, if highly manganiferous), and again precipitated. The mixed filtrates are made up to 500 c.c. and placed on one side for 12—18 hours for the removal of the great excess of ammonia. Simultaneously, a quantity of pure zinc, approximately equal to that in the ore under determination, is weighed accurately, dissolved in a similar quantity of hydrochloric and nitric acids, mixed with 25 c.c. of ammonia, and made up to 500 c.c. and placed also on one side. Coda has shown that, to insure accuracy, it is not necessary to employ sulphuric acid for the solution of the check zinc. A shorter method, employed by the authors, consists in taking double the quantities above quoted all through, dissolving and proceeding as above, but boiling with sulphuric acid only for 5 or 10 minutes (not to dryness) until red fumes cease to be evolved, making up to 500 c.c., after adding the ammonia, and filtering off only 250 c.c., which is then made up again to 500 c.c. for titration. The result may be a little low, but the error does not exceed 0.1 per cent., whilst the titration is better effected, owing to the absence of great excess of ammonia. The success of the whole process depends upon attention to details in the process of titration. The sodium sulphide solution should contain 35 grms. of the crystallised salt per litre, which is equivalent to about 0.01 grm. of Zn per c.c., but the titre rapidly alters on exposure to air, which necessitates the simultaneous performance of a check test with pure zinc. The burette may with advantage have a side-tube directly connected with the bottle containing the stock of standard solution, in order to minimise the action of the air when the burette is filled. Care must be taken that the colour of the spot upon the lead paper, which marks the end of the reaction, shall be identical in the ore- and check-solutions, as in that case the variation in the sensitiveness of the eyes of certain operators in regard to the detection of the first darkening of the paper, is eliminated. Two drops should be allowed to fall successively, after the lapse of a few seconds, upon the same spot upon the paper, the drops being taken from the solution by means of a narrow glass tube, which also serves as a stirrer. Towards the end of the operation, a test should be made after each fresh addition of 0.1 c.c., and very thorough stirring must be effected each time. A high temperature (even that of a hot summer's day) and a great excess of ammonia, alike interfere with the sharpness of the spotting reaction. The titration must, of course,

be made in a room of which the air is quite free from hydrogen sulphide. When copper is present it is possible to make a determination in the above way on a part of the solution, deducting from the result the equivalent of copper found colorimetrically in another portion; but this is not recommended, as the presence of copper sulphide interferes with the sharpness of the lead-paper indications. For approximate and rapid work with cupriferosus smelting products, the separation of copper may be avoided by adding to the ammoniacal solution, before titration, sufficient potassium cyanide solution to remove all but a trace of the blue colour from the liquid. A trace of blue is left to insure that no excess of cyanide shall have been added, as this would interfere with the accuracy of the result through the formation of a double cyanide of zinc. Results quoted show that volumetric tests, properly conducted, may give numbers in exact concordance with those obtained gravimetrically.—W. G. M.

Zinc, Volumetric Determination of, and a New Indicator for Ferrocyanide. G. C. Stone. *J. Amer. Chem. Soc.* 1895, 17, 473—477.

ALL the metals of the iron group, except manganese and zinc, having, if necessary, been removed from the solution containing the latter, the amount of manganese present is ascertained by titration with potassium permanganate, and then the zinc and manganese are determined together by precipitation with potassium ferrocyanide, using cobalt nitrate as an indicator.

The separation of iron and aluminium from the zinc and manganese is effected with barium carbonate, which should be freed from the alkaline hydroxide or carbonate, which it usually contains, by digestion with barium chloride.

After filtering off the precipitated aluminium and ferric hydroxides, the determination of the zinc and manganese should be proceeded with at once. If it should be necessary to allow the solution to stand, a little acid should be added to it, to prevent any zinc precipitating.

The manganese is estimated by boiling a portion of the solution, containing 0.1 to 0.4 per cent., and titrating with a solution of potassium permanganate containing 1.99 grms. per litre, 1 c.c. of this being equivalent to 0.001 grm. of Mn.

A second portion of the solution is rendered slightly acid with hydrochloric acid (addition of 5 c.c. of the concentrated acid per 100 c.c. of the solution prevents the precipitation of lead and causes no appreciable error; 10 c.c. prevent the precipitation of manganese) and titrated with potassium ferrocyanide. The solution of the latter is prepared by dissolving 30 grms. in a litre and is standardised by zinc or manganese in a slightly acid solution.

If much manganese be present, the colour of the precipitate becomes darker as the potassium ferrocyanide is added, and then, shortly before the end-point is reached, it suddenly changes to a pale green. It is unnecessary to commence testing with the cobalt nitrate until this change has taken place.

The test with the latter salt is made by placing a drop of a dilute solution on a porcelain plate and bringing a drop of the solution to be tested against it, so that the two touch but do not mix. An immediately shown, faint greenish line at the point of junction marks the end-reaction.

The manganese precipitate which is formed is not of normal composition, but consists of manganese and ferrocyanic acid in the ratio of $3\text{Mn} : 2\text{H}_4\text{FeC}_6\text{N}_6$.

A correction should be made for the amount of potassium ferrocyanide which is required to give a reaction with the cobalt nitrate. This is about 0.5 c.c. of a solution of the above strength per 100 c.c. of the solution to be tested.

—E. B.

PATENT.

Iron and Steel, A New or Improved Process for Determining the Carbonaceous Value of. G. W. Peipers, Remscheid, Germany. Eng. Pat. 662, Jan. 10, 1895.

THE improved process consists in comparing the marks made on unglazed porcelain by the piece of iron or steel to be tested, with those made by iron rods or pencils of known composition. The comparison is aided by partially

immersing the porcelain tablets in solutions which will dissolve the iron only, such as chloride of copper or of ammonium. After washing, the tablet may be treated with sulphuric or nitric acid, which will dissolve the carbon, leaving the graphite.—G. H. R.

ORGANIC CHEMISTRY.—QUALITATIVE.

Petroleum Benzine and Coal-Tar Benzene, Distinguishing between. Mitt. k. k. Versuchsanst. 1895, 13, [5], 241.

THE use of iodine has been recommended for the above purpose (Post, Chem. Techn. Analyse, 2nd Ed., 309; Böckmann, Chem. Tech. Unters. 985), the test depending on the variation in coloration of the solutions of iodine in the respective hydrocarbons and mixtures thereof. Attention is called to the conflicting statements of the above authors, and results of experiments are given in tabular form, showing that the test is of very limited value in regard to mixtures, visible variations of colour being determined only when the proportion of admixture is high.

Better results were obtained by taking advantage of the relative solubility of asphalt in benzene. The asphalt being prepared from Syrian asphalt by exhaustive washing with petroleum naphtha, to free it from constituents soluble in these hydrocarbons, was treated under uniform conditions with mixtures of petroleum benzine and coal-tar benzene, up to 70 per cent. of the latter. A well-graduated series of colorations from straw colour to dark brown, proportionate to the percentage of the latter, was observed. As an empirical test, therefore, it satisfactorily fulfils ordinary requirements.—C. F. C.

Naphthol Yellow in Vermicelli, Macaroni, &c., Detection of. F. Schaffer. Chem. Zeit. 1895, 19, 216.

FROM 10–20 grms. of the crumbled substance are warmed with about 40 c.c. of 50–60 per cent. alcohol. Addition of a few drops of pure hydrochloric acid to the solution of the colouring matter so obtained destroys the colour of naphthol yellow, but not of safranines, whilst Metanil yellow is coloured red. To identify the colouring matter with greater certainty, take 200 grms. of the substance and evaporate the alcoholic solution to a small volume. Hydrochloric acid then gives a whitish flocculent precipitate of dinitro α -naphthol, soluble in ether with a faint yellow colour. Naphthol yellow S is not precipitated by hydrochloric acid, but by soda, even in very dilute solution.—A. C. W.

Citric Acid, a Reaction of. Ludo Stahr. Nordisk pharm. Tidsskrift. 1895, 2, 141.

By the action of an oxidising agent on citric acid, acetone is formed; this by treatment with bromine, followed by an alkali, yields bromoform. To use these reactions as a test for citric acid, a few drops of deci-normal permanganate solution are warmed with 1 c.c. of the solution, and when the red colour has disappeared, 3–5 drops of saturated bromine water are added; on cooling, a white crystalline precipitate is obtained. If caustic soda be now added, the smell of bromoform is perceived. The test clearly indicates 2 mgrms. in 1 c.c. When bromine water is added first, a smaller quantity of permanganate is required for oxidation; thus bromine itself appears to act on citric acid. This is contrary to the results of Cloëz. If two equal quantities of bromine water, to one of which a little citric acid is added, be heated to expel free bromine, that portion to which the acid was added will be found to give a much larger precipitate of silver bromide than the other.—A. C. W.

Alkaloids and Glucosides, Characterisation of several.

E. Formánek. Rozprawy české akademie, 4, Cl. II., No. 9.

Alon.—The residue obtained on evaporation with nitric acid is coloured brown by ammonia and yellow by cold potassium hydrate solution. On evaporating with the latter, a deep violet residue is left, dissolving in water to a wine-red solution.

Amygdalin gives a colourless or pale yellow residue when evaporated with nitric acid, coloured rose by ammonia, and a transitory brown-rose with aqueous KHO. Alcoholic KHO gives a red-violet, changing to yellowish-brown.

Brucine.—Residue after evaporation with nitric acid, yellow, changing to grass-green (and subsequently to brown) with ammonia. Sulphuretted hydrogen water gives a violet, but KHO produces no characteristic coloration.

Strychnine.—Residue from evaporation with nitric acid is yellow, changed by ammonia to orange, and by KHO to red-violet, subsequently brown. This reaction occurs even when a large amount of brucine is present.

Ccotoin.—The solution in nitric acid is dirty green to brown, turning rose-red when heated. The brownish-red to brown residue is changed by aqueous KHO or ammonia to dirty green, then brown.

Paracotoin.—Forms red solution in sulphuric acid, changing to yellow. Residue after evaporation coloured red, and afterwards brownish-yellow, by aqueous KHO or ammonia.

Emodin.—Yellow solution in nitric acid. Evaporation residue brownish-vermilion, turning, with ammonia, to violet, and then to dirty red, and to violet, afterwards brown, with KHO.

Narcotine.—Nitric acid solution, dirty yellowish-green. Evaporated residue, yellow, changed to dirty green, then brown by ammonia, greenish-brown by KHO, passing into orange-brown, and turning a reddish-brown yellow on heating. Evaporated and strongly heated it becomes a bluish brick-red.

Physostigmine.—The yellow nitric acid solution leaves on evaporation a vermilion-red residue, turning to green after prolonged heating, and forming a green solution in water. KHO produces, after some time, a brown, as does also ammonia, but more slowly.

Salicin.—The pale yellow residue from evaporation of the nitric acid solution deepens on the addition of KHO or ammonia, and turns to a blood-red when heated with KCy on the water-bath.—C. S.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Phenol and the Three Isomeric Cresols. G. Jørgensen. Chem. Zeit. Rep. 1895, 19, 190.

AN aqueous phenol after addition of soda is freed from water by distillation. Excess of dilute sulphuric acid is added to the residue; a second distillate then contains all the phenols. These may be extracted by ether and obtained crystalline by evaporation of the dry ethereal extract. The author considers that a determination of the iodine absorption of a phenol affords a more rapid and accurate estimate than is given by the weighing of tribromophenol or by the method of Koppeschaar, if other substances which absorb iodine are absent. As criteria of the purity of a phenol may be taken its iodine absorption and solubility (1 gram. of phenol absorbs 8.1 gram. of iodine).

The physical properties of these phenols are shown in the following table:—

	Phenol.	Ortho-Cresol.	Meta-Cresol.	Para-Cresol.
Melting point.....	42°	36°	3°	36°
Boiling point.....	182°	190°	202°	201°
Specific gravity....	1.0206	1.0578	1.0498	1.0522
Solubility (one part in parts of water).	15	19	200	55

—A. C. W.

Lard, Analysis of. A. Goske. Chem. Zeit. 1895, 19, 1043–1044.

THE recognition of tallow in lard by means of the test consisting of the observation of the behaviour of the substance when allowed to crystallise from ether, is best effected by conducting the test at a temperature of 12°–13° C., as a lower temperature causes a confused crystallisation. Under the microscope the crystals thus separated from pure steam lard have the form of sharp-edged plates, often as much as $\frac{1}{2}$ mm. in width. A few bundles of needle-shaped crystals of dark appearance are also scattered about the field. When tallow is present, needles disposed radially are predominant. In butcher's lard, on the other hand, needles

are commonly present in quantity, and can with difficulty be distinguished from those of tallow. The practice, occasionally adopted, of adding mutton tallow to lard increases the difficulty. The preparation and examination of samples by each observer must be adopted to ensure reliable results. Seeing that American steam lard appears to be softer (richer in olein) than the average European product, the author was led to suppose it possible that such difference was due to a difference of breed or food, but direct experiment with raw fat of American origin showed that the lard rendered therefrom in the laboratory differs in no essential respect from that from European sources. The cause of the difference in the commercial product known as steam lard is therefore unexplained. With regard to the detection of cotton-seed oil in lard, the author uses the Beechi test as directed by the Italian Commission, and in doubtful cases resorts to the expression of the more liquid portion of the fat at a temperature of 26° – 30° C. Comparison of the darkening of the more and less solid portions, gives useful indications.—B. B.

Oak-Wood Extract, Analysis of, by the Hide-Powder

Method. F. Čerych. Der Gerber. 1895, 21, 241–243.

THE most weighty source of error in the hide-powder method is the unequal quality of the powder: this is avoided if the powder be washed with cold water until the washings are no longer rendered turbid by a solution of tannin. Another error is, however, engendered by thus freeing the powder from soluble gelatin, for it is found that the filtrate which has passed through such purified powder contains tannin. This fact appears to be due to the passage of the liquid up the sides of the tube, where it does not come into actual contact with the hide-powder; the presence of soluble gelatin ensures the absorption of the tannin in this portion of liquid. To remedy this drawback to the method, the author mixes the hide-powder with disintegrated filter paper in order to increase its effective surface.

One hundred grms. of hide-powder from a trustworthy source, is washed as mentioned above and intimately mixed with a cream of 35 grms. of filter paper. The water in this mixture is wrung out in a linen cloth, and the material is powdered and dried by cold air. The dried powder is ground until it is in a woolly condition, and is dried over sulphuric acid until it contains about 1.5 per cent. of water. Of the finished material, 9 grms. serve for each determination. The water may be more rapidly removed by alcohol, and the powder thus dried can be preserved for a longer time, and is not deteriorated in absorbent power.

The passage of the tannin solution through the hide-filter should occupy 2–3 hours; if unduly prolonged, the non-tannin will generally be too high.

The following tables show the influence of the proportion of water in which an extract is dissolved, and of the temperature at which the analysis is made, on the results obtained:—

Extract dissolved in 1 Litre.	Total Solids.	Insoluble Matter.	Non-Tannin.	Tannin.
5 grms.	47.12	0.12	18.44	28.56
15 "	47.12	1.22	18.50	27.40
30 "	47.12	1.65	18.40	27.07

Thirty grms. of extract per litre:—

	16°	19°	25°	34°
Insoluble matter	1.65	1.18	0.22	0
Non-tannin	18.43	18.41	19.04	19.58
Tannin	27.04	27.53	27.86	27.54
Total solids	47.12	47.12	47.12	47.12

From the facts that the insoluble matter increases with the strength of the solution, decreases with increased temperature, and increases with decrease of tannin, it may be inferred that the "insoluble matter" is itself a sparingly soluble tannin. The increase of non-tannin with rise of

temperature shows that the hide-powder yields gelatin at the higher temperatures. The more dilute the solution of extract, the more marked are these discrepancies. Other tables in the original paper show that with unwashed hide-powder the non-tannin is somewhat lower than with the washed powder, and increases with increase of concentration; it is, however, only extracts that show this peculiarity (compare Koch, this Journal, 1891, 803).

The author concludes that in order to obtain concordant results by the hide-powder method, it is necessary (1) to purify the hide-powder in the manner indicated; (2) to use always the same weight of extract for analysis; (3) to work at the same temperature, best at 18° – 20° C., making sure that the solution has the same temperature when the insoluble matter is filtered and when the tannin is determined. The so-called insoluble matter is not without value, since it is now shown to be a sparingly soluble tannin.

—A. G. B.

Sugar, Volumetric Estimation of, by means of Ammoniacal Copper Solution. Z. Peska. Rozprawy České akademie, 1895, 5, Cl. II. [19].

INSTEAD of the usual current of hydrogen, the author now employs a layer of vaseline to prevent oxidation of the copper solution. Two solutions are prepared: the first consisting of 6.927 grms. of pure copper sulphate dissolved in 160 c.c. of 25 per cent. ammonia, and made up to 500 c.c.; the second, of 34.5 grms. of Rochelle salt and 10 grms. of sodium hydroxide dissolved in water and diluted to 500 c.c. A mixture of 50 c.c. of each of these solutions is heated to 80° under a layer of vaseline 5 mm. thick; the solution to be estimated is run in at the rate of 1 c.c. at a time for the first test, but on repetition the whole amount may be added at once. The temperature is raised to 85° , the heating continued for two minutes in the case of glucose and invert sugar, and for four and six minutes respectively in that of maltose and invert sugar. The solution is then titrated at the last-mentioned temperature until the colour just vanishes. Dextrin raises the reducing power of the sugar less in this solution than in one prepared with potash; moreover, the ammonia does not affect the accuracy of the results. One gm. of cane sugar is on an average equivalent to 0.0026 gm. of invert sugar. The sugar of milk is estimated after precipitation with lead acetate and sodium sulphate. The following table gives the number of milligrams of each sugar in 100 c.c. of solution:—

No. of Cc.'s of Sugar Solution used.	100 Cc.'s of the Sugar Solution contain Mgrms. of			
	Glucose.	Invert Sugar.	Milk Sugar.	Maltose.
8	907.8	1049.2	..	..
9	889.4	935.1	..	..
10	862.3	844.6	..	..
11	730.7	779.0	..	..
12	670.8	707.6	..	..
13	620.0	654.5	..	..
14	576.3	608.7	..	..
15	538.4	568.9	1033.9	..
16	505.2	534.2	971.4	..
17	475.8	503.3	916.0	1023.0
18	449.7	475.7	866.5	968.8
19	426.3	451.2	822.3	929.3
20	405.2	429.0	782.4	876.3
21	386.0	408.8	746.0	836.4
22	368.7	390.6	713.0	800.0
23	352.8	373.8	682.7	766.5
24	338.2	358.4	654.8	735.8
25	324.8	344.3	629.2	707.5
26	312.4	331.2	605.5	681.3
27	300.9	319.3	583.5	656.8
28	290.3	307.8	563.1	634.1
29	280.3	297.3	544.1	613.0
30	271.1	287.5	526.2	594.2
31	262.4	278.2	509.5	574.5
32	254.2	269.6	493.8	557.1
33	246.6	261.6	479.1	540.8
34	239.3	253.9	465.3	525.3
35	232.6	246.7	452.2	510.7
36	226.1	240.0	439.8	496.8
37	220.0	233.5	428.1	483.7
38	214.3	227.4	417.0	471.3
39	208.8	221.7	406.5	459.5
40	203.6	216.2	396.5	448.3
41	198.7	211.0	387.0	437.6

No. of C.c.'s of Sugar Solution used.	100 C.c.'s of the Sugar Solution contain Mgrms. of			
	Glucose.	Invert Sugar.	Milk Sugar.	Maltose.
42	194.1	206.0	377.8	427.4
43	189.7	201.3	369.2	417.7
44	185.4	196.7	360.9	408.4
45	181.2	192.3	353.0	399.5
46	177.3	188.1	345.4	391.0
47	173.5	184.1	338.1	382.8
48	169.9	180.3	331.2	374.9
49	166.4	176.7	324.5	367.3
50	163.0	173.2	318.1	360.0
51	159.8	169.8	311.9	353.0
52	156.8	166.5	306.0	346.3
53	153.9	163.4	300.3	339.9
54	151.1	160.4	294.8	333.8
55	148.4	157.5	289.4	327.9
56	145.7	154.7	284.2	322.2
57	143.1	152.0	279.3	316.7
58	140.6	149.4	274.5	311.4
59	138.2	146.9	269.9	306.3
60	135.9	144.5	265.4	301.3
61	133.7	142.2	261.1	296.4
62	131.5	139.9	256.9	291.6
63	129.4	137.7	252.9	287.0
64	127.1	135.5	249.0	282.6
65	125.4	133.4	245.2	278.3
66	123.5	131.4	241.5	274.1
67	121.7	129.5	237.9	270.0
68	119.9	127.6	234.4	266.1
69	118.2	125.7	231.0	262.3
70	116.5	123.9	227.7	258.5
71	114.9	122.2	224.6	255.0
72	113.3	120.5	221.5	251.5
73	111.8	118.9	218.5	248.1
74	110.3	117.3	215.6	244.8
75	108.8	115.8	212.8	241.6
76	107.4	114.3	210.0	238.4
77	106.0	112.8	207.3	235.3
78	104.6	111.4	204.7	232.3
79	103.3	110.0	202.1	229.4
80	102.0	108.6	199.6	226.6
81	100.8	107.2	..	223.9
82	99.6	105.9	..	221.2
83	..	104.6	..	218.6
84	..	103.4	..	216.0
85	..	102.2	..	213.5
86	..	101.1	..	211.1
87	..	..	..	208.7
88	..	..	..	206.4
89	..	..	..	204.1
90	..	..	..	201.9
91	..	..	..	199.7

—J. L. B.

Formic Acid, Determination of. F. Freyer. Chem. Zeit. 1895, 19, 1184—1185.

THE conventional methods of determining formic acid, *viz.*, that which consists in determining the quantity of mercurous chloride which is formed on boiling it with mercuric chloride, and that having the oxidation of the acid with permanganate as its basis, leave much to be desired. The author treats 10—20 c.c. of the formic acid solution, containing about 0.5 of the acid, with 50 c.c. of a 6 per cent. solution of potassium bichromate and 10 c.c. of strong sulphuric acid, boiling the mixture under a vertical condenser for $\frac{1}{2}$ to 1 hour. The solution is diluted to 200 c.c., and the unaltered chromic acid is determined by adding 1—2 grms. of potassium iodide, 10 c.c. of a 25 per cent. solution of phosphoric acid, allowing to stand for 5 minutes, and titrating back with $\frac{N}{10}$ thiosulphate solution. The addition of phosphoric acid is said to allow the change from blue to the green of the chromic salt to be more readily observed. The rubber stopper used to connect the flask with the condenser should be boiled out with bichromate solution, lest it exert a reducing action on the liquid in the flask. The method can be used in the presence of acetic acid. Test analyses are satisfactory.

—B. B.

Writing Inks, their Examination. G. Wisbar. Papier Zeit. 1895, 20, 3059.

A GOOD writing ink must answer all the following requirements:—It must be a true solution, permanent both in bottle and in ink-pot; it must not "skin"; it should not be too acid (the corrosive action on steel nibs, however, is due as much to the iron and the organic acids as to the

free mineral acid); it must not penetrate good paper, but after drying for eight days it should be sufficiently insoluble not to be obliterated by 24 hours' soaking in water or alcohol. It must not become mouldy, and should dry on the nib to a varnish-like film, not forming a crumbling powder. To examine any commercial sample, a standard ink must be prepared. 23.4 grms. of tannin and 7.7 grms. of crystallised gallic acid are dissolved in water at 50° C., 10 grms. of gum in solution, 2.5 grms. of hydrochloric acid, 30 grms. of ferrous sulphate (also dissolved), and 1 gm. of phenol added. The whole is made up to 1 litre, allowed to stand at least four days, and then decanted. 10 or 15 c.c. of the sample to be tested are removed from the bottle with a pipette without shaking, and the remainder well corked and set aside. It is then compared with the standard, and if the two differ in shade, the latter must be tinted to match the sample by the addition of 2 or 3 grms. per litre of one or more of the following dyes, as may be required:—Bavarian Blue D.S.F. [A.], Nakar Red S. [A.], Acid Green V.B.S.Po. [O.], and Chestnut Brown [O.].

A piece of good writing paper is then tightly stretched in a frame, constructed so as to cause part of it to slope at an angle of 45°, and provided with a support for a pipette (in order to insure its uniform position) from which 0.6 gm. of the ink is made to run gently down the slope, the pipette being ground to a similar angle at the base. Two or more stains of ink, one being the prepared standard, are thus obtained, and the paper is allowed to dry, exposed to light. The inks are then diluted with an equal volume of water, and fresh stains produced, the better to observe the darkening of the tint. When dry, all are put aside for eight days, in a place exposed to light and air, and then compared for colour, dustiness, and fluidity, the latter being judged by the shape of the marks on the paper. One portion is also soaked in water, another in 85 per cent., and a third in 50 per cent. alcohol for two days, then dried again at ordinary temperatures, to observe the solubility.

The presence of a sediment in the original bottles containing the ink samples is not necessarily a proof of want of permanence; it may simply be due to the ink having been bottled up before the proper time. The samples should be allowed to rest for three days, then 50 c.c. pipetted off from the middle of the liquid, filtered through a small paper, and 25 c.c. run into a small bottle, the neck of the funnel being kept below the surface of the filtrate. The bottle, which must always be of the same size and shape for this test, is lightly covered with paper, and observed for several days, a good sample remaining without sediment for a fortnight. The amount of iron may also be determined in the usual manner, and should not fall below that in the standard (0.6 per cent.). The above remarks apply equally well to the combined writing and copying inks, by which term are understood inks yielding two copies during the first 24 hours, and one on the following day.

A number of experiments have been tried by Schluttig and Neumann on the substitution of other substances for the tannic and gallic acids usually employed. They find that many phenols and their derivatives give strong colours when mixed with ferric salts, but that only those bodies which approach gallic acid in constitution—*i.e.*, possess three adjacent hydroxyl groups—are available for the manufacture of writing inks. They have also observed that the darker the original colour of the iron salt, the more permanent is the resulting ink, and that tannin is a much inferior substance to gallic acid to employ whenever any degree of permanence is required. Their researches also tend to throw doubt on the generally accepted view that tannin is a digallic acid: for, as such, it should possess five free hydroxyl groups, and should form, therefore, a darker and more permanent iron salt than gallic acid itself.

—F. H. L.

Sugar Industry, Progress in, for the Third Quarter of 1895. Dingler's Polyt. J. 1895, 298, [4], 88—95; [5], 114—115.

See under XVI., page 41.

XXIV.—SCIENTIFIC AND TECHNICAL NOTES.

Petroleum Esters from the Spent Acids. Fuchs and Schiff. Chem. Zeit. 19, 1469—1470.

IN order to ascertain the practicability or otherwise of utilising for perfumery purposes the esters prepared by Zoloziecki and Aschan from the naphthene carboxylic acids contained in the residue from the alkali process in petroleum-refining, a sample of alkali sludge from an Austrian refinery was treated by Aschan's method, a pale yellow oil with a strong fatty-acid odour being obtained. This, although readily saponifiable with soda-lye, is unsuitable for soap-making, since the product breaks up rapidly when dissolved in water, and gives off the disagreeable odour of the fatty acids. By removing the hydrocarbons from this oil, and subjecting the residue to a series of fractional distillations from sulphuric acid, five fractions were obtained, from the acid numbers of which it was calculated that the mixture consisted of 66.78 per cent. of nononaphthene carboxylic acid and 33.22 per cent. of octonaphthene carboxylic acid. The ester prepared therefrom gave 92 per cent. of the theoretical yield, and had a pleasant odour, but proved unsuitable for use in perfumery by its behaviour when diluted, in which condition—contrary to the behaviour of the esters of the fatty acids—it lost its agreeable smell, and finally developed an odour resembling that of strong snuff. It may probably be found more suitable than eumarin for flavouring this substance. From a chemical point of view, the change signalled affords another proof of the constitutional difference between these acids and those of the fatty series.—C. S.

Shells of the Cocoa-Nut, Composition of. R. W. Tromp de Haas and B. Tollens. Annalen, 286, 303.

THE substance was finely powdered, and exhausted with dilute acid (HCl), and afterwards with ammonia, washed, dried, and exhausted with ether alcohol. The product thus purified was hydrolysed by boiling with dilute sulphuric acid (1 per cent. H₂SO₄). The solution, further treated in the usual way for the isolation of sugars, gave a satisfactory yield of crystallised xylose. The mother-liquors gave a further yield of the pentose, which appeared to be the only product of the hydrolysis.

The residue from the treatment was hydrolysed by treatment with strong sulphuric acid (Fleehsig, Zeits. Physiol. Chem. 7, 6), diluting, and boiling. From the solution crystallised dextrose was obtained.—C. F. C.

Oxycellulose. R. W. Tromp de Haas and B. Tollens. Annalen, 286, 296.

THE authors have further investigated the oxycellulose obtained by the action of nitric acid upon pine wood (*Ibid.* 267, 366; 271, 288). By solution in sulphuric acid (1.7 sp. gr.) and further hydrolysis, they have succeeded in obtaining dextrose. Treated with potassium hydrate solution at high temperatures (Lange), it yields a residue amounting to 20 per cent. of the original; the oxycellulose of Witz yields 50—60 per cent. of residue. On boiling with hydrochloric acid (1.06 sp. gr.), it yields furfural equal to 2.6 per cent. Previously dissolved in a mixture of sulphuric and hydrochloric acids, the yield was increased to 3.7 per cent., confirming the observations of Cross and Bevan (*Ber* 27, 1063). One of the authors (B. T.) follows the above communication with a few critical notes dealing with the observations of Cross and Bevan upon the furfural-yielding oxycelluloses (*Ber* 26, 2520; 27, 1061). These observations are confirmed. The products in question—the natural oxycelluloses—are “furfuroids” giving no pentose reactions. They may be oxy derivatives of the hexoses, probably similar in constitution to the glycosones, C₁₂H₁₆O₆ (*Ber* 22, 93), which are also easily condensed to furfural (Fischer).—C. F. C.

Sugars richer in Carbon, from Galactose. E. Fischer. Annalen, 1895, 288, 139—157.

THE author has built up from galactose, by methods already described (this Journal, 1890, 527, 638, 958, and

1141), oxy-acids, sugars, and alcohols containing one or more additional carbon atoms in the molecule.

The first addition of hydrocyanic acid to galactose results in the formation of two stereo-isomeric *gala-heptonic acids* (α - and β -acid).

α -Gala-heptonic acid lactone, C₁₂H₁₆O₇, already described by Maquenne and Kiliani (this Journal, 1889, 406), is crystalline when pure. Melting-point = 117° C. The lactone is very soluble in water, the solution being levorotatory, $[\alpha]_D^{25} = -52.2$, and forms a characteristic hydrazide, melting at 226° C.

α -Gala-heptose, formed by reduction of the preceding lactone, has not been obtained crystalline, but only in the form of a sweetish syrup. The sugar is feebly levogyrotary and is not fermentable. The hydrazone and osazone are crystalline, and melt at 205° and 224° C. respectively, with decomposition.

α -Gala-heptitol, obtained by further reduction of the heptose, crystallises in colourless needles melting at 187°—188° C. It is slightly sweet and rotates feebly to the left, $[\alpha]_D^{25} = -1.35$ ° (in borax solution).

Gala-octonic acid is the sole product of the further action of HCN on α -gala-heptose. Its lactone is crystalline, melts at 225°—228° C., and is only slightly soluble in cold water. The solution is dextro-rotatory, $[\alpha]_D^{25} = +64.0$ °. The hydrazide melts at 235° C.

Gala-octose, C₁₂H₁₆O₈ + H₂O, obtained by reduction of the preceding lactone, crystallises well in colourless, shining leaflets, melting at 109°—111° C. Its rotatory power exceeds +40°. The hydrazone and osazone melt at 205°—210° C. and 226°—231° C. respectively.

Gala-octitol, prepared from the octose, crystallises from alcohol in needles, from water in plates. It melts at 230°—232° C., is almost tasteless, and does not reduce Fehling's solution.

β -Gala-heptonic acid, produced in small amount, is separated with difficulty from the α -acid, and has not been obtained crystalline. It appears, however, to be feebly levorotatory, and furnishes a distinctive hydrazide, melting at 185° C. By treatment with pyridine and water at an elevated temperature the β -acid is converted partially into the α -compound.

β -Gala-heptose has been obtained crystalline. The sugar is sweet and melts at 195°—199° C. with decomposition. Its aqueous solution is levogyrotary, and when freshly prepared exhibits a strong biration. The deflection gradually increases, and becomes constant after about 24 hours, $[\alpha]_D^{25} = -22.5$ (after 10 minutes); -54.4 ° (after 24 hours).

The α - and β -gala-heptonic acids yield on oxidation with nitric acid, the corresponding gala-heptopentol-dicarboxylic acids, both of which are optically active (+). The α -acid was described by Kiliani (*loc. cit.*), and named by him *carboxy-galactonic acid*.—H. T. P.

New Books.

GAS MANUFACTURE, THE CHEMISTRY OF. A Practical Handbook on the Production, Purification, and Testing of Illuminating Gas, and the Assay of the By-Products of Gas Manufacture. For the Use of Students, Chemists, and Gas Engineers. By W. J. ATKINSON BUTTERFIELD, M.A., F.C.S. Chas. Griffin and Co., Limited, Exeter Street, Strand, London. 1896. Price 9s.

8vo volume, containing 333 pages of subject-matter, one page of bibliography, and the alphabetical index, 335—375. There are 62 wood engravings representing plant and analytical apparatus. In this work attention has been given to the recent extensive employment of petroleum for gas-making. The matter in the work is classified as follows:—I. Raw Materials of Gas Manufacture. II. and III. Coal-Gas. IV. Carburetted Water-Gas. V. Oil-Gas. VI. Enriching by Light Oils. VII. Final Details of the Manufacture of, and Sundry Schemes for Making and Enriching Gas. VIII. Gas Analysis. IX. Photometry. X. The Applications of Gas. XI. By-Products.

THE CHEMISTRY OF POTTERY. By KARL LANGENBECK, Chemist of the American Encaustic Tiling Co., &c. Chemical Publishing Co., Easton, Pa., U.S. America. 1895. Price 2 dols. Wm. F. Clay, Edinburgh.

THIS small 8vo volume opens with a preface, in which the author states that "whilst in the natural resources of a country the clays found on every side have seemed to offer a fruitful field for investigation, the information at command concerning the chemical needs of the potter has been so meagre that the efforts of our chemists have been practically abortive. The thousands of analyses published are mostly worthless, because they do not go far enough, or because unaccompanied by essential physical tests and practical trials." The hope expressed is that the present treatise will supply information that will turn future labours in this channel to good account. The book contains 191 pages of subject-matter, a frontispiece, and a few illustrations. The sub-divisions are as follows:—I. Analysis of Pottery Materials and Products. II. Physical and Empirical Tests. III. Pyrometry. IV. Classification of Ceramics. V. Pottery Glazes. VI. Red Ware. VII. Rockingham and Yellow Ware. VIII. Stoneware. IX. Raw Materials of White Ware Bodies. X. White Granite and Cream-coloured Ware. XI. Majolica and Enamelled Tile. XII. White Enamelled Brick. XIII. Floor-Tile and Terra-Cotta. XIV. Refractory Materials. XV. Burning the Ware. An alphabetical index of subject-matter is given.

L'INDUSTRIE DU BLANCHISSAGE ET LES BLANCHISSERIES. By ARTHUR BAILLY, Secretary of the Syndicate Chamber of Bleachers, Paris. Librairie J. P. Baillière et Fils, Rue Hautefeuille 19, Paris. 1896. Price, 5 fr.

THIS work is another of a series forming, as a whole, the "Encyclopédie de Chimie Industrielle." It is a small 8vo containing 376 pages of subject-matter. A preface at the beginning defines the extent and classification of the text as follows:—1. The Bleaching of New Pieces or Goods, of Yarns and Cottons. 2. Domestic Bleaching of Linen. 3. Industrial Bleaching (Cleaning), *i.e.*, such as carried on in establishments in or near to large towns. These branches are treated in the first part of the work, whilst at its close another but allied subject receives attention. The sub-divisions are as follows:—1. The Installation and Organisation of Public Wash-houses. 2. Special Bleach- and Wash-houses for the Linen of Hospitals, Restaurants, Hotels, and other Civil and Military Establishments. 3. System of Counting and Checking Linen, &c., received for Bleaching. 4. Relation between the direction of the above Establishments, their Personnel, and the ordinary business carried on. The work contains 106 illustrations, and the Table of Contents at the end serves as an index.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

CUSTOMS TARIFF OF NEW ZEALAND.

Board of Trade Journal, January 1896, 53.

No.	Articles.	Rates of Duty.
CLASS V.—DRUGS, MEDICINES, CHEMICALS, AND DRUGGISTS' SUNDRIES.		
70	Acid, acetic, n.o.c., containing not more than 30 per cent. of acidity.	Per lb. s. d. 0 1½
	For every additional 10 per cent. of acidity or fraction thereof.	" 0 0½
71	Acid, tartaric.	" 0 1
72	Baking-powder, yeast preparations, and other ferments.	20 % ad val.
73	Chemicals n.o.c., including photographic chemicals and glacial acetic acid.	20 % ad val.
74	Cream of tartar.	Per lb. 0 1
75	Drugs and druggists' sundries and apothecaries' wares, n.o.c.	20 % ad val.

No.	Articles.	Rates of Duty.
76	Essences, flavouring, spirituous, until 1st of February 1896.	15 % ad val.
	Essences, flavouring, spirituous, after 1st of February.	Per liquid gallon s. d. 16 0
77	Essences, flavouring, n.o.c.	15 % ad val.
78	Eucalyptus oil, in bulk or bottle.	20 % ad val.
79	Glycerine, refined.	20 % ad val.
80	Opium.	Per lb. 40 0
81	Patent medicines.	10 % ad val.
82	Proprietary medicines, or preparations (1) bearing the name of the proprietor on label or package; (2) bearing a prefixed name in the possessive case; (3) n.o.c., prepared by any occult secret or art.	40 % ad val.
83	Saccharine, except in the form of tablets or tablets.	Per oz. 1 6
84	Sarsaparilla.	25 % ad val.
85	Soda, carbonate and bicarbonate.	Per cwt.
86	Soda, crystals.	" lb. 1 0
87	Tinctures and medicinal spirits of any recognised pharmacopoeia, containing more than 50 per cent. of proof spirit.	" 0 6
88	Tinctures and medicinal spirits of any recognised pharmacopoeia, containing less than 50 per cent. of proof spirit.	" 0 6

PROPOSED DUTY ON BOTTLES IN THE UNITED STATES.

See Board of Trade Journal, January 1896, 63.

GENERAL TRADE NOTES.

THE WOOD-PULP INDUSTRY OF CANADA.

Board of Trade Journal, January 1896, 40.

THE wood-pulp industry with a rapid growth has attained large proportions. By the census of 1891, the product of pulp-wood was 261,155 cords, but as it was then recorded for the first time there can be no comparison with the previous decades. Pulp-mills did not appear in the census of 1871; by that of 1881 the invested capital amounted to 92,000 dols., the wages to 15,720 dols., and the product to 63,300 dols.; by the census of 1891, the invested capital had increased to 2,900,307 dols., the wages to 292,099 dols., and the value of the product to 1,057,810 dols.

There has been a correspondingly large increase in the exports of wood for pulp. The article did not appear in the Customs returns of 1889. In 1890 its export was valued at 80,005 dols., in 1891 at 188,198 dols.; in 1892 at 219,548 dols.; in 1893 at 386,092 dols.; and in 1894 at 393,260 dols. The export of wood-pulp also made great strides, amounting in 1890 (its first appearance in the returns) to 168,180 dols.; in 1891 to 208,619 dols.; in 1892 to 355,303 dols.; in 1893 to 455,893 dols.; and in 1894 to 547,217 dols.

Three things are necessary to the successful development of the manufacture of pulp—suitable wood, extensive water power, and cheap labour. All the elements indispensable to the success of pulp manufacture are to be found in Canada, besides particular additional advantages. The immense forests of coniferous trees contain a practically inexhaustible supply of the different kinds of wood required in this line of manufacture. They are, moreover, of a superior quality and very much sought after by the manufacturers of the United States, as is seen in the yearly increasing demand. With regard to quality and quantity, Canada is as well situated as Norway and Sweden, if not better.

If the price obtained in England is taken as a criterion, Canadian wood produces better pulp than that of Norway and Sweden, for in 1893 Canadian pulp was sold in England at an average of 24·80 dols. a ton, as against 20·77 dols. for the Scandinavian product.

PAPER MILLS IN INDIA.

Board of Trade Journal, January 1896, 86.

According to information received from the India Office, there are ten paper mills—four in the Bombay presidency,

four in Bengal, one at Lucknow, and one at Gwalior, which was worked for a short time only in the past year and then closed. Of the ten, three are private concerns in the Bombay presidency, one of which has not been at work for many years. The others have an aggregate nominal capital of Rs. 612,200. The fibrous materials used for making paper are chiefly rags, babai and moonj grasses, straw, jute, and hemp cuttings, and old jute bags and cloth. The quality of the papers made is now very good, and they have a large and increasing sale. Most of the white and blue foolscap and much of the blotting paper, note-paper, and envelopes used in the Government offices is now obtained from the Indian mills. The total quantity of paper made in 1894 was about 34½ million lb.; ten years previously it was about 13 million lb. The value of the out-turn in 1894 is reported at over Rs. 500,000. The number of persons employed is 3,544.

PRODUCTION OF SUGAR IN GERMANY.

Board of Trade Journal, January 1896, 78.

According to the German official statistics as to the production and taxation of sugar in the German Customs district, there were in operation in 1894-95 467 sugar manufacturing, 405 of which were beet-root sugar factories, 56 were sugar refineries, and 6 were for extracting sugar from molasses. These factories, according to *Handel's Museum*, used altogether 14,521,030 tons (metric tons of 2,204 lb.) of

beets, and produced 1,692,011 tons of raw sugar, as well as 992,136 tons of sugar of all kinds ready for consumption, the figures for the 1893-94 campaign being 1,270,508 tons of raw sugar and 819,639 tons of sugar ready for consumption. The quantity of beet-roots worked up was the largest ever known in Germany; the 1893-94 figures were 10,544,352 tons. The importation of sugar into Germany was insignificant, and remained at about the same level as in the previous year. On the other hand, considerably larger quantities of sugar were exported in 1894-95 than in the previous year, although the export of molasses has fallen off. In 1894-95, 609,663 tons of raw sugar and 392,857 tons of sugar ready for consumption were exported, as compared with 136,674 tons and 262,610 tons respectively in 1893-94. The consumption of sugar in Germany in the year 1894-95 was computed at 552,695 tons of refined sugar, i.e., 10·7 kilos. (23½ lb.) per head of the population, which compares with 10·1 kilos. in 1893-94 and 9·1 kilos., the average of the last nine working years.

UNITED STATES MINERAL PRODUCTION IN 1895.

Engineering and Mining Journal, January 4th, 1896, 1.

The value of the metals produced from domestic ores in the United States in 1895 amounted to 240,997,020 dols., as compared with 194,095,622 dols., the value of the output of the same metals in 1894. This is an increase of 24·2 per cent.

Metal Production of the United States in 1894 and 1895.

Metals.	Customary Measures.	1894.		1895.	
		Customary Measures.	Value at Place of Production.	Customary Measures.	Value at Place of Production.
			Dols.		Dols.
Aluminium.....	Pounds	817,000	490,500	850,000	467,500
Antimony.....	Short Tons	220	39,200	425	67,575
Copper.....	Pounds	353,504,314	33,540,489	386,000,000	38,035,500
Gold.....	Troy oz.	1,923,619	39,764,708	2,152,877	44,870,998
Iron, pig.....	Long Tons	6,657,388	71,966,364	9,346,606	112,159,272
Lead (value, N. Y.).....	Short Tons	166,867	10,585,048	159,245	10,287,227
Quicksilver.....	Fl'k, 76½ lbs.	30,440	1,065,849	33,978	1,313,580
Silver, common value.....	Troy oz.	49,846,875	31,403,531	41,298,764	26,928,712
Zinc (spelter).....	Short Tons	74,004	5,200,882	85,491	6,206,647
Total metals.....	..	..	194,095,622	..	240,997,020
Coal.....	Tons	169,960,781	181,721,871	195,000,000	212,000,000
Iron ore.....	Long Tons	11,880,000	11,800,000	18,000,000	31,500,000
Zinc oxide.....	Short Tons	22,814	1,711,275	22,690	1,588,300
Total values.....	..	..	201,282,116	..	245,088,300

The value of the coal output increased 16·6 per cent., or 27,278,129 dols., and of iron ore 112·1 per cent., or 16,650,000 dols.

UNITED STATES CHEMICAL IMPORTS.

Engineering and Mining Journal, January 4th, 1896, 20.

The imports of heavy chemicals into the United States for the 10 months ending October 31st, according to the Bureau of Statistics, were as follows:—

Soda ash, 229,349,774 lbs. in 1895, against 229,081,101 lbs. in 1894; bleaching powder, 86,511,857 lbs. in 1895, against 78,529,773 lbs. in 1894; caustic soda, 54,705,758 lbs. in 1895, against 36,483,160 lbs. in 1894; sal soda, 5,792,659 lbs. in 1895, against 18,928,704 lbs. in 1894; other salts of soda (excepting nitrate), 1895, 8,060,760 lbs., and 1894, 14,645,153 lbs.; chlorate of potash, 4,028,191 lbs. in 1895, against 3,768,837 lbs. in 1894.

SODA PRODUCTION IN THE UNITED STATES.

Engineering and Mining Journal, January 4th, 1896, 20.

The production of soda in the United States is increasing rapidly, and the output for the year 1895 was about

161,000 metric tons, counted as 58 per cent. ash. (It is a satisfaction to have one industry in which the greater part of the product is counted in metric tons.)

The great Solvay Works are preparing to increase capacity by 50 per cent. through their new Detroit Works. The Mathieson Alkali Company at Saltville, Va., is also preparing to make a large output of ash and caustic during the coming year, and is now working the Castner electrolytic process with excellent results. This Company has a magnificent plant, and will no doubt become a very important factor in the market.

The neighbourhood of Detroit, Mich., will shortly become a great, if not the greatest, alkali producing centre in the United States. The new Solvay works, now under construction, the Michigan Alkali Works at Wyandotte, Church and Co. at Trenton, and two other projected works, are all in the vicinity of Detroit. The Standard Oil Company is also proposing to operate alkali works at Cleveland, O., and there are two or three other projected works in other parts of the country.

THE PRODUCTION OF GLUCOSE IN GERMANY FROM AUGUST 1ST, 1894, TO JULY 31ST, 1895.

Chem. Zeit. 1895, 2222.

States and Administrative Districts.	No. of Factories producing Glucose.	Quantity of Starch converted into Sugar.				Quantity of Manufactured Glucose.			
		Starch prepared in the Factory.		Purchased Starch.		Hard Glucose.	Crystallised Glucose in the Form of Leaves, &c.	Glucose Syrup.	Sugar Colour or Caramels.
		Wet.	Dry.	Wet.	Dry.				
Province of Brandenburg	11	100 kilos.	100 kilos.	100 kilos.	100 kilos.	100 kilos.	100 kilos.	100 kilos.	100 kilos.
" Pommern	2	63,914	..	246,297	20,533	43,389	..	136,745	27,875
" Posen	3	5,477	..	25,900	..	1,949	..	18,500	..
" Schlesien	3	49,773	..	23,671	..	..	..	39,455	3,534
" Saxony and Hanover	4	25,386	1,116	15,472	1,801	3,007	..	22,445	1,733
"	5	7,410	..	10,100	18,048	10,963	7,057	15,955	600
Prussian total	25	149,060	1,116	321,500	40,382	59,398	7,057	233,120	33,742
Baden and Hesse	2	3,378	..	4,741	4,741	7,118	..	..	..
Mecklenburg and Anhalt	2	4,611	33	2,165	..	..	..	3,905	50
Alsace-Lorraine	2	5,774	..	202	9,586	2,239	..	10,444	..
German total for 1894 to 1895	31	163,723	1,169	323,867	54,700	68,665	7,057	247,469	33,792
Total previous year	30	265,491	7,383	297,423	26,843	79,160	60	264,565	36,992

—J. L. B.

THE RETURNS FROM THE GERMAN SUGAR FACTORIES, REFINERIES, AND FACTORIES FOR THE RECOVERY OF SUGAR FROM MOLASSES, FROM AUGUST 1ST, 1894, TO JULY 31ST, 1895.

Chem. Zeit. 1895, 2223.

Periods to which the Results refer.	Sugar Materials used.				Sugar Runnings.					
	Raw Beetroots.	Raw Sugar.	Refined Sugar.	From this the Sugar was taken by the following Processes:—	Osmosis.	Elution and Precipitation.	Substitution.	Separation.	Strontia Process.	Other Methods.
1. Beetroot sugar manufactories:—	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
From August 1, 1894, to July 31, 1895	145,210,295	1,019,562	60,714	144,389	255,558	..	311,760	100,880	..	..
The same period the preceding year	106,443,515	1,174,405	52,657	181,470	270,651	4,239	263,075	97,190	..	..
2. Sugar refineries:—	..	8,284,039	125,021	..	..	..	..	131,899	..	..
From August 1, 1894, to July 31, 1895	..	6,692,120	18,572	..	..	..	..	42,812	..	..
The same period the preceding year	..	..	..	..	..	..	..	..	..	..
3. Manufactories for the recovery of sugar from molasses:—	..	42,674	76,722	..	..	..	..	1,443,869	..	..
From August 1, 1894, to July 31, 1895	..	67,644	53,787	..	..	..	..	1,292,979	..	21,275
The same period the preceding year	..	..	..	..	..	..	..	..	..	..
4. Total sugar manufactories:—	145,210,295	9,346,075	263,487	144,389	255,558	..	311,760	1,676,648	..	..
From August 1, 1894, to July 31, 1895	106,443,515	7,934,178	175,016	181,470	270,651	4,239	263,075	1,432,981	21,275	..
The same period the preceding year	..	..	..	..	..	..	..	..	..	..

Sugar Produced.

Periods to which the Results refer.	Refined Sugar.									
	Raw Sugar Products.	Raw Sugar				Refined Sugar				Liquid Refined (including Invert Sugar Syrups).
		Crystal Sugar.	Granulated Sugar.	Sugar Candy.	Loaf Sugar.	Cube Sugar, &c.	Crushed and Piled Sugar.	Ground Sugar.	Muscovado Sugar.	
1. Beetroot sugar manufactories:—	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
From August 1, 1894, to July 31, 1895	16,761,221	295,643	369,554	..	282,930	219,869	34,262	148,370	143,688	22,735
The same period the preceding year	12,568,272	197,631	319,460	..	205,602	197,866	80,438	381,396	177,743	21,092
2. Sugar refineries:—	75,016	334,553	2,944,875	138,541	1,280,747	1,062,400	118,187	1,383,472	241,971	8,170
From August 1, 1894, to July 31, 1895	47,145	240,793	1,837,369	120,875	174,675	913,680	116,845	1,311,111	245,405	5,852
The same period the preceding year	..	..	..	..	..	..	..	..	..	..
3. Manufactories for the recovery of sugar from molasses:—	83,870	2,782	..	..	..	14,800	5,851	559,788	15,046	..
From August 1, 1894, to July 31, 1895	89,658	2,397	..	..	..	13,232	4,814	500,190	9,133	..
The same period the preceding year	..	..	..	..	..	..	..	..	..	..
4. Total sugar manufactories:—	16,920,107	632,978	3,314,429	138,541	1,563,677	1,297,069	158,300	2,382,630	409,795	30,905
From August 1, 1894, to July 31, 1895	12,705,075	440,821	2,156,820	120,875	1,468,277	1,125,478	292,097	2,222,697	432,281	26,944
The same period the preceding year	..	..	..	..	..	..	..	..	..	..

—J. L. B.

BOARD OF TRADE RETURNS

SUMMARY OF IMPORTS.

Articles.	Year ending 31st December.	
	1894.	1895.
	£	£
Metals.....	19,050,718	18,645,056
Chemicals and dyestuffs.....	6,319,594	6,558,249
Oils.....	7,505,504	8,110,625
Raw materials for non-textile industries.	43,091,405	44,114,973
Total value of all imports....	498,344,810	446,687,430

SUMMARY OF EXPORTS.

Articles.	Year ending 31st December.	
	1894.	1895.
	£	£
Metals (other than machinery)....	27,979,500	28,907,347
Chemicals and medicines.....	8,470,629	8,295,400
Miscellaneous articles.....	28,120,801	31,493,137
Total value of all exports....	245,824,333	226,169,174

IMPORTS OF METALS FOR YEAR ENDING 31ST DECEMBER.

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
			£	£
Copper:—				
Ore..... Tons	82,805	90,757	463,025	774,603
Regulus..... "	78,845	91,272	1,767,955	2,232,955
Unwrought..... "	57,051	42,538	2,364,278	1,831,806
Iron:—				
Ore..... "	4,413,652	4,459,311	2,978,507	2,977,952
Bolt, bar, &c. "	63,247	67,847	555,558	549,522
Steel, unwrought, .. "	8,587	10,862	76,810	95,003
Lead, pig and sheet .. "	161,861	162,024	1,514,785	1,654,063
Pyrites..... "	616,050	582,463	1,049,311	987,165
Quicksilver..... Lb.	3,843,791	3,724,053	303,302	334,558
Silver ore..... Value £	..	..	2,439,955	1,746,144
Tin..... Cwt.	45,331	86,065	2,718,499	2,631,038
Zinc..... Tons	4,926	5,986	819,841	935,891
Other articles... Value £	..	..	1,968,142	2,006,036
Total value of metals ..	..	..	19,050,718	18,645,056

IMPORTS OF CHEMICALS AND DYESTUFFS FOR YEAR ENDING 31ST DECEMBER.

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
			£	£
Alkali..... Cwt.	155,641	184,144	103,824	114,586
Bark (tanners', &c.) ..	320,151	384,659	124,604	146,367
Brimstone..... "	467,925	498,386	102,628	99,367
Chemicals..... Value £	..	..	1,375,489	1,276,270
Cochineal..... Cwt.	4,577	5,813	26,774	38,441
Cutch and gambier Tons	27,470	25,545	577,810	546,120
Dyes:—				
Alizarin..... Value £	..	..	251,095	302,218
Anilin and other ..	..	..	347,268	497,775
Indigo..... Cwt.	59,922	83,070	1,149,057	1,392,513
Nitrate of potash ..	289,363	228,477	265,564	213,655
Valonia..... Tons	24,598	35,605	311,119	395,941
Other articles... Value £	..	..	1,683,462	1,625,028
Total value of chemicals ..	..	..	6,319,594	6,558,249

IMPORTS OF OILS FOR YEAR ENDING 31ST DECEMBER.

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
			£	£
Cocoa-nut..... Cwt.	299,131	285,016	369,737	321,550
Olive..... Tons	26,711	14,827	894,151	522,816
Palm..... Cwt.	1,437,767	1,292,360	1,237,072	1,320,691
Petroleum..... Gall.	163,002,262	177,146,628	2,484,976	3,368,904
Seed..... Tons	29,067	35,631	654,065	721,807
Tran. &c..... Tons	24,213	24,597	443,974	406,448
Turpentine..... Cwt.	406,877	503,683	131,382	290,065
Other articles... Value £	..	..	1,929,147	928,344
Total value of oils... ..	..	..	7,505,504	8,110,625

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE INDUSTRIES FOR YEAR ENDING 31ST DECEMBER.

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
			£	£
Bark, Peruvian .. Cwt.	58,352	31,806	106,527	58,584
Bristles..... Lb.	3,677,311	3,964,750	532,733	556,494
Caoutchouc..... Cwt.	302,451	341,543	3,272,104	3,760,593
Gum:—				
Arabic..... "	53,124	72,281	135,119	169,062
Lac, &c..... "	116,350	114,042	610,870	629,492
Gutta-percha "	45,746	48,999	146,279	389,602
Hides, raw:—				
Dry..... "	419,205	491,542	988,942	1,153,941
Wet..... "	698,584	774,134	1,242,178	1,651,756
Ivory..... "	10,394	10,911	122,735	467,416
Manners:—				
Gano..... Tons	28,582	49,849	146,361	392,395
Bones..... "	88,464	74,056	412,529	320,054
Nitrate of soda... "	125,300	122,487	1,166,800	998,807
Phosphate of lime .. "	380,269	359,650	723,205	634,214
Paraffin..... Cwt.	618,051	720,804	633,207	755,790
Linen rags..... Tons	29,931	25,049	199,344	229,065
Esparto..... "	144,060	186,148	812,245	791,288
Pulp of wood..... "	279,765	297,494	1,432,100	1,574,400
Rosin..... Cwt.	1,454,489	1,427,579	331,183	396,798
Tallow and stearin .. "	1,837,587	2,175,822	2,344,773	2,567,167
Tar..... Barrels	111,640	121,601	71,556	85,865
Wood:—				
Bewn..... Loads	2,333,062	2,278,548	4,187,743	4,201,370
Sawn..... "	5,146,487	5,065,738	11,894,533	10,716,129
Staves..... "	12,145	144,751	544,797	594,695
Mahogany..... Tons	65,494	54,918	521,850	270,712
Other articles... Value £	..	..	9,009,308	10,791,280
Total value .....	..	..	43,091,405	44,114,973

Besides the above, drugs to the value of 1,012,907, were imported, as against 797,317, in 1894.

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR YEAR ENDING 31ST DECEMBER.

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
			£	£
Brass..... Cwt.	109,156	107,059	406,831	418,898
Copper:—				
Unwrought..... "	590,717	592,648	853,755	1,348,900
Wrought..... "	308,125	313,337	824,247	843,476
Mixed metal..... "	315,170	299,294	682,026	633,110
Hardware..... Value £	..	..	1,844,481	1,862,958
Implement..... "	..	..	1,194,594	1,247,708
Iron and steel..... Tons	2,649,398	2,888,149	18,688,763	19,695,382
Lead..... "	47,060	41,666	517,811	494,534
Plated wares... Value £	..	..	301,198	351,222
Telegraph wires ..	..	..	1,386,614	789,810
Tin..... Cwt.	116,992	113,134	432,017	383,029
Zinc..... "	183,077	197,287	126,508	150,135
Other articles... Value £	..	..	725,658	708,185
Total value .....	..	..	27,979,500	28,907,347

**EXPORTS OF DRUGS AND CHEMICALS FOR YEAR
ENDING 31ST DECEMBER.**

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
Alkali..... Cwt.	5,982,200	6,259,936	£ 1,630,948	£ 1,550,140
Bleaching materials ..	1,290,700	1,413,498	501,852	501,389
Chemical manures. Tons	354,303	329,255	2,329,454	1,552,345
Medicines..... Value £	..	..	973,894	1,048,204
Other articles.... "	..	..	3,031,472	3,231,322
Total value .....	..	..	8,470,620	8,295,400

**EXPORTS OF MISCELLANEOUS ARTICLES FOR YEAR
ENDING 31ST DECEMBER.**

Articles.	Quantities.		Values.	
	1894.	1895.	1894.	1895.
Gunpowder..... Lb.	8,315,900	8,000,300	£ 200,481	£ 181,190
Military stores.. Value £	..	..	1,062,565	2,082,788
Candles..... Lb.	19,250,900	23,331,600	331,086	384,772
Caoutchouc..... Value £	..	..	1,152,854	1,191,278
Cement..... Tons	425,532	395,401	703,889	641,918
Products of coal Value £	..	..	1,239,162	1,573,705
Earthenware..... "	..	..	1,607,845	1,839,941
Stoneware..... "	..	..	150,835	149,827
Glass:—				
Plate..... Sq. Ft.	1,336,600	1,445,061	72,634	79,991
Flint..... Cwt.	81,753	94,564	199,919	214,598
Bottles..... "	633,227	680,315	301,433	323,814
Other kinds..... "	178,907	224,898	141,392	170,741
Leather:—				
Unwrought..... "	133,153	159,089	1,230,074	1,423,016
Wrought..... Value £	..	..	279,849	355,422
Seed oil..... Tons	58,165	49,130	1,219,270	991,093
Floorcloth..... Sq. Yds.	20,185,700	22,434,800	752,415	863,057
Painters' materials Val. £	..	..	1,374,034	1,553,878
Paper..... Cwt.	901,680	906,809	1,412,649	1,437,857
Rags..... Tons	53,834	49,353	309,684	294,473
Soap..... Cwt.	576,537	730,152	621,292	756,924
Total value .....	..	..	28,120,801	31,493,137

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

23,665A. L. Mond. Apparatus for treating solid and pasty substances with gases at elevated temperatures. January 14. Date claimed December 10, 1895.

24,697. W. R. Herriog and M. Graham. Improvements in apparatus for charging inclined gas retorts. Complete Specification. December 16.

24,104. F. D'Arcy McNally. Improvements in hydrometers, saccharometers, and other like instruments. December 16.

24,138. C. A. Rittel and J. Hodgson. Improvements in the manufacture of vessels of aluminium or alloys of the same for cooking, heating, boiling, evaporating, and other purposes. December 17.

24,214. E. Powell. Improvements in furnaces. Complete Specification. December 17.

24,311. D. Allan. An improvement in air, gas, and liquid tight couplings for metal, rubber, vulcanite, or other tubing. December 19.

21,337. L. A. Chevalet and W. Bobby. Improvements in apparatus for heating and purifying water. December 19.

24,499. G. P. Wallis. Improvements in hydraulic presses for expressing oil from seeds and such like. December 21.

24,508. H. Eckardt. Improvements in and connected with regenerators for furnaces. December 21.

24,709. J. L. A. Aymard. Improvements in sterilising apparatus. December 24.

24,835. W. Raydt. Improvements in apparatus for filtering liquids and impregnating the same with gases. December 27.

24,890. W. Hainsworth. An improvement in ladles for molten metal. December 28.

24,943. T. B. Jones. Improvements in or connected with apparatus for filtering sewage and other liquids. December 30.

25,949. D. A. Peniakoff. Improvements in rotatory apparatus for calcining substances. December 31.

1896.

75. W. W. R. Warn and L. F. King. Improvements in or connected with calcium carbide gas generators. January 1.

282. R. H. Courtenay. Improvements in lamps for the combustion of special chemical compounds, with means for condensing the burnt products of combustion. January 4.

424. G. E. Sherwin. Appliances for cooling and heating air and liquids. January 7.

469. J. U. Askham. Improvements in apparatus for separating substances of different sizes or specific gravities. Complete Specification. January 7.

889. F. Godard. Improvements in apparatus for refrigerating liquids. January 13.

947. C. E. Mumford. Improvements in apparatus for turning malt and like materials on a kiln floor. January 14.

1112. D. A. Quiggin. Improvements in and relating to evaporators, condensers, and the like. January 16.

1177. C. S. Meacham. A new or improved apparatus for separating bodies of different specific gravity when immersed in a liquid. January 17.

1228. D. M. Hawes. See Class XI.

1294. C. B. Inman. A carbonating machine. January 18.

1300. C. Polony. See Class II.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

2723. F. H. Eydman. Apparatus for heating, evaporating, distilling, and condensing. December 26.

2824. S. M. Lillie. Apparatus for the continuous concentration of liquids. December 31.

3118. J. Foster. Evaporating apparatus. January 15.

4282. B. J. Green and W. Oates. See Class II.

4792. J. E. Carroll. Boiler feed-water heating and purifying apparatus. January 22.

18,518. S. Pitt. From La Société Internationale des Procédés A. Seigle. Apparatus for treating liquids by means of heat. January 15.

23,989. W. R. Herring and M. Graham. Apparatus for charging inclined retorts. January 22.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS

24,688. W. Synncock and G. Gosling. An apparatus for the production and automatic distribution of acetylene gas. December 16.

24,107. F. Horridge. Improved apparatus for heating purposes. December 16.

24,196. E. B. Pym and J. Gore. Improvements in apparatus for use in the manufacture of acetylene gas. December 17.

24,289. C. J. Yarnold. Improvements in or relating to the manufacture of ozone, and apparatus therefor. December 18.

24,302. A. Guillemaire. Process for deodorising and colouring in gold-yellow colour of oil and essence of petroleum and their derivatives. December 18.

24,381. L. Denayrouze. Improvements in the method of and apparatus for charging air with combustible matter and applying it for illuminating. December 19.

24,384. S. Cutler. An improved oil atomiser for gas carburetters. December 19.

24,505. A. Taylor and W. S. Taylor. Improvements in methods for incandescent gas lighting. December 21.

24,566. T. Holliday and J. H. Exley. Improvements in apparatus for manufacturing acetylene gas. December 24.

25,783. J. H. Paul. Improved treatment of spent oxide. December 27.

24,810. J. Moeller. An improvement in apparatus for making oil gas. December 27.

24,864. S. Learoyd. Improvements in fire-lighters by the coating of coal and other fuel. December 28.

25,000. S. Bender and T. Micoch. Improvements in furnaces and in the combustion of fuel. December 31.

1896.

148. W. G. Potter. Improvements in the manufacture of incandescent mantles for gas or oil lamps. January 3.

155. C. M. Stead and J. E. Brooke. An improved method of and means for enriching and burning lighting gas, and apparatus therefor. January 3.

317. G. Love. Improved apparatus applicable to coke ovens. January 6.

322. J. C. Bayley. An improved apparatus for generating, storing, and purifying acetylene and like gases. January 6.

361. H. Bower. Improvements in methods of separating the cyanogen compounds from gas liquor or other solutions containing cyanogen compounds. January 6.

395. A. Garton. Improvements in automatic apparatus for the manufacture of acetylene gas. January 7.

558. J. H. H. Duncan. Improvements in the production of incandescent mantles or bodies for gas and vapour lamps. January 8.

682. H. C. B. Forester. Improvements in and in the manufacture of artificial fuel. January 10.

771. M. Seipp. Process and apparatus for the complete combustion of coal-dust of different-sized particles in coal-dust or gas furnaces that may be immediately stopped. Complete Specification. January 11.

841. G. W. Breffit and F. G. Treharne. A new furnace for producing coke, with or without suitable apparatus for collecting the by-products. January 13.

858. A. Davis. Improvements in the process of and apparatus for carburetting air. January 13.

873. W. Raydt. Improvements in means for obtaining carbonic acid from gaseous mixtures. January 13.

1116. F. Rosbach-Rousset. An improved process and apparatus for the production of acetylene gas for acetylene gas lighting. Complete Specification. January 16.

1129. F. Knecherl. An improved method of producing light. January 16.

1136. F. Kollm. Incandescent body for illuminating purposes. Complete Specification. January 16.

1390. C. Polony. A process and furnace installation for continuous process of production of a non-exploding mechanical admixture of oxygen and hydrogen. January 18.

1332. C. G. Lu's. Improvements in apparatus for use in the production of acetylene gas. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1067. T. Rowan. Apparatus appertaining to gas lighting. January 15.

1953. L. M. Bullier. Carburetting air and gases. January 22.

4282. J. J. Green and W. Oates. Retorts for the manufacture of gas and for other purposes. December 26.

4750. W. Ure and S. T. Crossdell. Constructing and working coke ovens for the manufacture of metallurgical coke. January 22.

4879. G. Hayeraft. Manufacture of artificial fuel. January 22.

11,848. H. H. Lake.—From E. N. Dickerson. Processes and apparatus for the production of combustible gas. December 26.

11,848a. H. H. Lake.—From E. N. Dickerson. Method and apparatus for supplying combustible gas for illuminating purposes. December 31.

12,215. A. Sweetser. Production of oxygen gas and apparatus therefor. January 15.

15,168. W. Foulis and P. F. Holmes. Apparatus for obtaining cyanides from gases. January 8.

19,916. W. Ewing and J. Meikle. Apparatus for enriching illuminating gas. January 8.

21,927. N. Baron. Method of increasing the lighting power of petroleum. December 26.

23,057. G. Seeligmann. Lighting material and apparatus. January 22.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

24,080. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Improvements in the manufacture of colour lakes. December 16.

24,184. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of azo dyestuffs. December 17.

24,193. G. B. Ellis.—From La Société Chimique des Usines du Rhône, anct. Gilliard, P. Monnet, and Cartier. Improvements in the production of para-nitro-phenol and ortho-nitro-toluene-para-sulphonic acid. December 17.

24,194. G. B. Ellis.—From La Société Chimique des Usines du Rhône, anct. Gilliard, P. Monnet, and Cartier. Improvements in the production of para-nitro-phenol and ortho-nitro-toluene-para-sulphonic acid. December 17.

24,195. J. C. Mewburn.—From F. von Heyden Nachfolger. Improvements in the manufacture of para-amido-benzoic-sulphinide and of certain amides. December 17.

24,779. I. Levinstein, and Levinstein, Lim. Improvements in the manufacture of colouring matters. December 27.

24,842. C. D. Abel.—From L. Durand, Huguenin, and Co. Manufacture of new nitrated oxazine colouring matters dyeing with mordants. Complete Specification. December 27.

1896.

658. O. Imray. — From The Society of Chemical Industry in Basle, Switzerland. Manufacture of colouring matters dyeing wool green-black to blue-black. Complete Specification. January 10.

890. G. W. Johnson.—From Kalle and Co. Improvements in the manufacture of dry diazo compounds. January 13.

1331. H. H. Lake. — From K. Oehler. Improvements in the manufacture of colouring matters. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

3488. S. Pitt.—From L. Cassella and Co. Manufacture of blue safranin-azo dyestuffs. December 26.

3497. H. E. Newton.—From The Farbenfabriken vormals F. Bayer. The manufacture or production of naphtho-fluoresceine. December 26.

3580. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of a new dihydroxynaphthalene, and of certain sulphonic acids derived from this dihydroxynaphthalene or from the corresponding amidohydroxynaphthalene. December 22.

4018. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of direct-dyeing colouring matters. December 26.

4448. A. G. Green and R. Jansen. The manufacture and production of a new anilino base and of colouring matters therefrom. December 31.

4880. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs. January 15.

4961. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of derivatives of hydroxy-anthraquinone. January 15.

4962. H. E. Newton.—From The Farbenfabriken vormals F. Bayer. The manufacture or production of α - β -dihydroxynaphthalene, a new α - β -dihydroxynaphthalene sulphonic acid, and of colouring matters derived from α - β -dihydroxynaphthalene sulphonic acids. January 15.

5042. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of new basic azine dyestuffs and of new derivatives thereof. January 15.

5153. A. Bang.—From G. A. Dahl. Mordant-dyeing dyestuffs. January 15.

22,482. O. Murray.—From The Society of Chemical Industry in Basle. Manufacture of orange colouring matters by electro-chemical process. January 22.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

24,317. G. Douglas. Improvements in certain textile fabrics. December 19.

24,493. J. Fulton. Improvements in and relating to the weaving of textile web fabrics. December 21.

24,497. J. H. MacMillan and J. Mason. Improvements in the manufacture of crimped or mercerised woven fabrics. December 21.

24,586. L. Schniewind and A. Schmidt. Improvements in elastic woven textile fabrics. Complete Specification. December 23.

24,643. J. Y. Johnson.—From S. Wallach and Co., and E. Schweitzer. An improved process for removing mineral oil stains from vegetable fabrics. December 23.

24,696. J. MacDonald. Improved apparatus for decortiating reed grass and similar fibrous plants. December 24.

24,787. G. E. Wright and W. Monk. Improvements in the process of and material employed for degreasing and recovering oil and grease from wool, cotton waste, and other fibrous materials. December 27.

1896.

240. G. E. Wright and W. Monk. Improvements in apparatus for degreasing, scouring, and washing wool, cotton waste, and other fibrous materials. January 4.

340. G. Smith. Improvements in lining cloths or fabrics known as "fibre chamois," "fibre ramie," "fibre," or "fibrine." January 6.

492. J. Baxter, G. A. Baxter, and W. H. Hare. Improvements in finishing woollen or worsted fabrics. January 8.

877. J. J. Manu. Improvements in the manufacture of impermeable fabrics. January 13.

908. J. H. Macmillan and J. Mason. Improvements in the treatment and manufacture of textile fabrics. January 14.

1104. J. L. Bottomley. An improved manufacture of yarn. January 16.

1208. S. Schwabe and Co., Limited, and A. Binz. Improvements in the treatment of textile fabrics, to produce crinkled effects. January 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1518. F. Girard. Waterproofing paper and other fabrics and apparatus therefor, and in means for applying waterproof designs thereto. January 15.

2711. R. Aitken. Treatment of animal fibres and mixed animal and vegetable fibres. January 15.

3041. K. T. Sutherland and G. Esdaile. An improved method of degumming or separating the filaments of stalk fibres. January 15.

3590. E. Lashbordes. A process for chemically cleansing wool and woollen fabrics and rags. December 26.

22,817. C. Wetherwax. Method and apparatus for removing gummy and other matters from vegetable fibres. December 31.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

24,392. M. Beraud and A. Lautmann. Improvements in dyeing wool, silk, and the like. December 19.

24,789. S. Schwabe and Co., Lim., and J. Gilbertson. Improvements in the process of and machinery for printing woven fabrics. December 27.

1896.

372. A. M. Clark. From C. H. Boehringer. Improvements in the process of mordanting vegetable textile materials for dyeing. January 6.

1048. W. P. Thompson. From E. Dambremé. Improvements in mechanism for dye vats. January 15.

1290. J. Stalker and C. C. Connor. Improvements in the fixing or fastening of colouring matters on fibre, yarns, and fabrics in such manner as to resist the action of soap, alkalis, and light. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1691. G. Markus, M. Baender, and F. Sicker. Improvements in or relating to processes and apparatus for printing yarns in skeins. January 15.

3905. L. Rivett and R. H. Scott. Printing calico and other woven fabrics of cotton and cotton warps. January 22.

4671. J. G. Haslam. Dyeing apparatus. January 15.

23,592. S. Pitt.—From L. Cassella and Co. Process for rendering wool dyeings fast to "potting" or "spungeing." January 15.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

24,122. J. Enright. Improvements in the manufacture of sulphur dioxide and its derivatives, and apparatus therefor. December 17.

24,171. J. H. Darby. Improvements in the manufacture of ammonium salts. December 17.

24,848. H. H. Lake.—From O. O. B. Froelich. Improvements relating to the preparation of compounds of fluoride of antimony. December 27.

24,920. A. McDougall. The treatment of organic matters containing nitrogen for the production of ammonia and residual products. December 30.

1896.

75. W. W. R. Warn and L. E. King. See Class I.

335. H. R. Angel. Improvements in the manufacture of caustic soda, carbonate of soda, and sulphide of sodium. January 6.

579. J. B. Hilliard. Improved process of manufacturing chlorine gas. January 9.

720. B. Willecox.—From The Chemische Fabrik Griesheim. A process for obtaining hydro-sulphide of sodium or sulphate of sodium and sulphuretted hydrogen and sulphate of calcium from sulphide of calcium or soda residues and mono- or bi-sodium sulphate. January 10.

928. J. Foster. Improvements in and relating to the discharging of salts and the like from evaporators. January 14.

1022. A. von Rad and J. Rosenfels. Improvements in the manufacture or production of cyanogen compounds. Complete Specification. January 15.

1275. W. Mills. Improvements in manufacturing the silicofluoride of ammonium. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

18,526. J. Hargreaves and T. Bird. Manufacture of chlorates of sodium and potassium. January 8.

1895.

1168. U. F. Benker. Manufacture of sulphuric acid. January 22.

2660. A. E. Morgans. Production of cyanogen compounds. January 22.

2820. L. M. Bullier. Process for the manufacture of carbides or acetylides of the earth metals and alkali earth metals and of the oxides or salts of these metals. January 22.

3489. T. H. Bell.—From T. Schloesing. Manufacture of chlorine by means of magnesium chloride. January 22.

4267. J. Y. Johnson.—From The Verein Chemische Fabrik. Manufacture or production of chlorine. December 31.

5662. C. Hoepfner. Production of zinc chlorides. January 22.

7171. H. Reichardt and J. Bueb. See Class XVI.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

21,263. J. Badon. A new product for use in substitution of sheet glass for windows, engraved glass, painted glass, blinds, curtains, and other purposes. Complete Specification. Filed December 18. Date applied for June 14, 1895, being date of application in Belgium.

21,267. W. Schreiber. Process for durably burning aluminium ornaments into porcelain, stoneware, majolica, glass, and stove tiles, as also enamelled iron utensils. December 18.

24,283. F. Albrecht.—From W. Knapp. Improvements in or appertaining to the process for the production of coloured pictures, writing, or the like on glass, porcelain, enamel, or sheet iron. December 18.

24,286. A. J. Boulton.—From La Société Anonyme Belge pour la Fabrik des Emaux Artistiques. An improved manufacture of glass. December 18.

24,313. F. F. Warren. An improved apparatus for blowing glass bottles, sheet glass, and glass in every shape, which I call the "Warren system." December 19.

24,314. F. F. Warren. An improved apparatus for blowing glass bottles, sheet glass, and glass in every shape. December 19.

24,379. O. Lauch. Improvements relating to the ornamentation of majolica tiles, vases, and the like. December 19.

24,596. R. Thorburn. Improvements in or connected with the manufacture of tiles or other similar articles. December 23.

24,858. J. Maddock. A kiln hook for placing pottery-ware during fire. December 28.

24,907. J. Phillips. See Class IX.

24,933. H. A. Rumbelow, G. Rumbelow, H. St. R. Rumbelow, E. Rumbelow, K. Rumbelow, M. St. R.

Rumbelow, and G. Hall. Improvements in dead or glazed faced white and coloured bricks and building blocks, roofing and ornamental and fire tiles, sanitary pipes and ware, paving stones and pottery. December 30.

1896.

46. A. Kopp's Sohn. Improvements in the manufacture of articles of glass. January 1.

177. The Worcester Royal Porcelain Co., Lim., and E. P. Evans and C. F. Bions. Improvements in the manufacture of plates and other similar articles of pottery or earthenware. January 3.

251. D. Moore. Improved leer or lehr for annealing glass. January 4.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1221. W. Smith. An improvement in or pertaining to the "salt-glazing" of earthenware, stoneware, and other brittle articles. November 27.

1645. J. A. Fleming and E. Woollam. A rectangular oven or kiln for firing clay goods in any stage of manufacture, or other materials. December 31.

2175. A. Sherwin and C. W. Cobden. A novel or improved compound for use in the process of decorating or ornamenting ceramic ware. December 26.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

24,674. F. B. Bond. Improved fireproof flooring roofing, beams, brusses, and the like. Complete Specification. December 24.

24,898. M. Nahsen. An improved process for the manufacture of cement and cement-mortar. Complete Specification. December 28.

24,907. J. Phillips. Improvements in continuous kilns for burning bricks, tiles, terra-cotta, lime, &c. December 28.

24,967. M. Hoeft. Improvements in the production of marble-like stucco or plaster-work suitable for walls, ceilings, and the like. December 30.

1896.

68. W. R. Taylor. Improvements in apparatus for burning cement-making materials, lime, chalk, and the like, and the obtainment therefrom of carbonic acid gas. January 1.

643. A. W. Perriman and W. Owen. Improvements in or relating to the manufacture of steps, building or monumental slabs, and other articles of artificial stone, asphalt, or the like, and apparatus therefor. Complete Specification. January 9.

759. G. R. Hislop. Improvements in apparatus for revivifying spent limes, and for calcining cements and ores, or like materials. January 11.

1145. H. H. Lake. From A. D. Tyler, jun. An improved process for impregnating wood, or articles composed of wood, with solid or semi-solid substances. January 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

2710. R. Aitken. Treatment of wood with a view to preserving and colouring the same. January 15.

3608. F. Young. Manufacture of fire-clay refractory and non-conducting bricks and blocks, building bricks, or the like. December 26.

8402. G. R. Dawney. Improved tiles for permanent mentering, to be used in the construction of fireproof floors. January 8.

18,189. G. Michaelson. A process for imparting shaded colouring to, and for speckling or "curling" wood and the like. December 26.

22,201. B. Lohr. Process for producing compound asphalt and concrete slabs or plates, or compound plates or slabs of two similar substances. January 15.

23,145. E. H. Hurry and H. J. Seaman. New or improved process and apparatus for the manufacture of Portland cement and other similar cement. January 22.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

24,127. T. M. Ash and H. N. Weldon. An improved process for coating or plating non-metallic articles with metals. December 17.

24,241. J. H. Richards. A protective covering or coating for metallic wire and the like. December 18.

24,246. R. Thomson, J. Addie, and R. Addie. Improvements in treating auriferous, argentiferous, or other metalliferous ores for the extraction of the metals, and in apparatus therefor. December 18.

24,247. J. Addie, R. Thomson, and R. Addie. Improved process of treating auriferous, argentiferous, or other metalliferous ores to facilitate their separation from solvents used in extracting the metals therefrom. December 18.

24,248. J. Addie, R. Thomson, and R. Addie. Improvements in treating auriferous, argentiferous, and other metalliferous ores for the extraction of the metals and for the separation and recovery of the solvent employed in such treatment, and in apparatus therefor. December 18.

24,703. R. Heathfield and W. S. Rawson. An improvement in galvanising. December 24.

24,803. L. Pelatan and F. Clerici. Improvements in means or apparatus for the obtaining of precious metals from ores or materials containing them. Complete Specification. December 27.

25,095. W. J. Studds. Improvements in the methods of obtaining gold from antimony or ores or compounds containing antimony. December 31.

1896.

40. S. Callow. Silver alloy. January 1.

123. J. Giers. Improvements in furnaces for the manufacture of cast steel and homogeneous iron. January 2.

128. H. F. Julian. Improvements in the process of extracting metals from solutions. January 2.

202. E. Placet. Improvements relating to the treatment of metals, and to products resulting therefrom. January 3.

203. E. Placet. Improvements in the treatment of iron and steel. January 3.

244. F. T. Franke. Improvements in and connected with annealing or tempering furnaces. Complete Specification. January 4.

303. C. C. Longridge and G. T. Holloway. Improvements in plant and process for smelting auriferous antimony ores. January 4.

315. W. H. Bennett. Process for soft-soldering aluminium. January 6.

549. W. Blackmore. The treatment of antimonial and arsenical ores, materials, or furnace products containing gold, silver, or platinum. January 8.

618. J. B. Torres. Improvements in or relating to the extraction of metals from their ores and other metal-containing compounds, and in apparatus therefor. January 9.

1055. A. J. Boulton. From C. Prioux and C. Hugot. Improvements in or relating to soldering metals. January 15.

1096. T. Hampton. Improvements in the manufacture of steel. January 16.

1146. L. Doig.—From Russel and Erwin Manufacturing Company. An improved method of preparing metal and metal articles for stamping and drawing in dies. Complete Specification. January 16.

1149. W. H. Hyatt and J. Henochsberg. Improvements in extracting gold and in apparatus therefor. January 16.

1257. J. Armstrong. Improvements in the extraction of silver, gold, lead, and zinc from their ores. January 17.

1271. H. R. Angel. Improvements in the reduction of refractory ores. January 18.

1316. A. J. Boulton.—From C. J. L. Otto. An improved manufacture of iron and steel. January 18.

1325. F. A. Ellis. Improvements in the drawing and planishing of tubes of aluminium alloy, and in means employed therefor. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

801. H. R. Angel. Improvements in the extraction of lead with silver, gold, or other metals from ores blended with sulphide of zinc or otherwise. January 8.

1895.

2278. W. Kaufmann. Process for the production of metals and metallic alloys containing carbon and silicon. January 8.

2338. G. Robson and S. Crowder. Improvements in the treatment of finely divided substances, such as crushed ores, slime, tailings, and the like, for the separation and recovery of metals and metallic compounds therefrom. January 8.

2729. H. L. Sulman. Apparatus for recovery of precious metals from their solutions. December 11.

2730. H. L. Sulman. Precipitation of precious metals from their solutions. December 13.

2804. O. Imray.—From L. Diehl. Metallic mixtures and alloys for effecting electro-chemical decompositions. January 15.

3959. H. H. Lake. From P. Manhes. Process of desulphuration of castings and alloys of nickel and cobalt. January 22.

5295. R. C. Smith and A. B. Brown. Making chilled castings. January 22.

5958. C. G. T. Bennett, E. H. Shortman, and B. Bracey. Improved method of treating galvaniser's flux skimmings to recover ammonia and facilitate the extraction of the zinc, with apparatus for use therein. January 15.

6802. J. S. MacArthur and J. Yates. Extracting gold and silver from ores and the like. January 22.

16,920. B. C. Hinman. Process and apparatus for extracting gold from ores and other auriferous substances. December 26.

18,177. H. A. de Neuville. Process and apparatus for the extraction of gold and silver from their ores and from other auriferous substances. January 8.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

6565A. H. Tee. Improvements connected with the electrolysis of chlorides and other salts, and the evaporation of solutions. Filed December 19. Date claimed March 30, 1895.

24,165. L. Epstein. Process for hardening the active material on the positive plates of secondary voltaic batteries. December 17.

24,172. A. C. Iwanowski. Improvements in or connected with galvanic batteries. December 17.

24,394. A. C. Miles and B. F. de Morgenstern. Improvements in and relating to galvanic batteries. December 19.

24,447. C. M. Pielsticker. Improvements in the separation from their cathodes of electrolytically precipitated gold and silver from cyanide solutions. December 20.

24,516. L. Epstein. Improvements in secondary voltaic batteries. Complete Specification. December 21.

24,834. C. Therye and A. Oblasser. Improvements in electric accumulators. Filed December 27. Date applied for June 28, 1895, being date of application in France.

24,837. P. Jensen.—From H. C. F. Stormer. Improvement in the method and apparatus for washing alkali-amalgam obtained in electrolytic apparatus. December 27.

25,002. R. Heathfield and W. S. Rawson. Improvements in electrolytical apparatus. December 31.

1896.

130. R. J. Gulcher. Improvements in and relating to electric accumulators. Complete Specification. January 2.

475. W. C. Bersey. Improvements in electric accumulators. January 7.

477. C. N. Stewart. Improvements in electrical storage accumulators. January 7.

535. H. W. Headland. Improvements in primary and secondary batteries. January 8.

557. R. Collins and F. Cogan. Improvements in electric batteries. January 8.

710. A. C. Miles and B. F. de Morgenstern. Improvements in and relating to electric accumulators. January 10.

719. B. Willeox.—From La Soc. P'Accumulateur Fulmen. Improvements in electrical accumulators or storage batteries. January 10.

778. H. W. Headland. Improvements in secondary batteries. January 11.

780. H. Leitner. A new or improved method of manufacturing electrodes for secondary electric batteries. Complete Specification. January 11.

791. W. Walker, jun., F. R. Wilkins, J. Lones, and C. Vernon. Improvements in primary voltaic batteries. January 11.

842. S. O. Cowper-Coles. Improvements in and connected with the manufacture of electric conductors. January 13.

888. A. U. Alecock. An improved secondary battery or accumulator. January 13.

986. J. C. Graham. Improvements in the electro-deposition of metals. January 14.

1051. D. G. FitzGerald and W. C. Bersey. Improvements in voltaic batteries. January 15.

1068. J. C. Graham. An improved electrical process for recovering metals from weak solutions and for concentrating the electrolyte. January 15.

1069. C. Pollak. Improvements in or connected with electrical condensers. January 15.

1144. W. Heraeus. Improvements in electrodes for electrolytical purposes. January 16.

1228. D. M. Hawes. Improvements in the manufacture of battery cells or vessels to contain acids or other chemicals. January 17.

1238. P. A. Newton.—From C. Willms. Improvements in the manufacture of electric batteries. Complete Specification. January 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

24,541. C. Kellner. Method of and apparatus for effecting electrolysis. December 26.

1895.

2999. The Cowper-Coles Galvanising Syndicate, Lim., and S. O. Cowper-Coles. Obtaining zinc from its ores, and the electro-deposition of zinc upon iron or other metals or alloys. January 15.

18,936. H. Leitner and E. Reicher. An improved process for the preparation of electrodes for primary, secondary, and dry batteries. January 15.

22,120. T. W. Allan, A. Powell, and C. J. Tibbits. Electric accumulators or storage batteries. December 31.

XII.—FATS, OILS, AND SOAP MANUFACTURE.

APPLICATIONS.

24,418. E. S. Wilson and E. Stewart. Improvements in the separation and purification of colouring matter from crude cotton-seed oil. December 20.

24,544. G. MacDonald. Improvements in filtering, purifying, and decolorising oils, saccharine and other juices, alcoholic liquors, water, sewage, sewage effluents, and other liquids and fluids, and in materials and apparatus therefor. December 21.

24,714. A. E. Morgans. Improvements in the treatment of oleaginous and fatty substances of all kinds, and hydrocarbons, for purification and other purposes. December 24.

24,787. G. E. Wright and W. Monk. See Class V.

1896.

5. J. E. Bedford and C. S. Bedford. Improvements in the treatment of linseed oil. January 1.

799. H. Hinterberger. Apparatus for separating oil and air from water, and recovering the oil. January 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

23,228. S. Crowder. Recovering oils or fatty substances from clays, sands, ores, mine slimes, or other finely-divided substances. December 31.

1895.

3466. J. T. A. Walker. Detergent or washing powder. January 8.

20,107. H. T. C. Kraus. Process of extracting oil from vegetable seed. December 26.

23,106. W. T. Whiteman.—From The Cleveland Linseed Oil Co. Purifying oil extracted by solvent from linseed or similar substance. January 8.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, ETC.

APPLICATIONS.

24,063. J. C. Sellars. Compound or material for use in connection with non-oleaginous protective coverings or paints. Complete Specification. December 16.

24,224. L. Kneche. Improvements in the manufacture of lac, varnish, and the like. Complete Specification. December 18.

24,324. T. Sheppardson. An anti-fouling and anti-corrosive composition for ships' bottoms and the like. December 19.

24,546. R. Langhans. Improvements in the manufacture or production of coatings composed of earthy oxides. December 21.

25,009. H. H. Lake.—From T. Benfield. An improved process of making oxide of lead. Complete Specification. December 31.

25,023. G. H. Smith. Improvements in the treatment or purification of red oxide of iron. December 31.

1896.

654. E. Serullas and F. Hourant. Improved process of obtaining and purifying gutta-percha. January 9.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

24,950. A. K. Y. Anderson and J. Mackintosh. A process for treating hides and skins in the manufacture of leather. Complete Specification. December 30.

24,968. J. B. Seammell and E. A. Muskett. Improvements in tanning. December 31.

1896.

289. J. Hudson. See Class XV.

COMPLETE SPECIFICATION ACCEPTED.

1895.

22,714. C. Knees and D. W. Alexander. Process for tanning hides. January 22.

XV.—AGRICULTURE AND MANURES, ETC.**APPLICATIONS.**

289. J. Hudson. A process for rendering waste leather soluble and applicable as a manure. January 4.

COMPLETE SPECIFICATION ACCEPTED.

1895.

21,627. L. Tralls and E. Burmeister. Treatment and manufacture of manure and in preservatives and disinfectants for manure. December 26.

XVI.—SUGARS, STARCHES, GUMS, ETC.**APPLICATIONS.**

24,456. C. Hellfrisch. Process for the treatment of potato starch with chlorine under heating. Complete Specification. December 20.

24,544. G. MacDonald. See Class XII.

1896.

333. E. Müller and C. Müller. Process for clarifying vegetable juices. January 6.

1101. M. Sachs. An improved process for treating the by-products of sugar works and sugar refineries. Complete Specification. January 16.

COMPLETE SPECIFICATION ACCEPTED.

1895.

7171. H. Reichardt and J. Bueb. Process for manufacturing cyanides out of molasses and lyes resulting from beetroot-molasses. January 8.

XVII.—BREWING, WINES, SPIRITS, ETC.**APPLICATIONS.**

24,387. D. Young. From C. Bullock and C. M. Reed. An improved method of and apparatus for purifying and refining alcoholic liquors. Complete Specification. December 19.

1896.

318. W. Adlam and A. Wilson. An improved cylinder for kilning malt. January 6.

766. E. Davies and H. M. H. Goodfellow. Improvements in the treatment of spent hops for preparing the same for use as a stuffing material, and in machinery therefor. January 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

17,496. H. Elion. Manufacture of yeast. January 22.

20,997. S. Kuhlmann. Brewing, and apparatus therefor. January 22.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY, AND DISINFECTANTS.**APPLICATIONS.****A.—Chemistry of Foods.**

24,153. J. Rose. Improvements in the manufacture of cheese. December 17.

24,156. S. S. Bromhead.—From V. Durant. Improvements in apparatus for effecting a rapid separation of the fatty matter in milk without the aid of rotation or beat. December 17.

24,282. W. P. Thompson.—From M. Braumann and A. Braumann. Improvements in the preservation of green vegetables and the like. Complete Specification. December 18.

24,293. H. J. Haddan.—From E. Freixa. An improved process of manufacture of nitrogenised water. Complete Specification. December 18.

24,552. J. Pleines. Improvements in the manufacture of baking powder. December 21.

24,854. W. Robinson. Improved milk steriliser. December 28.

B.—Sanitary Chemistry.

24,168. G. D. Yates. Improvements in softening water for domestic or other use, and in compositions therefor. December 17.

24,544. G. MacDonald. See Class XII.

1896.

821. J. H. Williams. Apparatus and process for purification, softening, or hardening of water for domestic, manufacturing, or other purposes. January 13.

1038. R. E. von Lengerke. Improvements in arrangements and apparatus for filtration of sewage. January 15.

COMPLETE SPECIFICATIONS ACCEPTED.**A.—Chemistry of Foods.**

1895.

4886. W. H. Thew and J. H. Hooker. Preparation of peptonised milk and cocoa. January 15.

6257. J. L. Johnston and Boyril, Lin. A new or improved method of obtaining and preserving the soluble albumen of animal food. January 22.

13,176. F. V. Friderichsen. Process of manufacturing fodder. December 26.

22,887. C. M. U. Dahle. Process for the preservation and preparation for transit of fish liver. January 8.

B.—Sanitary Chemistry.

1895.

166. F. P. Candy. Improvements in and in apparatus for use in connection with the purification of sewage and impure waters. December 31.

3360. H. T. Wright. Apparatus for softening and purifying water. December 26.

4514. P. Boisserand. Sterilising and purifying liquids. December 26.

C.—Disinfectants.

1895.

5358. J. B. McArthur. Disinfecting materials. January 15.

XIX.—PAPER, PASTEBOARD, ETC.**APPLICATIONS.**

24,272. A. Duffek and A. Merrel. Improvements in the manufacture or preparation of cellulose suitable as a raw material for paper. Complete Specification. December 18.

24,275. T. A. Marshall.—From G. Smidth. Improvements in separating fibres from the waste liquors of paper-making machinery. Complete Specification. December 18.

24,421. J. White. Improvements in apparatus for straining paper pulp. December 20.

1896.

210. H. H. Lake.—From E. Berland and J. Girard. Improvements in the manufacture of paper pulp from the broom plant. January 3.

COMPLETE SPECIFICATION ACCEPTED.

1894.

24,826. H. Sweetapple. Manufacture of vegetable parchment paper. December 26.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

24,517. O. Imray. — From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of hydroxy phenacetine-salicylate. December 21.

24,615. M. Woolf. The preparation and production of essences or extracts from vegetables. December 23.

24,848. H. H. Lake. — From O. O. B. Froelich. Improvements relating to the preparation of compounds of fluoride of antimony. December 27.

1896.

9. W. Majert. The manufacture or production of an ammonium compound of casein. Complete Specification. January 1.

21. W. Majert. Improvements in the manufacture or production of vanillin. Complete Specification. January 1.

529. C. J. Caspers. Improved process for the preparation of artificial musk. January 8.

601. T. O. Kent. A new or improved extract of coffee, and the method of preparing the same. January 9.

816. E. Durkopf. An improved process of producing methyleneditannic acids from formaldehyde and tannin. January 11.

1202. J. Y. Johnson. — From Vereinigte Chininfabriken, Zimmer and Co. The manufacture or preparation and production of new medicinal compounds. January 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

24,446. M. Otto and A. Verley. Manufacture of perfumes. December 26.

1895.

5135. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of a sweet compound and of certain intermediate products therefor. January 15.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

24,440. W. Friese-Greene. Improvements in the manufacture of sensitised paper suitable for photographic purposes. December 20.

1896.

371. A. M. Clark. — From Lembach and Schleicher. Improvements in photographic developers. January 6.

450. G. J. Ball and B. F. C. Costelloe. An improved method in photography. January 7.

507. J. B. Findlay. Improved screens for use in photo-mechanical process work, and in the three-colour process of photography. January 7.

871. W. Haydon. Certain new and useful improvements in preventing halation in photographic dry plates. January 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7188. B. J. B. Mills. — From A. Lumière and L. Lumière. An improved photographic process giving,

without transfer, images with their half tints, and the application of this process to photography in colours. January 22.

21,989. H. E. Mendelsohn. Means for producing photographs resembling engravings. December 26.

XXII.—EXPLOSIVES, MATCHES, ETC.

APPLICATIONS.

24,209. A. J. Boulton. — From M. Reuland. Improvements in or relating to blasting or other cartridges. December 17.

24,725. W. Weiffenbach. Improvements in the manufacture of pyrotechnic compounds. Complete Specification. December 24.

24,847. H. H. Lake. — From W. Greaves and E. M. Hann. Improvements in or relating to explosives. December 27.

1896.

949. W. Theodorovic. Improved process for reducing to small fabric fragments cellulose bodies, for facilitating the nitration thereof, and for other purposes, and the production of explosives from such reduced and nitrated cellulose bodies. Complete Specification. January 14.

1226. R. H. Courtenay. Improvements in explosive compounds, with means to increase the explosive force of gun-cotton, ordinary gunpowder, and other explosives. January 17.

1312. O. Imray. — From F. C. Glaser. Manufacture of a new gunpowder. January 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

4769. A. Luck and A. H. Purnford. Manufacture of nitrocellulose and compounds thereof. January 8.

22,327. H. Siebeck. Process and apparatus for igniting quick-matches or fuses. December 31.

XXIII.—ANALYTICAL CHEMISTRY.

APPLICATION.

1040. F. G. Waller. Collecting and analysing gases. January 22.

COMPLETE SPECIFICATION ACCEPTED.

1895.

20,051. E. Jahr. Process and apparatus for testing butter and other fats. December 31.

PATENTS UNCLASSIFIABLE.

APPLICATIONS.

24,163. L. Grote. An improved process of manufacture of a mouldable mass from asbestos fibre or other fibrous material. December 17.

25,013. W. L. Woods. An improved plastic composition and process of combining the same. Complete Specification. December 31.

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COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready in the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages uniform in size with the Journal.

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This Memorial will take the form of a statue to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science, while the surplus will be devoted to the furtherance of biological science. Donations towards the fund should be sent to Mr. G. B. Howes, Hon. Sec. Huxley Memorial Committee, Royal College of Science, South Kensington, S.W.

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Meeting held Monday, January 6th, 1896.

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THE EFFECT OF LIME SALTS ON HOP INFUSIONS.

BY JOSEPH W. LOVIDOND.

In most manufactures, at various stages, chemical and other changes take place, which, though clearly indicated by change of colour in the material and reckoned as important factors in the quality of the ultimate product, are too subtle for the balance of the analytical chemist.

As an example for illustrating the importance of these obscure changes, I have selected the phenomena attending the boiling of hops in water containing calcium bicarbonate and other salts in solution, not only because of the distinctive colours produced, but also because in my past brewing experience a specially undesirable flavour was noticed in beer brewed with water drawn from a deep chalk well, and containing calcium bicarbonate in solution, which led to the rule of first boiling the water and then allowing it to cool to the desired temperature for mashing. The soundness of this empirical practice will be evident when we come to compare the difference between the specific colour curves of a similar water before and after boiling. There is but little doubt that colour variations are attended by co-related variations in flavour, although no attempt is here made to establish such co-relations, as such a course would involve a more extensive set of investigations than was possible in the time available for preparing this paper.

The effect of the earthy salts usually present in ordinary brewing water has received but little attention, and, so far as I have been able to ascertain, none at all from an analytical point of view.

The authorities on the subject are few. "Science Pratique du Brassayr," by Johnson Freuk and Dr. Henin, edition 1890, mentions some advantages of the use of water containing lime salts in solution, but make no reference to the colour effect.

Southby, in his book "Practical Brewing," says, "The presence of the carbonates of the alkalis has an even more injurious effect on the ales, for these salts promote the solution of the colouring matter of both the malt and the hops, and also of the coarse, resinous, bitter principles of the latter. Neither of these salts is so objectionable in black beers as in ales, and some have asserted that waters for brewing stout and porter ought to contain a small proportion of the carbonates of the alkaline carbonates; this, however, is a mistake, as the best waters for brewing black beers are those which contain only carbonates of lime and magnesia, together with some chlorides and minute amounts of earthy sulphates and alkaline silicates."

Moritz and Morris, in "A Text-book of the Science of Brewing," mention the question of colour, and state, "Briefly it may be said that gypseous waters give pale beers and prevent the extraction of the coarse, rank flavour of the hops; sodium carbonate water, on the other hand, gives deeply tinted beers, extracting much of the coarse and rank hop flavouring; soft waters come intermediate between these extremes. Sodium sulphate gives a thin, harsh, cold flavour, but a pale colour. Common salt and calcium chloride also yield pale beers, and the hop flavouring is neither rank nor cold. Magnesium salts are not used apart from gypsum, and their effects alone are therefore unascertained."

Faulkner, in his "Theory and Practice of Modern Brewing," p. 9, states that "the other carbonates, magnesian and calcic, have little or no influence, I think, except in the way of coating our boilers, liquor tanks, and pipes with scale, and neutralising the normal acidity of the malt."

In the American Brewers' Journal for August 1895 appears a paper by Dr. F. Mierau, in which he details some valuable experiments as to the action of calcium hydrate and carbonate upon the colour of hop extract, and gives some elaborate details as to his method of procedure and the results with waters containing different constituents, but in describing the results uses somewhat vague terms, such as "light yellowish fluid," "pale beer," "much paler," "much yellower colour," "strongly coloured fluids of a specific reddish tint," &c. I have adopted Dr. Mierau's method of procedure, not only because of its simplicity and effectiveness, but also because my quantitative colour terms may be used for comparing with Dr. Mierau's results. He describes his method as follows:—

"My method consists of simply boiling the water or salt solutions to be tested with hops. I use beakers of equal size, and in boiling have the heating in the same sand-bath as uniform as possible. To each 100 c.c. of water I take 3 grms. of the same hops, selecting as nearly as possible uniform catkins, which I pick apart and place in the water."

To this method I adhered, but found it necessary after 30 minutes' boiling to filter at once from the hops, as the colour change was rapid if the liquid was allowed to cool on the hops. The colour changes were slow after the hot filtration; in some cases the liquid did not filter quite bright, and they were measured in this condition. The unit value of the black curves represent the different degrees of this turbidity. Attempts were made to re-filter after cooling, but it was found that the necessary exposure brought about other changes, and this procedure was abandoned.

The analysis of the chalk-well water used is as follows:—

	Grms. per Litre.
Total solid matter	0.508
Calcium carbonate	0.202
" nitrate	0.0267
Sodium chloride	0.0343
Magnesium carbonate	0.0071
Silica	0.0076
Sulphates	None.
Phosphates	Trace.
Oxide of iron	Trace.
Free carbonic acid	0.126

Illustration.

The illustrating charts are based on the laws which govern the appreciation of colour by the vision, and have already been before this Society. It will be only necessary to call attention to two of them.

1st. The vision can only simultaneously distinguish two colours in the same beam of light.

2nd. The two colours simultaneously distinguishable are always those adjacent in their spectrum order, red and violet being considered adjacent for this purpose.

Except in two instances of water containing sodium chloride, where green is present, red, orange, and yellow are the only colours in the liquids before us this evening; therefore, apart from these two cases, the only possible combinations are red with orange and yellow with orange; but, of course, in any proportions, the effect of these combinations on beer is pleasing as the yellow preponderates,

and displeasing as the red preponderates; and so far as my own experience goes, delicacy of flavour is associated with yellow preponderance and coarseness of flavour with red preponderance.

In constructing the colour charts, measurements were made at stated intervals of strata thicknesses in accord with the numbers on the horizontal lines. The measured colours were then plotted on perpendiculars through these numbers in accord with the scale of colour units on the perpendiculars of the charts; then by joining the points of similar colours, the specific colour curves for each substance are established.

In the lantern illustrations each line is numbered in accord with a chart number, and the colours are made up with the standard glasses used in obtaining the measurements used in constructing the charts.

The solutions in the bottles are duplicates of the solutions used in constructing the charts, and are numbered in accord with them.

We have before us three methods of demonstrating the nature of the colours produced:—

1st. On the charts, by means of the coloured lines, which indicate the numerical or unit colour depth of each of the

constituting colours which, when combined, produce the colour sensation of any given stratum thickness.

2nd. By transmitting light through the glass combinations used in making the chart measurements, reproducing in each case the colour of the liquid.

3rd. Duplicates of the liquids used in glass bottles of 4 ins. diameter; they are therefore in accord with the 4-in. strata measurements on the charts, and with the colour produced by the glass combinations in the fourth place in the lines on the screen.

For the purpose of bringing these colour curves into some degree of order for comparison, they are divided into three types or divisions, according to the nature of the colour sensations they produce, as represented by the absorption curves.

In No. 1 type the yellow curves preponderate over the orange curves at all densities; this type includes those light-coloured ales known technically as "pale" and "golden-yellow," and probably correspond to Dr. Mierau's terms, "light yellowish fluid," "pale beers," and "much paler." The experiments contain the following instances of this class:—

NO. 1 TYPE.

No.		Strata Thicknesses of Maximum Colour.					
		Yellow Units.	Inches.		Orange Units.	Inches.	
4	Chalk-well water, boiled and filtered	60	at 15	and	16	at 15	
9	Distilled water with 0.2607 grm. magnesium bicarbonate.	83	at 18	and	7	at 18	
13	Distilled water with 0.05 grm. magnesium bicarbonate.	56	at 15	and	17	at 15	
12	Distilled water with 0.10 grm. sodium bicarbonate.	88	at 18	and	17	at 15	
10	Distilled water with 0.15 grm. sodium chloride.	68	at 15	and	7	at 7	{ Orange disappears at 12.5 in favour of green. { Orange disappears at 13.5 in favour of green.
11	Distilled water with 0.3 grm. sodium chloride.	84	at 15	and	13	at 11	

In No. 2 type the yellow preponderates over the orange at the lower densities then decreases, in favour of orange at the higher densities; this type includes those ales known technically as "deep golden," and probably corresponds to Dr. Mierau's term "much yellower colour."

NO. 2 TYPE.

No.		Strata Thicknesses of Maximum Colour.			
		Yellow Units.	Inches.	Orange Units.	Inches.
1	Distilled water	48	at 14	44	at 18
3	Chalk - well water, boiled, not filtered.	49	at 13	76	at 18
8	Distilled water with 0.1307 grm. magnesium bicarbonate.	56	at 2	72	at 18
14	Distilled water with 1.0 grm. sodium bicarbonate.	18	at 8	86	at 18

In the paler examples of this type, yellow preponderates over orange at the lower densities, and red at the higher densities. In the medium examples, yellow is less than orange at all densities. In the extreme examples, orange preponderates over red at the lower densities, and red preponderates in the higher densities. A distinguishing feature in the members of this type is, that red is always one of the two distinguishing colours at the higher densities. All high-coloured ales will be comprised in this group which probably corresponds to Dr. Mierau's term, "strongly coloured fluid with a specific reddish tint."

It would be unsafe to draw conclusions from a few preliminary experiments such as these, but it may be permitted to draw attention to some of the most characteristic agreements and differences, such as that already mentioned as existing between a calcium bicarbonate water before and after boiling. A reference to Nos. 2 and 4 diagrams will show that the effect of removing the calcium bicarbonate from a chalk-well water by boiling and filtering is to convert it from a water which produces a dark-coloured extract, classable into No. 3, the worst type of colour for ales, into a water producing a light-coloured extract, classable into No. 1, the best type of colour for ales.

NO. 3. TYPE.

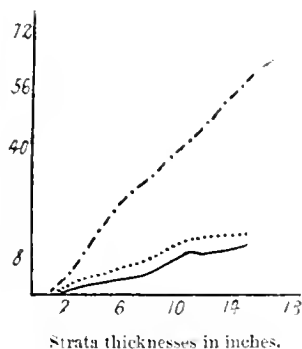
No.		Strata Thicknesses of Maximum Colour.					
		Yellow Units.	Ins.		Red Units.	Ins.	
2	Chalk-well water	66	at 8	disappearing at 13.5	in favour of 56	at 15	
7	Distilled water with 0.06535 grm. magnesium bicarbonate.	15	" 53	"	5.5	" 46	" 15
5	" " " 1.0269 " calcium "	19.8	" 8	"	16.0	" 8	" 18
6	" " " 0.513 " " "	8	" 6	"	9.5	" 76	" 18
		Orange Units.					
18	Chalk-well water with 150 grms. sugar crystals	21	" 4	"	7.5	" 12.5	" 9
17	" " " 100 " " "	43	" 4	"	6.5	" 20.5	" 9
16	" " " 50 " " "	25	" 4	"	6.7	" 38.0	" 9
15	" " " 5 " " "	20	" 4	"	4.0	" 61.0	" 9

No. 1 TYPE.

No. 4.

Chalk-well water boiled 10 mins., then filtered and boiled 10 mins. with 3 grms. of hops.

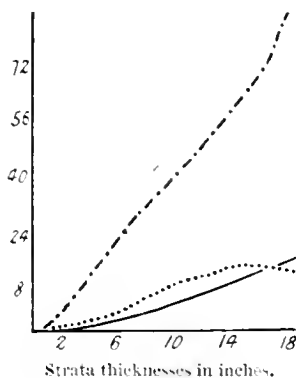
Colour units.



No. 12.

0.10 gm. sodium bicarbonate per litre distilled water boiled 10 mins. with 3 grms. of hops.

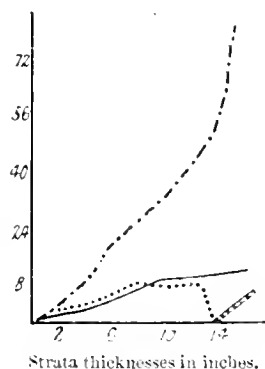
Colour units.



No. 11.

0.3 gm. sodium chloride per litre boiled 30 mins. with 3 grms. of hops.

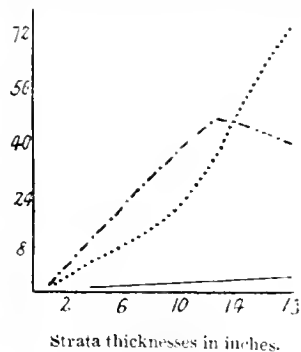
Colour units.



No. 2 TYPE.

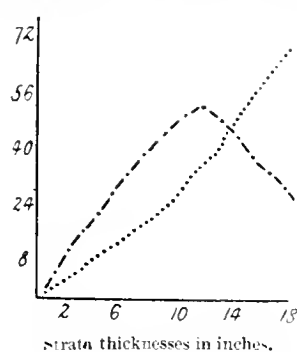
No. 3.

3 grms. hops per litre of chalk-well water previously boiled 10 mins. Not filtered, then boiled 10 mins.



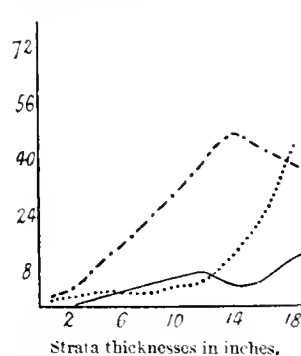
No. 8.

0.1397 gm. magnesium bicarbonate per litre distilled water, with 3 grms. of hops.



No. 1.

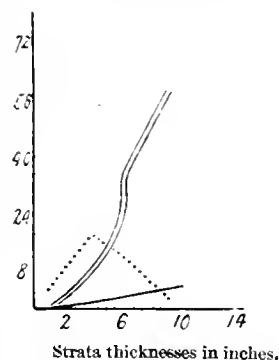
3 grms. of hops per litre of distilled water boiled 30 mins.



No. 3 TYPE.

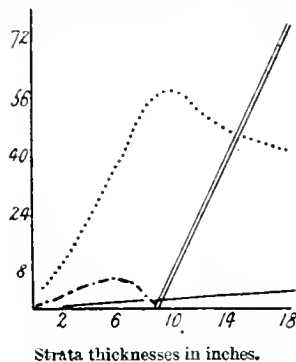
No. 15.

0.59 gm. sugar per litre of chalk-well water boiled with 3 grms. of hops.



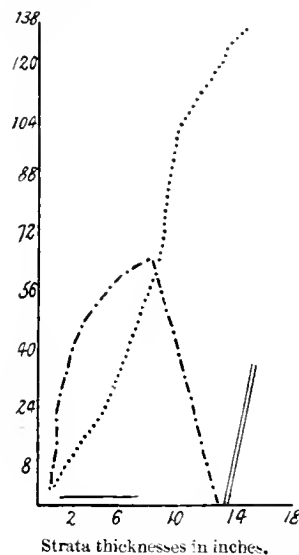
No. 6.

0.513 gm. calcium bicarbonate per litre distilled water. Boiled 30 mins. with 3 grms. of hops.

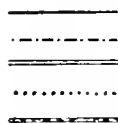


No. 2.

Chalk-well water boiled 30 mins. with 3 grms. of hops.



BLACK
YELLOW
RED
ORANGE
GREEN



A reference to the colour curves of No. 15, 16, 17, and 18 will show that the addition of sugar crystals to a calcium bicarbonate water reduces the colour without altering the type from No. 3; the reduction of colour has some relation to the proportion of sugar used, lessening as the quantity increases.

On comparing the composition of the waters producing the pale solutions in No. 1 type, that containing 0.2607 gm. magnesium bicarbonate may be left out of the question for the present, as this salt, in other proportions, is represented also in No. 2 and No. 3 types, and requires more preliminary investigation. This division also contains one example of sodium bicarbonate and two examples of sodium chloride. The specific colour curves of these sodium salts are somewhat similar in type with those of No. 4 natural chalk-well water from which the calcium bicarbonate has been removed, boiling and filtering. If we compare the same curves with the darker curves of No. 1 distilled water in the second division, an impression is created that the pale colour of the sodium solutions may be due to specific combinations of these salts with some principle in the hops, and not due merely to the absence of calcium bicarbonate.

The colour of No. 1 in the second division is simply that of hops extract in distilled water, and is useful for comparing with variations in colour caused by the salts other waters. The colour of No. 3 shows that natural chalk water with the calcium carbonate in suspension produces a type of curves similar to distilled water, but containing a larger proportion of orange.

Division 3 contains only examples of the most objectionable colours, that is, having red preponderating in the higher densities. It may therefore be assumed that these waters are objectionable for brewing; and as we have deferred the consideration of the magnesium waters for the present, there remains only the natural chalk water No. 2, containing 0.020 gm. calcium bicarbonate per litre, and No. 6 distilled water, containing added calcium bicarbonate. Their specific colour curves tend to confirm the view that calcium bicarbonate is objectionable for brewing. This set of experiments does little more than point to the necessity of more exhaustive work.

DISCUSSION.

The CHAIRMAN, in inviting discussion, said that all must have listened with great pleasure, especially those who were connected with the brewing trade, to the very interesting communication which Mr. Lovibond had made. He had been in the habit of using Mr. Lovibond's tintometer for a long time past, and found it to be decidedly superior to any other instrument used for colour estimation. It not only gave the total colour, but also the proportion of each of the constituent colours in a given liquid, and was especially valuable in the examination of beers and caramels.

Mr. J. HERON was very much pleased to have heard Mr. Lovibond's paper, because it was the first time that a paper of such a nature had been read before the Society in connection with brewing. He would be very sorry to criticise adversely any paper read by Mr. Lovibond, but it struck him that the author had performed a certain amount of experimental work which hardly obtained in practice, because instead of adding the hops to malt wort and experimenting upon such a solution, Mr. Lovibond had made an infusion of hops with water having certain mineral constituents in solution. It was shown that the addition of sugar diminished the shade of colour to a large extent, and he would like to ask Mr. Lovibond whether he had made any experiments with malt wort, and what would be the nature of the change when the wort was boiled up with the hops. Of course a certain amount of precipitation took place, and perhaps some bodies which gave a red colour would disappear during the boiling. He himself had made a number of experiments on solvent action of the different salts in brewing waters on hops, not so much with a view of ascertaining the colour as of determining the flavour and quality of the extract. He must congratulate Mr. Lovibond on attacking the question from his point of view, and hoped that the paper just read would be the first of many valuable contributions on the same subject. The application of the

tintometer to brewing operations opened up a very wide field of inquiry; there were questions of very great importance in connection therewith which might be attacked in that way, so that brewers would probably be able to tell, not only whether the hops had been properly kilned, but could gauge the quality of malts by the nature of the colour curve.

Mr. E. GRANT HOOPER would have liked to have heard a little more with reference to some other features accompanying the question of colour, and more especially as to flavour. He knew that it was extremely difficult to express or describe a flavour, but when he saw the samples placed before the meeting he could not but think the difference of colour represented to some extent also a difference of flavour. From a brewing point of view the flavour was of the greatest importance, though of course regard must also be had to colour. From an inspection of the diagrams, it seemed to him that the introduction of sugar, which Mr. Lovibond had that evening said very little about, made a great difference to the colour, as indicated by the red line on the third series of plotted curves before the meeting. He rather thought, too, that the precipitation of solid matter in the solutions had more to do with the colour than Mr. Lovibond had suggested. In the two charts of type 1, Mr. Lovibond showed a chalk-well water which had been boiled 10 minutes and another which had been boiled 30 minutes. On the first chart was shown a black line which indicated opacity, and in the second there was a total absence of the black line, but the yellow line went up pretty straight and apparently equal in both of them. Yet he could not but think that the precipitation which had occurred had at least affected the colour to some extent, since it was a common experience that a substance precipitated in an organic solution left the liquid of lighter tint, and he was of opinion that the use of a hard water had a greater influence upon the colour of wort than appeared from the abstract of the paper which Mr. Lovibond had presented to them that evening. It was certainly a feature which possibly had not been much thought of before, that the colour of beer was derived partly from the hops, and was not exclusively due to the malt. It would, however, probably be more interesting to study the effect of different waters upon malt products, because the degree or difference of colour due to these bodies was certainly more varied and more decided than could be due to hops. He had been interested in hearing from the Chairman that he had found the tintometer of such great use.

Mr. LOVIBOND said, in reply, that the paper was only one of preliminary investigation. A beginning had to be made somewhere, and he had begun with hop samples because his attention had been drawn in that direction by a paper by Dr. Mierau. He had no reason to suppose that his experiments would not apply to malt also. The colour curves illustrated were specific for the substances themselves. Malt in common with other substances had a specific rate of absorption, varying probably with the quality of the malt; he knew that it was so with caramels and roasted malts, and on referring to the lines shown, say on charts Nos. 1 and 2, it was a fair inference that the particular lines indicated substances formed by hops under the conditions named; and in that way the method became an analytical one for the discovery of compounds which had hitherto escaped detection. The presence of solid matter had only the effect of darkening the colour; it did not alter the nature of the curves; it simply made it impossible to carry the investigations so far if solid matter were not present. The specific nature of the chemical compound represented by the colour curves would be unaltered, but the power of seeing them would be reduced by the opacity of the mixture. In reference to colour and flavour, he was quite sure that each colour had a co-related flavour. He said 25 years ago, at the time when his attention was called to the objectionable flavour produced by using an unboiled chalk-well water, he did not then appreciate the colour differences which probably accompanied the changes in question. The inference to be drawn was that the colour of the beer was reduced by boiling the water, and was co-related to a fine flavour, as compared with a coarse flavour produced by the unboiled water. It was impossible to

imitate a specific pale colour. Caramel might be added, but the colour could not be imitated; although it might approximate at one density, it would diverge as the density increased; and if a beer was submitted to him in which a pale malt colour had been imitated by caramel, it could be detected by its yielding the colour curves specific for caramel. Sugar, so far as he could judge, only modified the effect of calcium bicarbonate on beer. He had used in the series referred to a chalk water unboiled, with four proportions of sugar. What the effect would be with malt wort was a question open to investigation. His own interest had been very much quickened by the present experiments, as the results obtained were unexpected — alkalis, for instance, showing a pale colour with distinctive curves at the low strengths, whereas he had previously thought that alkalis would probably give a dark extractive colour, but he found instead these distinctive light colour curves. In chart No. 14 the alkali was increased to one gramme per litre, and instantly there was a change into a more degraded class, indicating that, at that strength, the usual alkaline action on organic matter had commenced.

Mr. HOOPER said he gathered that the presence of a precipitate in a liquid in no way affected the colour. He thought that those who had had experience of analytical work would agree that where a precipitate had been produced the colour was lightened. Did it not follow that the elements of the colour had really changed by the removal of one or more of the colour-producing substances?

Mr. LOVINSON thought that reasoning would apply if the solid matter itself was coloured, but if colourless it would not affect the curves, but would simply render the colour more obscure. It was in fact just the difference between a definite chemical compound and a mechanical mixture which gave the mean of the bodies mixed.

Mr. HOOPER understood that the precipitate carried down the colouring matter with it.

Mr. LOVINSON: Unless you have made experimental measurements which prove that, I do not see how you can arrive at such a conclusion, knowing as I do how difficult it is for the unaided vision to judge in such cases within certain limits whether the visual differences are caused by intrinsic colour changes or by variations in the quantity of light transmitted.

Mr. J. C. RICHARDSON: But the matter suspended in a stable compound would not affect the absorption number of that compound if it did not disturb the molecule.

Mr. LOVINSON: That is my view exactly.

Meeting held Monday, February 3rd, 1896.

MR. B. E. R. NEWLANDS IN THE CHAIR.

THE MANUFACTURE OF LINOLEUM.

BY WALTER F. REID, F.I.C., F.C.S.

THE linoleum industry is a comparatively modern one, the first factory having been established about 30 years ago. Like so many products, however, of modern science, linoleum had numerous precursors, through which its evolution may be traced from a very remote antiquity. The first stage in this evolution was waxed cloth or canvas, and to this day oil-cloth is called "Wachstuch" in Germany and "toile cirée" in France. In this country the term "cerc-cloth" does not seem to have been applied to the newer material, partly perhaps because the chief use of cerc-cloth was for the preservation of dead bodies, but also, I think, because the manufacture of oil-cloth originated in this country, and with it the new word. It is generally stated that the brothers Van Eyck first introduced the use of oil in painting towards the middle of the 15th century; but this statement is certainly incorrect. A varnish called "lineleon," containing linseed oil, was used in the 8th century. In 1239, in the reign of Henry III., oil was used for painting in this country, and the account-rolls of our kings since that time make frequent mention of painter's oil, which, at the end of the 13th century, was worth 1s. a

gallon in England. In Italy, also, boiled linseed oil was in common use among painters at the end of the 14th century, for Cennini gives clear instructions for the preparation of "Polo bollito con fuoco," as he quaintly calls it. In Germany the use of oil in painting seems also to have been well known in the latter half of the 14th century, for Theophilus and Erasmus allude to it in very clear terms. A foreigner travelling in England in the 15th century gives an interesting account of the way in which our artists then worked. The canvas was laid upon the floor, and the colours applied to it in this position. He states, as something noteworthy, that these English artists kept their feet clean. Perhaps it is to this habit of keeping the feet clean that we owe the first use of oil-cloth as a floor covering. However, the first use to which oil-cloth seems to have been put was for hangings or tapestry and for windows. In 1636 a patent was granted for "painting with oyle cullors upon wollen cloath, kerseys, and stuffes, being pper for hanging, and alsoe with the said cullors upon silk for windowes." Numerous mixtures of oils with resins of various kinds were used until 1751, when we have the first notice of the use of "india-rubber or gum lastie" as an ingredient in the coating material. This brings us a step farther towards linoleum, for, after various compounds of india-rubber had been suggested, E. Galloway, in 1841, proposed the addition of pulverised cork to plastic india-rubber in order to give a "certain elasticity" to the combination. This compound laid upon canvas was proposed as a substitute for floor-cloth, and is practically what was known a few years later as kamptulicon. The machinery and methods adopted in the production of kamptulicon much facilitated the development of its successor; indeed, some of the improvements suggested for kamptulicon have only lately been applied to linoleum. For instance, in 1851, L. S. L. Bunn made kamptulicon upon wire gauze instead of canvas, and he also invented a method for producing mosaic patterns. At first the inventor of linoleum, F. Walton, called his new product kamptulicon, and it was not until several years after its invention that linoleum became known under its new name. The cement was patented in 1860, and, after supplementary patents had been taken out in 1861 and 1863, the Linoleum Manufacturing Company was founded in 1864. After the lapse of the original patents other factories were founded, and there are now 25 factories in which linoleum is produced, the greater number of which are in Great Britain.

The two chief ingredients in the manufacture of linoleum are cork and linseed oil. To these are added smaller quantities of kauri gum, resin, and pigments of various kinds. Formerly the bulk of the cork used came from Spain and Portugal, but large and increasing quantities of that material are now produced by Algeria, where there are very extensive forests of the cork oak. In the manufacture of bottle corks about one-half of the cork is wasted, and this waste is the main source of supply for the cork used in linoleum works. There is, however, a very large quantity of cork available in the forests, which, though not suitable for the manufacture of bottle corks, would be of excellent quality for linoleum.

The first operation to which the cork waste is subjected is that of passing it over a deep sieve to which a rapid reciprocating motion is given. The dust and much of the dirt fall through the sieve, while stones, pieces of metal, &c., remain upon the sieve, and are removed from time to time. The lighter cork passes over the top of the sieve to the cork-breaker or crusher. The peculiar characteristics of cork render it a very difficult material to pulverise, and many machines have been devised for that purpose. On the one hand it is elastic, and cannot be subdivided by mere pressure, while on the other it soon abrades the hardest steel. Knives used in cutting cork require sharpening after every two or three cuts. The cork-breaker which appears to give the best results on the large scale, consists of a number of very strong circular saws rotating close to a number of steel bars, the ends of which are toothed in an opposite direction to the teeth on the circular saws. The pieces of cork are pushed along the surface of the steel bars, caught by the revolving saws, and finally torn to pieces

between the two sets of teeth. The teeth require frequent sharpening; but this can be done without difficulty by means of an emery wheel, and, on the whole, this form of machine is one in which the working parts can be easily kept in an efficient state. The cork, after leaving the breaker, is in pieces about the size of a pea, which are passed on to the grinding mills. These are ordinary horizontal mills similar to those used in flour-mills; but the stones should be either lava, sandstone, or some similar rough stone. The French burrs, so indispensable in cement factories, for instance, are of little use for cork, which slips upon their comparatively smooth faces, thus causing the output to be much smaller than in the case of softer but rougher stones. The pulverised cork is next sifted and weighed into sacks, which are placed in a drying stove for about 24 hours. The coarser particles are returned to the mill and re-ground. The powdered cork is an extremely light powder; it is easily suspended in the air, and such a mixture is highly explosive. Great care must be taken to protect all artificial lights about cork mills or mixing machinery, and even with the greatest precautions small explosions are sometimes caused by sparks from the machinery. Speaking after considerable experience of both materials, I would rather handle dynamite in bulk than ground cork in a loose state. Although, as you will see from the sample shown, the ground cork is extremely light and elastic, yet this is one department of the industry we are considering which is capable of considerable improvement. You will all have noticed in cork that a number of dark particles are interspersed throughout the elastic substance of which it mainly consists. These are hard and devoid of elasticity, and, for our purpose, are a deleterious adulterant of the cork. They consist largely of tannin, and, on an average, constitute as much as 10 per cent. of the weight of the cork. By separating these impurities from the powdered cork, a considerable improvement would be effected in the colour and elasticity of the linoleum. It is these portions of the cork that first decay, and if you examine a cork which has been buried in the earth for some time you will find the dark nodules have become cavities, while the surrounding elastic material is comparatively sound. For light-coloured linoleums a simple process for bleaching cork is a desideratum. Many attempts have been made in this direction; but the colouring matter is difficult to destroy without at the same time diminishing the strength and elasticity of the cork. Numerous substitutes for cork have been tried in the manufacture of linoleum, such as sawdust, spent tan, peat, &c.; but the resulting product possesses less elasticity than when cork is used, and consequently wears out more rapidly.

In order to form linoleum the pulverised cork is mixed with a material technically known as "cement," of which oxidised linseed oil is the main constituent. The linseed oil should be of good quality; some varieties oxidise badly and give much trouble in the seasoning of the linoleum. I am not aware of any analytical test that will indicate accurately the drying properties of a given sample of linseed oil. The test usually employed is to heat a portion of the oil to about 500° F., stirring continually, and blowing air through the hot oil. Dense fumes are given off, and, after a time, the oil becomes thicker, and a sample of it, when cooled, should be "stringy," i.e., capable of being drawn out into threads. Oil solidified in this way forms the basis of the cement used in some kinds of floor-cloth—for instance, corticine. It makes a good, tough cement; but the chief objection to its use is the smell, which it retains persistently, and which is, as you will notice, not agreeable. The chemical changes which take place during the thickening of oil by heat are quite different from those which bring about solidification at the ordinary temperature. In the former case there is a loss of weight of about 5 per cent., while in the latter an increase of weight of about 11 per cent. results. There is still considerable uncertainty as to the chemical changes which take place during the oxidation or "drying" of linseed and similar drying oils. Although Mulder has thrown much light upon the chemistry of the subject, subsequent observers have not been able to confirm his results in several important

particulars. Hazura, for instance, to whom we owe some valuable researches on the subject, found 5 per cent. of glycerin in linoxyn. This shows that the substance formerly called linoxyn is a glyceride—a fact which Mulder failed to detect. Hazura regards the drying oils as mixtures of linolenic, isolinolenic, linolic, and oleic acids, all of which are liquid. These liquid acids were isolated from various oils and the proportions of the various constituents were found to be as follows:—

	Per Cent. of Liquid Acids.				
	Linseed Oil.	Hemp Oil.	Nut Oil.	Poppy Oil.	Cotton Oil.
Linolenic acid	15	15	13	5	..
Isolinolenic "	65	70	7	30	40
Oleic "	15	15	80	65	60
Linolic "	5	70			

The oleic acid plays no part in the drying process; but the glycerides of this and the other fatty acids are said to be split up into the free fatty acids and glycerin, the latter being oxidised to carbonic acid and water. Water is undoubtedly produced in considerable quantities during the oxidation of linseed oil; but it is probable that acrolein is one of the chief products of the decomposition of the glycerin, as it is evolved in considerable quantities. The glycerides of the drying acids are supposed to be converted into glycerides of the corresponding oxy-acids. Hazura states that the end product of the drying is the solid oxylinolein. Had he extended his researches over a longer period he would have found that this solid is still further oxidised into a semi-liquid body, of which you see here a sample, and to which I called attention on a previous occasion (this Journal, Nov. 30th, 1894).

Apparently this liquefaction has been brought about by means of hydrogen peroxide, for, in 1876, S. Cohné proposed to convert drying into lubricating oils by means of this reagent. Ozone considerably facilitates the oxidation of drying oils; but I am not aware that it has been used upon an industrial scale.

The addition of some salts of lead or of metallic lead not only hastens drying, but also increases the total amount of oxygen absorbed. With the addition of finely divided metallic lead, linseed oil will increase in weight by about 14 per cent. in a few days, while without lead the increase is only 11 per cent. after many months. One theory attributes the drying of linseed oil to the growth of an organism named by D. J. Freire *microclados oleorum*. This must be a remarkable organism, not only indifferent to light or darkness, but revelling in such mineral poisons as lead and mercury salts, and actually luxuriating in temperatures far above the boiling point of water.

During oxidation the specific gravity of linseed oil increases considerably. While that of the raw oil is about 0.93 and of boiled oil 0.94, the oxidised material is heavier than water. A rise of temperature takes place, especially during the earlier stages of the operation.

The linseed oil, if freshly prepared, is allowed to settle in tanks before use. Impurities, known under the general name of "mucilage," subside, and, after their separation, the oil is of a better colour when boiled. Water is not altogether insoluble in linseed oil, and there are few oils that do not contain a small percentage of it. It gives rise to much frothing at the commencement of the boiling operation, but may be easily removed by running the oil through a filter of dry salt. The process of boiling the oil does not differ materially from that in general use in the manufacture of paints and varnishes. The temperature is from 300° to 350° F., and should be carefully watched, as overheating would not only deteriorate the oil, but possibly cause an explosion. Linseed oil being a bad conductor of heat, the contents of the pans should be continuously stirred. As soon as the oil is hot, driers are added in the proportion of from 1 to 2 per cent. of the weight of the oil. In some works red lead alone is used; in others, litharge; but a mixture of both these oxides of lead in various proportions seems to be most in favour. In

spite of the researches of many patient investigators, the exact chemical changes which take place during the boiling of linseed oil are still unknown.

The boiled oil is run or pumped from the boiling pans into settling tanks, where a further quantity of "mucilage" is deposited. These tanks, as well as the boiling pans, should be covered in, and provision must be made for the destruction of the fumes given off, which are decidedly offensive. With the progress of synthetical chemistry a use may be found for these fumes; they contain much acrolein and several volatile acids, chiefly of the fatty series. Various methods have been suggested for the oxidation of the boiled oil, but Walton's original process is still used in the majority of factories.

In this process the oil is pumped to the top of a high building and allowed to flow down over a number of pieces of a light cotton fabric known as "serim," which hang vertically from iron bars. The air in the building is heated to about 100° F., and in the course of 24 hours the layer of oil which adheres to the surface of the "serim" solidifies. The flooding with oil takes place daily, and in this way a succession of layers of oxidised oil is deposited on the "serim." The thick sheet of oxidised oil thus formed is now known as a "skin." This method of oxidising oil is slow, and necessitates a considerable stock of oil. The length of a "skin" being about 25 feet, it is evident that however carefully the building may be heated, the upper portion will be better oxidised than the lower. The quantity of oil remaining on the lower part is also greater, and the consequence is that the lower end of a "skin" is invariably thicker and softer than the upper. On the other hand, each layer of oil, once oxidised, is protected from further oxidation by the succeeding layers. In this way the formation of the viscous semi-fluid substance due to the final oxidation of the oil is avoided. In six to eight weeks the successive oxidised layers upon the serim will amount to about half an inch. The "skins" are then cut down and ground between rollers preparatory to the next process. The serim is now quite rotten, and has become a useless and costly adulterant of the linoleum. Many suggestions have been made for expediting the oxidation of linseed oil. Long before the invention of linoleum, in 1851, Froggart passed oxygen gas through the oil for that purpose, and in 1862 Glass proposed heating the oil and then passing air or oxygen gas through it. Walton himself has devised several other methods of carrying out this important operation, but the one I have described is that in most general use.

Of the numerous processes for oxidising oil in bulk, that of Messrs. Bedford appears to be the only one which has stood the test of practice, it being now in use in several linoleum works. The linseed oil is taken in the raw state and is introduced into a horizontal steam-jacketed cylinder inside which is a central shaft which is furnished with arms and can be rotated at a high velocity. The oil only half fills the cylinder, and by the action of the arms or beaters it is converted into spray. The requisite temperature having been attained, which differs according to the quality of oil to be produced, a current of air is passed through the spray. The temperature rises as oxidation proceeds, and is controlled by introducing cold water into the jacket instead of steam. In five or six hours oil can be oxidised in this apparatus; but if required of a light colour a lower temperature is maintained and the process then takes 24 hours.

The defect of most of these rapid processes seems to be that the oil which is first oxidised remains exposed to the further action of the oxidising agent, and becomes over-oxidised before the whole of the oil has solidified.

By whatever process the oil has been oxidised, the next stage—the preparation of the linoleum cement—differs but little in the various factories. The ground oil is mixed with resin and kauri gum in various proportions. A good elastic cement is composed of about 8½ cwt. of oxidised oil, 1 cwt. of resin, and 1 cwt. of kauri gum. The kauri is first pulverised, but the resin, which acts as a flux, can be used in lumps. The mixing operation is carried out in a steam-jacketed pan provided with stirrers, and samples are taken from time to time, it being of the utmost importance that no overheating shall take place. When perfectly homo-

geneous, the cement is run into pans of a convenient size for further treatment. In summer it may be necessary to cool the cement as it issues from the pan in a plastic state, as this material, as well as the ground oil, has a great tendency to heat and even to catch fire if left in bulk exposed to the air. The cakes of cement, before mixing with the ground cork, are cut into smaller pieces and are then passed through steam-heated mixing rolls, with slightly more than their own weight of cork. The rough mixture is then further amalgamated in a mixing drum, various colouring matters being at the same time added according to the colour desired for the finished linoleum. From the mixing drum the material passes into another apparatus resembling a large sausage machine, but of very strong construction. It is called a "German," not because it was made in Germany, but because the mass of linoleum issuing from it bears a strong resemblance to a German sausage. To start this machine steam-heating is necessary, but once at work the heat generated by friction and by the oxidation of the oil is sufficient to soften the mixture. In summer it may even be necessary to circulate cold water in the jacket instead of steam. This machine is undoubtedly an imperfect one. The power which it requires is enormous, and there can be no doubt that much of this power is consumed in mixing over and over again material that has already been sufficiently mixed for the object in view. On leaving the "German," the linoleum material, now in the form of lumps or pellets, is passed through mixing-rolls, in which it is converted into sheets resembling in colour the surface of the finished linoleum. By revolving one of the rolls at a greater speed than the other, or keeping one of them cooler, the mass may be made to adhere to one of the rolls, from which it is removed by a scraper.

In some works the linoleum mixture is rolled on to canvas in the condition in which it leaves the mixing-rolls, but it is sometimes passed through another machine called a "scratcher." This consists of a pair of mixing-rolls similar to the preceding, but instead of removing the coating of linoleum material from the roll to which it adheres, by means of a scraper, a rapidly revolving spiked roller is used, which tears it off in small pellets. This final machine does not appear to secure any greater uniformity in the finished linoleum; on the contrary, pellets of darker colour than the bulk are sometimes accumulated on the spikes of the scratcher, from which they become detached from time to time, and give a spotted appearance to the linoleum, especially in damp weather. The material as it leaves the scratcher has a consistence resembling that of damp earth. It can be balled together in the hand; but, unless subjected at the same time to heat and considerable pressure, it will not permanently retain the shape given to it. The next process is the rolling of the material upon the canvas which forms the backing. This canvas is of jute, and usually 78 inches in width, which allows 3 inches on each side for waste. The rollers are steam-heated, and both revolve at the same speed.

Wire gauze has been suggested as a substitute for canvas, and I have here a sample made under Hembry's patent. The fabric is tough, and of course the iron wire is not so liable to decay as the jute canvas. Owing, however, to the smoothness of the wire, it is difficult to weave gauze of this kind more than 3 feet wide. A fabric in which the wire gauze is imbedded in india-rubber is now being much used, especially for covering stairs.

The linoleum composition is placed in a hopper, from which it falls upon a carrier of wire-gauze which passes through a steam-chest and drops the linoleum between the rolls. The canvas is passed over one of the rolls and under the other, and carries with it as much of the facing mixture as the space between the rolls will allow. This space is adjustable according to the thickness of linoleum required. Under the combined heat and pressure the linoleum adheres firmly to the canvas, and linoleum floor-cloth is the result. Sometimes the fabric is passed between cold polished rolls while still warm, this having the effect of giving a better finish to the surface. In order to protect the canvas back, a species of varnish known as "backing" is spread upon it by means of a machine resembling that used for a similar purpose in india-rubber

and other works. The composition of the "backing" is different in almost every work; but the main ingredients are oxidised oil, kauri, resin, shellac, and colouring matter. The solvents are coal-tar naphtha and methylated spirit, and the consistence should be such that, while fluid in a steam-heated pan, it solidifies sufficiently on cooling to enable the linoleum to be handled. After backing, the linoleum is seasoned in buildings kept as nearly as possible at a uniform temperature of 75° F. It is usually suspended in "bights" from battens, and when this system is adopted, care must be taken to reverse the top and bottom of each bight from time to time, otherwise the upper part, being in the hottest part of the building, would season more than the lower. A better plan is to season the linoleum in horizontal racks, in which each piece, being at one and the same level, has a better chance of seasoning uniformly.

Linoleum made as described is of one colour throughout, and when an ornamented surface is required this is supplied by means of designs printed upon it in oil-paint in the same way as is done with its predecessor, oil-cloth. This oil-paint, however, soon wears off, and, as we have seen, even in the pre-linoleum, kamptulicon times, efforts were made to produce coloured patterns extending right through the thickness of the coating composition. The simplest way of doing this is obviously to roll simultaneously and continuously mixtures of different colours upon the same canvas side by side. This produces stripes of different colours, and although the effect is not adapted for large surfaces, yet for passages or stairs this cheap method may be of some utility. The first practical step in this direction was, I believe, taken in 1885, and in 1891 and 1892 T. Mitchell devised a process by which the samples before you were produced. A partitioned frame is fixed opposite the rolls in such a manner that the linoleum material is drawn between the rolls by the backing canvas. Each partition in the frame contains linoleum of a different colour, and the stripes are subsequently welded together by the pressure of the rolls. Provision is made for the adjustment of the width of each partition and consequently the breadth of each stripe.

But modern requirements for the ornamentation of surfaces necessitate something more than stripes, and several methods have been developed to produce patterns of the most varied character extending right through the bulk of the coating layer of the linoleum. Time will not allow of a description of all these methods, and I shall therefore select those which have been carried out on the most extensive scale. Two main principles have been chiefly successful: one is the use of stencils or grids to mould or shape the loose material into designs, and the other is to use cutters or knives which cut out pieces of the material that has already been partially compressed into a sheet. Of the former kind are the machines of Godfrey, Leake, and Lucas. In the first instance most of the operations comprised in this process were carried out by hand, but the inventors have lately devised a machine to perform the whole of the work automatically. The cloth or canvas, which may already bear a thin facing coat of linoleum material, is carried along the surface of a horizontal table. Stencil-plates, with openings corresponding with the different parts of the design to be produced, are lowered upon the cloth, and a measured quantity of granulated linoleum is distributed upon each stencil-plate and passed through the openings by means of scrapers. The plates, which travel about their own width on and with the moving canvas, are then raised again and returned to the first position. The canvas bearing the granulated linoleum then passes through heated rolls, between which it is consolidated in the usual way. Another method adopted by the same inventors for producing a mosaic pattern, is to spread the granulated linoleum material upon a table and then to lower upon it a grid, the divisions of which are of the shape of the tesserae. Plungers or dies are then inserted into the divisions corresponding with the colour of the linoleum upon the table. On lifting the grid only those divisions will remain full in which the material has been consolidated by the dies. The process is repeated with different colours, and the tesserae are then discharged upon the backing fabric, the whole being subsequently

consolidated in a press. When narrow outlines are required between the tesserae forming the bulk of the design, a stencil of wire netting is used, bearing, affixed to its lower surface, metal plates corresponding in shape with the tesserae which are already upon the canvas. Granulated linoleum is then brushed through the netting and fills up the outline spaces. The stencil is then removed and the whole surface consolidated by pressure. What is known as inlaid linoleum is made under the patent of C. F. Leake, the carpet inlaid being the joint invention of Leake, Godfrey, and Lucas.

A different principle is adopted by F. Walton, who employs cylinders fitted with cutting knives shaped and arranged according to the pattern. Between these knives are radial pistons or plungers, which push out the pieces cut from a sheet of linoleum material and fix them upon a cylinder covered with projecting pins. Between the pin cylinder and the tesserae the backing canvas is stretched, and when the whole of the pieces forming the pattern are cut out, the canvas leaves the pin cylinder, carrying with it the tesserae which are then subjected to pressure sufficient to cause them to adhere to each other and to the backing. Instead of cutting out the tesserae from a previously rolled sheet, the same inventor has devised a machine in which the tesserae are moulded as required. Granulated linoleum material is placed in a hopper fixed above a cylinder furnished with recesses, each of which is of the shape of the tesserae to be produced. The bottom of each of these recesses is movable and furnished with pins which project into the interior of the hollow cylinder. Inside the moulding cylinder is another cylinder which is eccentric to it, and as the former revolves the latter presses upon the pins, pushing the bottom of the die outwards and gradually ejecting the tesserae formed. These tesserae are delivered on to a travelling band or carrier, furnished with needle-points, which retain them in their proper positions and carry them along a horizontal table. There they are fixed upon the canvas, which is to form the backing of the linoleum, by pressure between other rolls. Apart from the difficulty of securing an accurate register by this means, the machinery is complicated, requiring 28 rolls for a four-colour pattern.

Although these inlaid linoleums have some advantages as compared with those which preceded them, yet they have also disadvantages peculiar to themselves. In order to secure colours of sufficient brilliancy the linoleum must be mixed with considerable quantities of colouring matter. These pigments are of different chemical composition; therefore a variegated piece of linoleum cannot be regarded as a homogeneous sheet. In course of time the texture of the various tesserae varies according to the chemical changes taking place in each. In the case of linoleums built up of tesserae cut from previously rolled sheets, the cohesion at the junction lines of the different colours is much less than in a sheet of one colour, or even in a sheet composed of various colours which have been consolidated in the granular form. The elasticity of these linoleums is much less than that of the plain material, partly because of the pigments used, and partly because increased pressure is required to ensure thorough cohesion between the tesserae.

Printing linoleum is a simple operation, similar to printing wall-papers and oil-cloth by hand. But, in order to ensure success, special precautions have to be taken. The blocks are made of wood, into which strips of brass are inserted, the edges of these strips forming the printing surface. Where a considerable surface has to be printed the block must not be solid; but the field must be built up, as it were, of a number of parallel lines somewhat like the shading in a woodcut. There must be a block for each colour, and, in addition, a "smash" block is used for patterns which contain large surfaces of colour. The Addlestone Linoleum Company, Limited, have kindly prepared these samples, which will, I hope, convey a good impression of the successive operations of linoleum printing. Although the pattern is a simple tile one, consisting of alternate black and white squares, yet five blocks have been used to produce it. Upon the piece marked 1 the white body colour alone has been printed. To No. 2 the black body has been added. No. 3 has had the black tiles more

clearly defined by the black outline block, and in No. 4 the same operation has been performed with the white. In No. 5 the "smash" block has been used, which, you will notice, has considerably smoothed the surfaces of colour. Sometimes the outline blocks are used before the body blocks; much depends upon the quality of the blocks themselves, as well as upon the character of the design. By working the natural colour of the linoleum into the design, it is obvious that a third colour could be obtained with the same number of blocks. Oil colours alone are used for linoleum, and I fear more attention is paid to the quick drying of the paint than to its durability under wear. The fact that a considerable thickness of colour must be laid on has prevented the use of cylinder printing machines. A machine has, however, been devised in which printing is done in much the same way as by hand. Blocks covering the whole width of the linoleum are made to rise and fall alternately, first upon a colour pad run in underneath them, then upon the surface of the linoleum, stretched upon a table underneath. The "register" is obtained by fixing the edges of the linoleum upon steel pins carried by an endless steel band at each side of the table. The cost of the blocks renders the use of such a machine remunerative only when large quantities of one pattern have to be printed.

After printing, the linoleum has again to be seasoned until the paint has set. The edges are then trimmed by hand, and the fabric is ready for use. Plain linoleum is usually made in two colours, brown and red. The brown is generally the more elastic, but it has the disadvantage of showing marks more plainly. We live in the iron age, and any article of iron placed upon wet linoleum will leave a dark mark. This is due to the action of the tannin contained in the cork upon the iron. In course of time linoleum becomes hard and brittle; here is a piece about 16 years old, which was originally as supple and elastic as the samples you have just seen. The particles of cork remain quite elastic; it is the cement which has hardened. The oxidised oil in it has become further oxidised, and the resulting acid bodies have combined with the pigments and other constituents, forming inelastic substances. It will be difficult to find a substitute for the cheap and durable cork; but probably a more stable cement will be found, possibly derived from mineral oil. Whatever defects linoleum may possess, it is at the present time undoubtedly the best and cleanest floor covering, and I think an inspection of the numerous patterns before you will convince you that in appearance it leaves nothing to be desired. Our thanks are due to the Staines Linoleum Manufacturing Company and to the Addlestone Linoleum Company for most of the interesting samples which you have seen.

DISCUSSION.

The CHAIRMAN having invited discussion:—

Mr. F. WALTON had listened with great interest to the paper. Mr. Reid's facts were not correct in every particular, but the paper was nevertheless full of valuable information. The growth of the industry had been a matter of great surprise to him. When he made the first piece of what was now called linoleum—but which was not as Mr. Reid had stated then called kamptulicon—it was considered impossible to deal with india-rubber in that way because it was too intractable to adhere to the rollers without injuring the fabric. He had succeeded in realising the use of oxidised linseed oil, and that was the beginning of an industry which had now reached a production of 12,000,000 yards annually. And he believed that the industry was still in its infancy, and that its future lay in the development of the improvements which the author had explained, namely, the production of fabrics with the pattern running right through.

Mr. W. F. REID, in reply, thanked the members for the kind way in which his paper had been received. As Mr. Walton had called his accuracy in question with respect to the naming of linoleum after its predecessor kamptulicon, he would remind him of the paper which he, Mr. Walton, read before the Society of Arts in 1862, when he described his linoleum cement. In that paper, after showing the resemblance of the cement to india-rubber, he said: "Fibre, whether flock or cork, mixed in and rolled into sheets, gave

me samples of kamptulicon and other floorcloths." In the list of applications of the new cement he mentioned "kamptulicon (of any colour)."

Mr. F. WALTON replied that when he read the paper referred to he had no idea of such a fabric as linoleum. He was then connected with a firm of india-rubber manufacturers, and invented a fabric made from oxidised oil and cork for which he suggested the name of kampticon. Later on, he made a similar material rolled on canvas, which was immediately recognised as a valuable invention, and to this was given the name linoleum, the word having been coined by himself in conjunction with an Essex clergyman.

The CHAIRMAN complimented Mr. Reid on having produced a valuable historical record of the linoleum industry, in which he had rightly given honour where it was due—especially to Mr. Walton, the father of the manufacture.

Mr. H. DE MOSENTHAL exhibited some examples of Röntgen's new photographic method, including the bone structure of a frog and of a human hand and wrist seen through the surrounding flesh and skin, and gave a description of the apparatus for producing and using the rays which, for want of a better term, are known as the *x* rays.

Mr. OSCAR GUTTMANN, while not questioning Prof. Röntgen's right in regarding himself as the discoverer of a new kind of light, called attention to the fact that other investigators had observed phenomena and produced results resembling those described and claimed by him. Records of such work had recently appeared in the Proceedings of the Hungarian Society of Civil Engineers. Moreover, Dr. Goldstein, an assistant of Helmholtz, had published, eight or nine years ago, in the German papers, photographs of objects produced by certain rays, the reason of which he could not explain, and had followed these up by other work in the same direction. A more notable instance still was that of Reichenbach, the inventor of creosote, who, about 1848, published a pamphlet on what he called the Od, which consisted of a sort of halo surrounding every natural body, and rendering it luminous under certain conditions. In his writings at that time Reichenbach gave illustrations of bodies which he stated had been photographed through other bodies which were transparent to this illuminating medium or fluid. Du Bois-Reymond had denounced him as a lunatic at the time; but since Röntgen's discovery had excited curiosity in the matter, a certain professor at Cologne had made further experiments, and had actually succeeded in repeating Reichenbach's productions. Last of all, Prof. Edvy-Ilés of Budapest had stepped in and claimed to be able to produce similar photographs to Röntgen's without the aid of either Crookes' or Hittorff's tubes. His method was simply to use a metal plate as the anode, put the sensitive plate on that, then the object to be photographed on that, and lastly, another metal plate as the cathode, connect the plates with the machine, and the picture came out as well as with a tube such as Mr. De Moenthal had described.

Manchester Section.

ROOMS OF THE CHEMICAL CLUB, VICTORIA HOTEL.

Chairman: George E. Davis.

Vice-Chairman: Peter Hart.

Committee:

G. H. Bailey.
R. Forbes Carpenter.
R. S. Dale.
C. Dreyfus.
H. Grimshaw.
J. M. Irving.

M. J. Langdon.
I. Levinstein.
W. H. Perkin, jun.
Sir H. E. Roscoe.
E. Schunck.
W. Thomson.

Hon. Local Secretary:

J. Carter Bell.

Bank House, The Cliff, Higher Broughton, Manchester.

Meeting held Friday, January 3rd, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

THE EFFECT OF HEAT ON THE ILLUMINATING POWER OF COAL-GAS.—ITS RELATION TO THE THEORY OF FLAME.

BY WILFRID IRWIN.

You may remember in my last paper (this Journal, 1895, 546) that I demonstrated to you the fact, which I believe I was the first to point out, that when used in conjunction with the same gas, different enrichers do not give the same comparative results with different burners. Thus, suppose we take—

Hydrogen + benzene, with union jet,

Hydrogen + pentane, with union jet,

Hydrogen + benzene, with Argand,

Hydrogen + pentane, with Argand,

you readily notice how much greater influence the Argand burner has in increasing the illuminating power of the pentane flame than the benzene flame.

The converse I also showed to be true, namely, that the same enricher with the same burner will yield different results with different gases. Thus, benzene added at the rate of 1 gallon per 10,000 cubic feet of a 15-candle gas composed of disilluminated gas + benzene will give an addition of more than three candles with the Argand burner, whilst with ordinary 15-candle coal-gas a result of barely half that amount would be obtained.

With the object of accounting for these phenomena, I have made the following experiments:—

I. A wrought-iron 1-in. pipe, 4 ft. in length, was placed in a furnace in a horizontal position in such a way that the central portion only was heated. One end was connected with a supply of ordinary Manchester gas, the other by means of an india-rubber tube to a glass vessel, through which the gas had to pass on its way to a burner, the ordinary union jet being the one employed.

A stream of gas was now slowly passed through the pipe, whilst the temperature of the furnace was gradually raised, and a light having been applied to the burner the action on the flame was carefully watched. Up to a dull red heat no alteration whatever in the flame was observable. At a medium red heat the illuminating power of the flame just began to give way, whilst another slight increase caused it to decline rapidly and in fact it soon fell to below 1-candle power. No smoke was to be seen in the glass vessel between the pipe and the burner, nor on looking down the former, whilst the gas was passing, was any luminous glow visible, and only a slight deposit of carbon was formed on the side of the pipe. The temperature at which this change in the gas occurred was determined by Siemens' method, and found to be 830° C. This figure is probably a little below the mark, but I think we may safely say that the temperature at which gas becomes practically non-luminous with the union-jet flame to be somewhere between 850° and 900° C.

The resulting feebly luminous flame plainly shows stratification into five layers. Namely—

1. The lower non-luminous layer.
2. The lower luminous layer.
3. The middle non-luminous layer.
4. The upper luminous layer.
5. The upper non-luminous layer.

On proceeding with our experiment and gradually raising the heat of the furnace, the luminous portion became fainter and fainter and the upper non-luminous layer increased in extent. Fumes of smoke began to be visible in the intervening glass vessel, at the same time the last remnant of the old luminosity disappeared but in its place rays of luminous specks, due to particles of ignited carbon issuing from the jet, gave a certain amount of light to the flame.

Other experiments were made with mixtures of hydrogen and benzene and hydrogen and pentane, with the result that the said mixtures were both found to lose their lumi-

nosity at about the same temperature as ordinary Manchester gas.

I next varied the experiment, and instead of cooling the gas between the heated portion of the pipe and the burner, I had a diminisher screwed on the end of the pipe, fitted the burner into it, and arranged my furnace so that the main part of the heat should ply right on the end of the pipe. By a suitable arrangement the gas flame itself was protected from the fumes and light of the furnace so that the action of heat on the gas could be readily observed.

Just at first, after a light was applied to the gas and the furnace kindled, the flame appeared to increase a little in brilliancy, but it soon again began to fall as in the previous experiment. At a bright red heat the stratification became again apparent and the two bright layers, with the dark line separating them, instead of gradually fading away as in the first experiment, began to draw nearer to the orifice of the burner until at last, at an almost white heat, they came in contact with it and one after another disappeared, the flame being again rendered slightly luminous by the red-hot particles of carbon issuing from the burner.

Before commenting on the foregoing results, I wish to draw your attention to experiments with mixtures of pure hydrogen + acetylene and pure hydrogen + benzene. I have here jets of each of the mixtures and can vary the proportions in each as I please. Notice what takes place when the proportions of acetylene and benzene are so reduced that the two flames are only slightly luminous. In each case you will see that the flame becomes stratified and the five layers previously referred to become apparent.

Conclusions. I.—The fact that the passage of ordinary coal-gas or of a mixture of hydrogen and benzene through a red-hot pipe reduces enormously the illuminating power of the said gases without production of soot, and of only a slight carbon deposit in the heated pipe, shows clearly that a decomposition of benzene into other hydrocarbons takes place, which have not the same ability to form luminous products of decomposition as benzene has. It also explains why the Argand burner shows lower results with a gas rich in benzene than the union-jet burner does. The greater heat of the Argand burner evidently acts in the same manner on part of the benzene in the gas as the red-hot pipe does, thus decomposing it before sufficient oxygen can come in contact with it to produce further decomposition into carbon and hydrogen. It is evident from what I have said that it is only when the temperature of the flame is below 900° C. that benzene can be of much assistance in increasing its illuminating power. This action of heat on benzene, &c. also accounts for the fact that you often cannot get the full initial value of different enrichers when added to a gas at the same time.

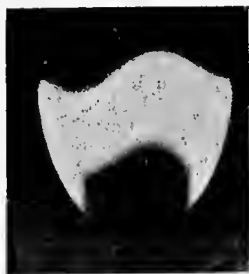
II.—In my second experiment, when the burner was placed in the hottest part of the pipe, the increase at first in the illuminating power of the flame was due no doubt to that which gives the Argand burner its superiority with ordinary gas—less heat being lost by radiation, a smaller quantity of hydrocarbons is required for combustion in order to maintain the heat of the flame.

The presence of sparks of incandescent carbon at a temperature of 1,100° C. to 1,400° C. shows that a certain amount of ultimate decomposition is now taking place inside the pipe.

The gradual approach of the various layers in the feebly-luminous flame to the orifice of the burner as the temperature of the gas, issuing from the pipe rises, shows that the position of these layers is chiefly one of temperature, and by determining the temperature of the gas before leaving the pipe the heat of the flame at the points of the various layers could be approximated.

III. Having previously shown that the upper luminous layer in these feebly-luminous flames is due to the presence of Marsh gas, there can be no doubt that this gas is one of the products of decomposition in the hydrogen + benzene and hydrogen + acetylene flames which I have just exhibited.

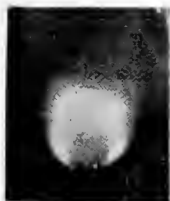
What the other products of decomposition in the benzene flame are and those which enable it to act as such a high enricher, it is difficult to say.



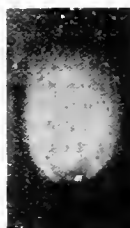
Manchester gas before and after passing through red-hot pipe.



Benzene + hydrogen gas before and after passing through red-hot pipe.



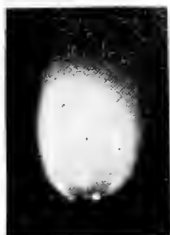
1



2



3



4

Photographs of flame of ordinary gas issuing from the burner at a very high temperature, No. 4 being the highest.

Free acetylene it cannot be as this substance, when diluted with hydrogen, is far less powerful as an enricher than benzene itself, and it also requires in such a diluted form a far higher temperature for its decomposition (according to Lewes's theory) than it could possibly get in the lower part of the flame.

It may possibly be that immediately on formation acetylene is able to decompose at the same temperature as when pure, *i.e.*, about 800° C. but this has not been proved.

Benzene itself is not an endothermic compound and therefore simple decomposition into carbon and hydrogen would not be likely to produce luminosity as in the case of acetylene. From my experiments with the heated gases, I have come to the conclusion that the intrusion of a certain amount of oxygen is required to split up the benzene molecule, the products of decomposition being Marsh gas, carbonic oxide, and solid carbon, the last raised momentarily when in a nascent state to a high temperature by its approach to the hot mantle, which as Professor Smithells has recently shown, surrounds every flame.

Since a flame produced by burning a mixture of hydrogen and acetylene also exhibits stratification it is clear that the question of the cause of luminosity cannot admit of the simple solution put forward by Prof. Lewes; here, as in the other cases, luminosity is produced by two different reactions occurring at different levels and different temperatures and much more labour will be required before any clear light on the subject is obtained.

The whole question of flame luminosity is very involved but if the solid carbon theory be the true one, why do not the particles of solid carbon issuing along with the gas from the highly heated pipe yield an illuminating effect equal to, or even greater than, that of the gas when burnt in the usual manner?

Leaving matters of purely scientific consideration let us consider what light, commercially speaking, can be gathered from the experiments I have described.

The temperature at which I have shown ordinary gas loses most of its luminosity is less than that of all gas retorts towards the end of the process of carbonisation. When a retort is first charged it is absolutely necessary to keep the furnace at a very high temperature in order to obtain the best result of gas. Towards the end of the process, however, this is not the case as less heat is lost by evolution of gas, and may not the low quality of the gas then produced be largely caused by the over-heating of the slow current generated at the time.

It has been suggested by White to pass water-gas through the retort as the charge is nearing the finish in order to reduce the temperature. I am unaware of this having been worked successfully on a commercial scale but there is no doubt that water-gas so treated would require less oil-enrichment to bring it up to a given standard of luminosity.

Before concluding I would like to refer to another point bearing upon this matter and that is the question of the standard burner. When coal-gas only was manufactured, this was not so important, but now that oil-gas, &c. have entered the field and comparisons have to be made, surely some more logical standard than the Argand burner (which, as I have previously shown, is much more sensitive to one enricher than to another) could be adopted. We have superceded candles at one end of the bar of our photometer, surely it is far more important to have a truer standard burner at the other end.

Advocates of other systems of lighting are not slow in finding out the defects in our present method of testing, and are inclined rather to overstate the differences than otherwise, and for the sake of consumers it is very important that a satisfactory settlement of the question should be arrived at.

Meeting held Friday, February 7th, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

PHOTOGRAPHY BY THE "RÖNTGEN" RAYS.

BY GEORGE E. DAVIS.

THE most interesting subject at the present time is the discovery by Röntgen that certain rays which accompany the luminous rays of light, pass through many substances which are perfectly opaque to the ordinary rays, and thereafter reduce the silver salts on a sensitive photographic film in the same manner as the so-called chemical rays do.

Röntgen's demonstration of the correctness of Clerk Maxwell's speculations is only a few weeks old, so that not much is known yet concerning the physical properties of these particular radiations, but several demonstrations have taken place, both in this country and abroad, from which something of their nature may be gathered.

Dr. Speiss, the lecturer at the Urania Institution in Berlin, a few days ago gave a demonstration showing that the new rays (provisionally called the "X" rays) pass through wood, aluminium, and many other solid bodies, such as earthenware and ebonite, while they will not pass through most metals, bones, or glass; and he further warned his audience against premature optimism with regard to the practical employment of Prof. Röntgen's discovery.

At the last meeting of the French Academy of Science, M. Poincaré exhibited a number of photographs which had been taken of objects placed behind opaque bodies, and M. Lebon has made a communication to Prof. Arsoval, who laid it before the Academy, tending to show that these "X" rays are not merely altered light rays, but radiations accompanying the luminous rays of ordinary light.

The practical adaptation of the discovery is progressing day by day. It will be as well, however, to bear in mind Dr. Speiss's advice, as the photographs produced, so far, are not in the ordinary sense of the word photographs, but rather prints in which the object takes the place of the negative, as in the preparation of transparencies for the lantern. Up to the present, there is no known method by which these "X" rays can be focussed so as to form an image on a glass plate in the ordinary camera. At Vienna, Prof. Neusser has shown his students a print of a gallstone in the liver, and another of stone in the bladder, but the account does not say whether the prints were produced from the living organism or from post-mortem preparations. Prof. Mosetig is also credited with having demonstrated with the greatest clearness and precision the injuries caused by a revolver-shot in the hand of a patient, and the position and nature, of a malformation in the foot of another.

Amongst the photographs exhibited by Dr. Speiss was one of very interesting character, showing the hand of a servant of the Urania Institution. This man some years ago ran a piece of glass into his hand, which could not be extracted. The photograph by the "X" rays shows this piece of glass quite distinctly. Recently, at the Camera Club in London, Mr. Campbell Swinton showed some photographs similar to those obtained by Professor Röntgen by the use of Crookes' radiant matter tubes. Mr. Swinton employed a half horse-power electric current, and passing it through an induction coil, he loaded 10 Leyden jars. The discharge from them was passed through a second induction coil, by the secondary system of which a Crookes' tube was excited. He stated that he only succeeded in this way, and had failed with Crookes' tube excited by an ordinary induction coil. He further stated that the visible light of the Crookes' tube does not pass through wood and other similar materials, but that the new effects seem to be due to some other radiation which accompanies the visible light, and has the power of penetrating the wood or like material and affecting the sensitive plate when covered by it. He observed that ebonite, carbon, and most organic matters were transparent to this radiation; and that, on the other hand, all metals, except aluminium and perhaps lead, were opaque to it. Curious to say, clear glass was very opaque, but ground glass was less so.

Evidently a great deal of investigation has yet to be made. At present it is stated from Berlin that these radiations are not refrangible, but this seems doubtful; proper media may yet be found. The lecturer produced a photograph of a living human hand, which had been taken by placing the hand on a camera, at the back of the frame containing a sensitive plate, the Crookes' tubes being placed behind the hand. A leather purse containing three coins had also been photographed in a similar way. The coins and the metal clasp were the only objects portrayed on the plate. Both these plates were developed in the usual manner by photographers. I have here a few of these prints for your inspection, and from them you will be able to judge of the importance of the discovery.

ON THE ESTIMATION OF ORGANIC MATTER BY MEANS OF CHROMIC ACID.

BY JOSEPH BARNES, F.I.C.

IN the analysis of water the amount of oxygen absorbed from permanganic acid is generally viewed as a sort of measure for organic carbon, and Frankland has so far recognised this that he has given factors for calculating the amount of carbon from the number obtained by the so-called "oxygen absorbed" test. The extent of oxidation effected by this process is, however, only a small fraction of what would ensue if all the carbon were oxidised to carbon dioxide, and varies indeed with different kinds of organic matter, so that different factors have to be used for different classes of water: the factor for river water being 2.38, whereas that for deep well water is 5.8.

Now, seeing that this test is so largely used in the examination of polluted waters, sewage, effluents, &c., I have endeavoured to work out a process in which the extent of oxidation would be much greater than that brought about by the usual method, so that the amount of oxygen absorbed might be a more reliable measure for the carbon. Processes in which chromic acid serves as the oxidising agent have been described (Paul Degener, *Zeit. f. anal. Chem.*, Vol. 24, p. 129; C. A. Burgardt, *Man. Lit. and Phil. Soc.*, Dec. 14th, 1886; C. F. Cross and E. J. Bevan, *Chem. News*, Vol. 55, p. 2; L. Legler, *Analyst*, Vol. XII., p. 14; Otto Hehner, *ibid.*, Vol. XII., pp. 25 and 44), and are indeed used, though I believe not very extensively; and attempts have been made to effect by its aid complete conversion of the carbon into carbon dioxide, and thus to estimate it quantitatively by determining either the residual chromic acid or the carbon dioxide evolved.

I have made numerous experiments with chromic acid, but have not succeeded in effecting complete oxidation of carbon; and, indeed, whenever the process was conducted with this end in view, there was either a considerable loss of oxygen or of chlorine in the presence of chlorides, or else the process became one that could not be termed "practical."

I eventually fixed upon the following empirical method as one that could be easily worked, and in which the conditions of experiment could be easily maintained by different workers:—25 c.c. of strong sulphuric acid are mixed with 50 c.c. of the solution of organic matter and 10 c.c. of chromic acid solution added. The mixture is then heated for one hour on the water bath, an excess of a ferrous salt added, and the whole titrated back with permanganate.

In all cases parallel experiments have been made with permanganic acid by a process that I have always been in the habit of using for sewage and sewage effluents. Ratios have been calculated in each case from the numbers obtained by the two methods, and are placed in the last column of the table of experiments. These ratios are of interest, and might, after a large number of tests, become of value in differentiating organic substances. It will be observed that the ratios for glycerol, starch, sugar, and gelatine are very low. Tannic acid, infusion of peat and urine give the highest ratios, and albumen and blood give ratios very similar to those of domestic sewage. The gelatine ratio is higher the more putrid the solution becomes. This is not noticeable in the case of albumen, but, if anything, the tendency is the other way. It seems also remarkable that the oxidisability of these solutions to hot chromic acid does

not increase as they become more putrid. The extent of oxidation by means of the chromic acid method amounts in the cases of the albuminoids gelatine and albumen to about 18 per cent., and that of glycerol, sugar, and starch to from 80 to 95 per cent., of what would be required for the conversion of the whole of the carbon into carbon dioxide. As a measure for carbon it is very evident that this method is superior to the permanganic acid one, for although it does not yield an exact measurement for carbon in carbon compounds, yet, on the other hand, the permanganic acid process almost fails to indicate this element in the cases of starch, sugar, and gelatine.

It will be noticed, in comparing the results yielded by different amounts of the same substance, that the influence of mass is very obvious. In the chromic acid process the figures are as a rule higher the less the proportion of organic matter bears to the chromic acid. With the permanganic acid process this is just the reverse. Whether this is owing to a loss of oxygen induced by peroxide of manganese, or whether oxidation proceeds more rapidly as manganoous sulphate is formed, as in the well-known case of oxalic acid, are questions that I am at present not able to answer.

Solutions used in the Experiments.

Chromic Acid.—6.2 grms. of potassium bichromate are dissolved in water; 50 c.c. of strong sulphuric acid are then added and the whole is made up to one litre. The addition of acid prevents the peculiar behaviour of ordinary bichromate solution in refusing to wet the inside of the glass when the pipette has been used for a short time: a more regular delivery is thus ensured.

Solution of Ferrous Sulphate.—18 grms. of ferrous sulphate crystals are dissolved in a mixture of 100 c.c. strong sulphuric acid and 200 c.c. of water: when cool the solution is made up to $\frac{1}{2}$ litre. 10 c.c. of this solution, when mixed with 10 c.c. of the above chromic acid, should yield a solution containing a little residual ferrous salt. A solution of ferrous sulphate containing so much free acid as here given changes in strength with extreme slowness.

Potassium Permanganate.—A solution containing 4 grms. per litre.

Standard Potassium Permanganate for Titration.—This is prepared so that 1 c.c. contains $\frac{1}{2}$ mgrm. of available oxygen, and may be standardised by the usual methods. It is almost exactly one-half the strength of the foregoing.

Strong Sulphuric Acid.—The best quality of commercial sulphuric acid, free from arsenic, and known as "sulphur vitriol," has been used in these experiments.

Dilute Sulphuric Acid.—1 volume of strong sulphuric acid is mixed with two volumes of distilled water; the hot mixture is then coloured pink with a few drops of permanganate solution and set on one side to cool.

The Chromic Acid Process.

Measure 50 c.c. of the liquid to be tested, or if a smaller amount is taken it is made up to this volume with distilled water. Pour it into a flask of 300 c.c. capacity, add 25 c.c. of strong sulphuric acid by means of a graduated cylindrical measure, and, after shaking, run in 10 c.c. of the chromic acid solution, cover with a watch glass, and place on a boiling water-bath, and let it remain for one hour; remove from the water-bath and set the

TABLE OF EXPERIMENTS.

Results expressed as Parts of Oxygen absorbed per 100,000 Volumes of Solution.

No.	Description of Solution.	Chromic Acid Method.		Permanganic Acid Method.		Ratio.
		Amount of Solution taken.	Oxygen absorbed.	Amount of Solution taken.	Oxygen absorbed.	
		c.c.		c.c.		
1	Solution of gelatine containing 0.237 grm. dry organic matter per litre.....	50 20	5.20 5.62	75 50	0.33 0.30	0.050
2	The above solution after keeping six days.....	50 25	5.65 5.50	100 50	0.20 0.07	
3	" " " fourteen days ..	50 25	5.10 5.40	100 50	0.05 0.05	0.118
4	Commercial egg albumen containing 0.3515 grm. dry organic matter per litre.....	50 25	8.75 9.20	100 50	4.25 4.20	
5	The above solution after keeping seven days	50 25	8.70 9.20	100 50	4.15 4.00	0.463
6	Fresh white of egg, filtered, containing 0.394 grm. dry organic matter per litre.....	50 25	10.55 10.70	100 50	4.07 4.55	
7	The above solution after keeping ten days	50 25	9.30 8.65	100 50	4.00 3.60	0.455
8	Water containing 0.2 per cent. of putrid blood ...	50 25	8.65 9.00	100 50	4.88 4.70	
9	Water containing 2 per cent. of urine. This was found to contain 10 parts of Cl per 100,000	50 30 20	8.90 9.20 9.10	100 50 25	5.47 5.75 5.70	0.621
10	Water containing 2 per cent. of the same urine after keeping seven days.....	50 25	8.00 8.30	100 50	4.95 5.20	
11	Solution of glycerol containing 0.1 grm. per litre.	50 25	11.35 11.60	50 25	1.45 1.10	0.622
12	Boiled starch containing 0.1 grm. tous-les-mois starch per litre	50 25	9.55 9.80	100 50	0.15 0.15	
13	Solution of cane-sugar containing 0.1 grm. per litre.....	50 25	9.25 9.40	100	0.20	0.111
14	Solution of cane-sugar containing 0.1 grm. per litre after inversion by boiling with sulphuric acid..	50 30 20	9.20 21.50 21.50	100 75 50	1.22 8.40 8.30	
15	Settled sewage, chiefly domestic. Sample 1.....	40 20	19.40 20.60	50 25	9.90 10.00	0.400
16	" " " " 2.....	40 20	7.81 7.88	50 25	4.05 4.00	
17	" " " " 3.....	40 20	6.31 6.50	50 25	3.90 3.70	0.512
18	" " " " 4.....	40 20	6.50 1.90	50 50	3.90 0.80	
19	The above Sample 4, after precipitation and filtration through gravel	50 25	2.00 1.90	100 50	0.90 0.80	0.595
20	Peat, washed in cold water, then infused in hot water containing a small quantity of sodium carbonate and then filtered.....	50	6.20	100	4.10	
21	Commercial tannic acid containing 0.1 grm. per litre	50	9.00	50	7.10	0.661
						0.789

flask and contents to cool for two or three minutes in a dish of cold water; add 10 c.c. of the ferrous sulphate solution, pour into $\frac{1}{2}$ litre of cold water, and titrate with the permanganate until the green colour of the liquid changes to grey. A blank experiment is done in precisely the same way and at the same time with 50 c.c. of pure water in place of the solution of organic matter, and the amount of standard permanganate used is deducted from that required in the actual test.

Permanganic Acid Process.

100 c.c. of the liquid to be tested, or a smaller measured quantity made up to this volume with pure water, are placed in a stoppered bottle; 10 c.c. of dilute sulphuric acid are then added, and finally 10 c.c. of permanganate (1 grms. per litre). The bottle is placed in a tank of water at 70° F. and allowed to remain $2\frac{1}{2}$ hours, maintaining the temperature at 70° F. if necessary by the occasional addition of hot water. Now add 10 c.c. of the ferrous sulphate solution, and after the liquid has become quite clear, titrate it with the standard permanganate (1 c.c. = $\frac{1}{2}$ mgrm. O.).

A blank experiment is made at the same time with 100 c.c. of pure water, and the amount of standard permanganate used deducted from that required in the actual test.

EXPERIMENTS made to SHOW the EXTENT of VARIATION which may occur in the BLANK EXPERIMENTS with the CHROMIC ACID PROCESS. 50 c.c. of Distilled Water taken.

	No. of Experiment.			
	1.		2.	
Amount of permanganate used in the final titration.	0.80	0.80	0.75	0.80
Permanganate required by excess of ferrous salt over the chromic acid.	0.55	0.55	0.55	0.55
Owing to loss of oxygen and impurities in the reagents upon heating.	0.25	0.25	0.20	0.25

	No. of Experiment.			
	3.		4.	
Amount of permanganate used in the final titration.	0.75	0.80	0.80	0.70
Permanganate required by excess of ferrous salt over the chromic acid.	0.55	0.55	0.50	0.50
Owing to loss of oxygen and impurities in the reagents upon heating.	0.20	0.25	0.30	0.20

EXPERIMENTS made to SHOW the INFLUENCE of CHLORIDES. 50 c.c. of Water containing 0.150 grm. Ammonium Chloride per Litre.

	No. of Experiment.			
	1.	2.	3.	4.
Amount of permanganate used in the final titration.	0.90	0.80	0.85	0.80
Permanganate required by excess of ferrous salt over the chromic acid.	0.55	0.55	0.55	0.50
Owing to loss of chlorine and impurities in the reagents upon heating.	0.35	0.25	0.30	0.30

Nottingham Section.

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SESSION 1895-96.

Wednesday, March 13th:—

Mr. L. Archbutt. "An Evaporation Test for Cylinder Oils."

Discussion on Mr. R. M. Caven's paper: "Some Properties of Ferric Phosphate."

In April (date not fixed).—Mr. John White. "Filtration and Domestic Filters."

Meeting held at Derby, Wednesday, February 5th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

NOTE ON THE IGNITION OF SAWDUST BY NITRIC ACID.

BY L. ARCHBUTT, F.I.C.

AN outbreak of fire caused by nitric acid coming into contact with an easily inflammable packing material, such as hay, is not an unknown occurrence, although there do not appear to be many cases on record. The burning of a railway car in Baden some years ago, suspected to have become ignited in this way, led to some experiments by Prof. Haas, a summary of which may be found in the *Analyst*, Vol. VI. (1881), p. 231. Prof. Haas filled boxes of 12 to 20 litres capacity with variable proportions of hay, straw, tow, and blotting-paper, placed these within larger boxes, and filled the intervening space with hay or tow to act as a non-conducting envelope. He then saturated the hay, &c. in the inner box with nitric acid, pressed it down rather tightly, and put a lid on. When very strong nitric acid was used, red nitrous gas quickly appeared, followed by whitish vapours and then smoke, and on lifting the lid the contents of the box were seen to be red hot, and readily burst into flame if stirred up or gently fanned. With acid of 1.395 sp. gr., the action took place more slowly, and 20 minutes elapsed before the final stage was reached, but the same result was eventually obtained as with the stronger acid.

Further experiments by Prof. Haas are recorded in this Journal, Vol. IV., (1885) p. 496. In these, weaker nitric acid was employed, and it was found possible to ignite hay contained in a box by means of nitric acid even as low in strength as sp. gr. 1.276 (13.6 per cent. HNO_3).

I have not been able to find any recorded experiments with sawdust, and the fact that it is largely employed for packing Winchesters of nitric acid in boxes, seems to show that it is regarded as a safe packing material. A few experiments which I have made may therefore be worth placing on record.

Of course, no one familiar with the properties of the strongest nitric acid would doubt that sawdust can be readily set on fire by it. The experiment is a favourite one for lecture demonstration, though, owing to the small quantities operated upon, certain precautions are necessary for success. Thus, the sawdust should have been previously thoroughly dried by heating it until it has begun to char, and to make success certain the sawdust should be warm. If a small paper tray, measuring about 3 inches square by

$1\frac{1}{2}$ inches deep, be filled with the dry and warm sawdust, and then about 20 c.c. of the nitric acid, prepared on the lecture table by distilling nitre with sulphuric acid, be poured upon it, first red fumes and dense white smoke appear, and in a few seconds the whole mass bursts into flame.

My experiments were made with weaker acid, chiefly of 1.40 sp. gr. (65.3 per cent. HNO_3) and 1.35 sp. gr. (55.8 per cent. HNO_3), and the sawdust was not dried in any way, but was used just as it came from the saw. A wooden box, measuring internally 6 ins. square by 12 ins. deep, placed within a larger box, 15 ins. square by 18 ins. deep, the space between them being packed with a non-conducting layer of sawdust, formed the apparatus. The sawdust experimented upon was placed in the inner box to a depth of about 4 ins. On this was placed a glass bottle about $2\frac{1}{2}$ ins. diameter and $6\frac{1}{2}$ ins. high, and the bottle was packed all round with the same sawdust and then withdrawn. Into the cavity thus formed the acid was poured, and then the hole was filled up with sawdust, and a loose lid was placed upon the top.

Expt. 1.—Pitch-pine sawdust used, and 1 quart of nitric acid of sp. gr. 1.43. This experiment was made in a large fume cupboard. At first red fumes and then dense white smoke appeared, soon followed by sparks projected from under the loose lid, as from a mild squib. Owing to the violent action, the fire was quenched at this stage, and the remaining experiments were made in the open air.

Expt. 2.—White deal sawdust, and 1 quart of nitric acid of sp. gr. 1.40. Red fumes; then dense white smoke. No flame; but on removing the lid the sawdust was found to be red hot, and the inside of the box was deeply charred.

Expt. 3.—Ordinary pine sawdust, and 1 pint of nitric acid of sp. gr. 1.40. Red fumes; smoke in 2 minutes; and on lifting the lid off the box at the end of 3 minutes the contents inflamed at once.

Expt. 4.—Oak sawdust, very fine and quite damp. 1 pint of nitric acid of sp. gr. 1.40. Red fumes in 1 minute; pale white smoke in 5 minutes; dense white smoke in 8 minutes. On lifting the lid the sawdust was seen to be red hot, and when stirred up it inflamed.

Expt. 5.—Elm sawdust, quite damp, from a freshly cut log. 1 pint of nitric acid of sp. gr. 1.40. Red fumes; much heat and steam, but no actual charring or smoke in half an hour. Then stopped the experiment.

Expt. 6.—Ordinary pine sawdust, and 1 pint of nitric acid of sp. gr. 1.352. Exactly the same result was obtained as in Expt. 3, but rather more time was required.

Expt. 7.—Oak sawdust, damp. 1 pint of nitric acid of sp. gr. 1.35. Red fumes. Pale smoke in 8 minutes, getting denser, but not very dense. Waited 15 minutes longer, and then removed the lid, and found the sawdust charred in places, but not red hot. Smoke and charring continued until the experiment was stopped.

Expt. 8.—Oak sawdust, dry, from a log two years old. 1 pint of acid of sp. gr. 1.35. Red fumes in 1 minute; smoke in $3\frac{1}{2}$ minutes, getting very dense. Contents of box did not appear to be red hot, and there was no flame on stirring, but plenty of charring and smoke occurred.

Expt. 9.—Elm sawdust, same as used for Expt. 5, but air-dried. 1 pint of acid of sp. gr. 1.40. Red fumes in 3 minutes; smoke in 6 minutes, getting very dense. Contents of box red hot, but no flame on stirring.

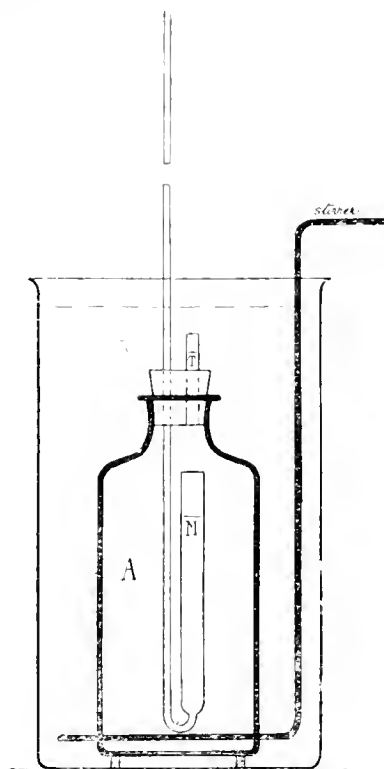
DISCUSSION.

In reply to a question by the Chairman, Mr. Archbutt said that he would recommend the use of kieselguhr or some similar absorbent material for the safe packing of bottles containing dangerous acids.

NOTE ON AN EXPERIMENT MADE TO DETERMINE THE PRESSURE OF ETHER AND SOME OTHER VOLATILE LIQUIDS IN CLOSED VESSELS.

BY L. ARCHBUTT, F.I.C.

I HAVE been induced to communicate this note by a question put to me by the President at our last meeting. About two years ago, my attention was directed to the iron drums used for the conveyance of large quantities of ether by railway, and it became necessary to ascertain the pressure to which such drums might become subjected in practice, owing to the expansion and increased vapour-tension of the contained ether caused by a rise of atmospheric temperature. The drums are not, of course, completely filled with ether, a space being left to allow for the expansion of the liquid; such expansion, however, would cause internal pressure by compressing the air in the space, and this must be added to the increased vapour-tension of the ether, due to the rise of temperature which caused the expansion. For several reasons, the combined effect could not be calculated, and it was necessary to make an experiment, for which purpose the following apparatus was devised:—



A glass bottle A (see figure) was fitted with a sound ordinary cork carrying the manometer M, and a short glass tube T, of about $\frac{1}{4}$ in. bore, not projecting beyond the cork inside the bottle. The cork was fixed firmly in the bottle, tied down with string, and well covered with sealing-wax. The bottle being empty and dry, mercury was first poured through the narrow tube T, into the short wide limb of the manometer, up to the mark M. The capacity of the bottle was then ascertained by pouring in methylated spirit from a measure until the liquid rose to a mark on the narrow tube T. The volume of spirit required was 550 c.c. The bottle and the manometer were then emptied, rinsed with ether, and dried by aspirating a current of air through.

In order to make an experiment with ether, mercury was poured, as before, into the manometer, and the bottle was

completely filled with ether up to the mark on the tube T, the mercury being adjusted to the mark M. The bottle was immersed up to the neck in running water at 50° F. and left there until the ether had acquired the temperature of the water, more ether being added to make up for the contraction due to cooling. In one experiment $\frac{1}{20}$ th and in another $\frac{1}{10}$ th of the total volume of the ether was then withdrawn by means of a pipette passed through the tube T, and a small cork was inserted in the tube as far as the 550-c.c. mark, and firmly fastened with string. The whole apparatus was now placed in a tall beaker containing sufficient water to completely cover the cork of the small tube T, and a thermometer was suspended in the water, which was heated up by a small flame and frequently stirred. When it was required to read off the pressure in the bottle, the mercury in the manometer was first adjusted to the mark M by pouring the necessary quantity down the long limb, and then the height of the column was marked in pencil on a narrow strip of paper gummed to the glass tube. The length of the mercury column between the two marks was afterwards measured.

In several experiments with ether, it was observed that the pressure slowly decreased on standing at a fixed temperature, owing to the air dissolving in the ether, and by raising the temperature rapidly a higher pressure could be obtained than by raising it slowly. By slow heating, the ether could be caused to expand until it almost completely filled the bottle, and as the slightest leakage of air would have been detected by the bubbles formed in the water, and none was seen to escape, there can be no doubt of the solution or occlusion of the air in the ether. In the following experiments, about half an hour was occupied in raising the temperature from 50° F. to 100° F., this range being regarded as sufficient. The liquids experimented with were commercial ether of, nominally, 0.725 sp. gr., the light petroleum naphtha known as gasolene, and the volatile liquid hydrocarbon condensed in the compression of oil-gas:—

Liquid.	Air-Space.	Pressure in Lbs. per Square Inch.	
		At 50° F.	At 100° F.
Ether.....	$\frac{1}{20}$ th	0	Lbs. 17.0
".....	$\frac{1}{10}$ th	0	14.1
Gasolene.....	$\frac{1}{10}$ th	0	13.0
Oil-gas hydrocarbon.	$\frac{1}{10}$ th	0	14.1

The liquids used gave the following results:—

Liquid.	Specific Gravity at 60° F.	Boiling Point.
Ether.....	0.7234	° F. 88 to 90
Gasolene.....	0.6596	82
Oil-gas hydrocarbon.	0.8084	66 rising very rapidly, First drop at 100° F.

DISCUSSION.

Dr. CLOWES mentioned some experiments which had been made to show the danger of sending cylinders of liquified ammonia from the Continent which were quite filled. Even mild steel cylinders had been burst by the expansion of the liquid caused by a comparatively slight rise of temperature under such circumstances.

The CHAIRMAN remarked that the application of safety-valves to the vessels or drums would appear to be necessary under such conditions. He asked if any of the members had experience of the ether light for lantern purposes, as an explosion had recently occurred when using this light, which he was disposed to attribute to the defective character of the safety-jet which had been used. It had been, however, considered that the high specific gravity of the ether was at the bottom of the mischief, which he was not disposed to agree with.

Dr. CLOWES said that he had met with cases in which an explosion had been caused by igniting air charged with vapour from a less volatile liquid, while air charged with vapour from a more volatile liquid of lower specific gravity did not produce an explosive mixture, owing to the larger amount of vapour present causing the explosive limit to be exceeded.

Mr. ARCHBUTT briefly replied, and then said that his note on "A Simple Device for checking the Loss of Iodine by Evaporation in Hübl's Test" had been anticipated in a paper by Dr. Schweitzer, of New York, in the last number of the Journal (Vol. 14, page 1934). He might say, however, that for several years he had used the simple device of sealing the stoppers of the bottles with a small quantity of a solution of potassium iodide, and, after they had stood the required time, simply rising this into the bottles before commencing titration. The solution on the stopper was invariably coloured yellow by iodine.

The CHAIRMAN asked what was the strength of the solution.

Mr. ARCHBUTT: A 10 per cent. solution.

Yorkshire Section.

Chairman: C. F. Tetley.

Vice-Chairman: J. J. Hummel.

Committee:

H. E. Aykroyd.
J. E. Bedford.
F. W. Branson.
T. Fairley.
N. Farrant.
A. Hess.

W. Leach.
W. Mc'D. Mackey.
A. G. Perkin.
C. Rawson.
Geo. Ward.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:

H. R. Procter, Yorkshire College, Leeds.

Meeting held at the Yorkshire College, Leeds, on Monday,
January 27th, 1896.

MR. THOS. FAIRLEY IN THE CHAIR.

THE COMBUSTION OF COAL AND GAS IN HOUSE FIRES.

BY J. B. COHEN, PH.D., AND G. H. RUSSELL, A.I.C.

The object of the following experiments was in the first place to re-determine the extent of pollution of town air by smoke arising from house fires burning coal, and secondly to find if a more extensive use of gas fires might be recommended by way of mitigating or removing this evil.

Coal Fires.—A few determinations of the amount of soot given off from a good quality of Yorkshire house coal (Silkstone Haras) were made by Mr. G. Hefford, and appeared in a paper by Cohen and Hefford in the February number of this Journal, 1893. Cotton-wool plugs were employed for collecting the soot from the fire. Subsequently one of us found that the exceedingly hygroscopic character of cotton wool might, in view of the small quantity of soot in proportion to that of the wool, lead to appreciable errors unless dried and weighed with special precautions. Another source of error in the former determinations might have arisen from the fact that the carbon dioxide in the chimney gases was determined in samples drawn occasionally, and might therefore not accurately represent the average amount of carbon dioxide passing up the chimney during the whole period of combustion. It was consequently thought desirable to repeat the determinations so as to avoid these possible sources of error, and to extend them so as to include house coal from the Durham and Lancashire coalfields.

The results may be summarised briefly as follows:—

Using a similar kind of coal to that employed in the former determinations (there called A), the weight of soot per 100 litres of chimney gases and the per cent. of CO₂ were both found to be much lower than in the previous determinations. The net result has been to raise the per cent. of soot on the carbon burnt from 5 to an average of 7.7 per cent. on this particular quality of coal.

The average per cent. of soot in 12 analyses, including 8 of Yorkshire coals, 2 of Durham coals, and 2 of Wigan coals, amounted to $6\frac{1}{2}$ per cent. on the carbon burnt.

The quantity of soot obtained in different experiments with the same kind of coal varies, as will be seen from the table. It is no doubt influenced by the manner of firing and by the amount of draught. There was no slack in any of the samples.

The determinations were carried out as follows:—

The chimney gases were aspirated through a brass tube of about $\frac{1}{2}$ inch diameter. The end inserted into the chimney was closed and a narrow slit about 3 ins. long, was cut longitudinally at about 1 in. from the closed end, through which the chimney gases could be drawn. To the open end of the brass tube, a glass tube containing the weighed cotton-wool plug was inserted.

The cotton plug was dried in a weighing bottle in the steam oven, then kept overnight in a desiccator over sulphuric acid, and weighed against another cotton plug dried in the same manner along with the experimental one,

and the process repeated until consecutive weighings were constant.

The air was aspirated by means of two gas-holders, each holding about 15 litres, and the chimney gases were drawn off at the rate of about a litre a minute, which would approach the speed of the gases passing up the flue. The object of this was to prevent a greater deposition of soot in the brass tube than would occur in its progress up the chimney. Before reaching the aspirator a portion of the chimney gases was tapped by a smaller aspirator and made to pass through a drying tube and two weighed potash apparatuses. An average sample of chimney gases was thus obtained in which the CO_2 was determined.

In this way the operation was continued for about five to six hours, and during the time 200–300 litres of chimney gases were aspirated by the large aspirator, of which 5–20 litres were drawn through the small one. A good fire was maintained all the time, and the gases were aspirated from the first lighting of the fire.

The following is a tabulated statement of the results:—

No.	Carbon Dioxide.			Soot.		Per Cent. of Soot on C. burnt.	Name of Coal.
	Chimney Gases.	Weight of CO_2	Weight of C.	Chimney Gases.	Weight of Soot.		
	Litres.			Litres.			
1	10.0	0.045	0.0102	218.0	0.0155	6.9	"Silkstone Harb" (Yorks).
2	10.5	0.0435	0.0097	282.5	0.0267	10.2	
3	9.5	0.037	0.0082	249.5	0.0174	8.0	
4	7.0	0.0485	0.0118	231.0	0.0228	5.8	
5	7.5	0.058	0.0143	161.5	0.0292	9.3	
6	7.5	0.060	0.0148	182.5	0.0219	6.0	"Haigh Moor Best" (Yorks).
7	5.0	0.037	0.0091	175.0	0.0247	7.7	
8	6.5	0.0515	0.0127	278.5	0.0278	5.1	
9	16.0	0.118	0.0289	240.0	0.0243	5.6	"Harvey Seam" } (Durham).
10	6.5	0.053	0.0131	230.5	0.0227	4.8	"Hutton Seam" }
11	6.0	0.0375	0.0090	262.0	0.0282	7.1	"Best Deep Yard" }
12	6.0	0.0475	0.0118	230.0	0.0232	5.1	"Best Arley" } (Lanes).
Total.	98.0	0.6305	0.1536	2744.0	0.2814	6.5	Mean.

In column 4, the carbon in the carbon dioxide of the air calculated at 0.04 per cent. and measured at 20° , is deducted.

Gas Fires.—The use of gas in place of coal has often been suggested as a remedy for the smoke nuisance. Many people profess an objection to gas fires either from experiencing a real feeling of discomfort or from purely sentimental reasons. It has been alleged, moreover, that carbonic oxide is given off into the room from gas fires—a statement which, if true, would manifestly condemn their use. It is impossible to ascertain or explain the cause of, and therefore to controvert, sentimental objection; but the other points may be easily tested, *i.e.*, as to the evolution of carbonic oxide and as to the cause of physical discomfort.

Through the kindness of Messrs. Wilson and Sons, we have been able to test their gas stoves for carbonic oxide, and to make a rough comparison between three different species of gas stoves which they supply and coal fires as regards heating effect, from the point of view of economy and health.

We may say in parenthesis that we have no further object in naming Messrs. Wilson and Sons beyond acknowledging their readiness to supply us with all necessary apparatus and full permission at the outset to publish our results, whether prejudicial to their interests or not.

Carbonic Oxide.—We may state briefly that there is practically no carbonic oxide passing from a gas fire; *i.e.*, the volume does not amount to 0.01 per cent. of the flue gases with the full pressure of gas and burning 42–44 cb. ft. an hour.

When the gas is first lighted with slight explosion and the gases immediately aspirated for about two minutes from the front of the fire above the clay rings, an average of 0.9 per cent. of carbonic oxide was found.

Gases aspirated from within the clay rings contained on the average 10.5 per cent. of carbonic oxide.

We attach no importance to this, as, from experiments made at the College, samples of gases may be drawn from

the interior of a coal fire containing as much as 6 per cent. of carbonic oxide, none of which, with a reasonable chimney, ever finds its way into a room.

It will be readily understood that with a down draught unburnt hydrocarbons and carbonic oxide may be wafted into the room from a gas fire and probably also from a coal fire. The following tables contain the experimental results. A preliminary examination of the gases from the gas fires was made with Hempel's gas apparatus, by the palladious chloride and with hæmoglobin tests, with the following results:—

I.—Estimation of Carbonic Acid and Carbonic Oxide with Hempel's Gas Burette.

	Flue-Gases.		Gases from the centre of the Fire.
Carbonic acid.....	4.5 per cent.	4.7 per cent.	5.07 per cent.
Carbonic oxide.....	Trace	Trace	(not determined).

II.—"Palladious Chloride" Test for Carbonic Oxide.

Time of Absorption.	Flue-Gases.			Gases from top of Fire immediately after lighting.
	30 minutes.	45 minutes.	240 minutes.	74 minutes.
Indications of carbonic oxide due to blackening.	Very faint grey stain.	Faint grey stain.	Distinct grey stain.	Deep black stain.

III.—Hæmoglobin Test.

The flue-gases were aspirated through tubes containing calcium chloride, strong sulphuric acid, and soda lime, and finally through a flask containing a solution of blood.

Only the faintest indication of the presence of carbonic oxide was detected in *ten* litres of the flue-gases.

It was found possible, by this test, to detect with certainty less than 1 c.c. of carbonic oxide in *ten* litres, or 0.01 per cent.

We are indebted to Messrs. C. E. Brittain and H. de H. Boyd for carrying out the hæmoglobin tests.

IV.—Quantitative Determination of the Amount of Carbonic Acid and Carbonic Oxide in Flue-Gases.

In these experiments the flue-gases were aspirated through a brass tube of about $\frac{1}{2}$ in. diameter, inserted in the flue-pipe about 2 ft. above the aperture of the stove. The end

inserted in the flue-pipe was closed, and a narrow slit about 4 ins. long was cut longitudinally, through which the gases could be drawn off.

After passing the brass tube, the gases were aspirated successively through an empty vessel to condense moisture, drying-tubes, containing calcium chloride, and strong sulphuric acid, and eventually the carbonic acid present in the flue-gases was absorbed in the weighed potash-bulbs (A). After again drying, the residual gases were oxidised by passing over heated copper oxide in an ordinary combustion furnace, the water and carbonic acid thus formed being estimated by absorption in the calcium chloride tube (C) and the potash bulb (B) respectively.

The apparatus was finally connected up to an aspirator, and a gentle stream of gas maintained throughout each experiment, the total volume aspirated being measured in each case.

	I.	II.	III.	IV.	V.	VI.
Rate of consumption of gas, cu. ft. per hour	44.0	43.6	44.0	42.5	42.2	42.8
Volume of gases aspirated	6,000 c.c.	5,750 c.c.	1,750 c.c.	6,000 c.c.	5,100 c.c.	4,000 c.c.
Weight of carbonic acid (A)	Grms.	Grms.	Grms.	Grms.	Grms.	Grms.
Weight of carbonic acid (B) (oxidised carbonic oxide) ..	0.4235	0.4315	0.1125	0.473	0.4078	0.3172
Weight of water (C)	Nil.	0.001	0.0025	0.0067	0.0060	0.0048
Weight of water (C)	0.0105	0.0175	0.0125	0.0052	0.0058	0.0053

The percentage of carbonic acid is given from the weight of A. If the increase in weight of B is due to oxidised carbonic oxide, the percentages will stand as follows:—

Percentages.	I.	II.	III.	IV.	V.	VI.
Carbonic acid	3.58	3.83	3.26	3.91	4.05	4.02
Carbonic oxide .....	..	0.005	0.046	0.036	0.038	0.0385

Average per Cent.
Carbonic acid... 3.99
Carbonic oxide... 0.037

Owing to the large amount of water formed after passing the gases over the hot copper oxide, we concluded that either, (1) unburnt hydrogen, (2) saturated hydrocarbons, or (3) unsaturated hydrocarbons, were present in the flue-gases. We endeavoured to prove the presence of olefines in the gases by absorption with fuming sulphuric acid in a Hempel's gas-burette, with the following results:—

V.—Percentage of Olefines.

	I.	II.	III.	IV.	V.
Percentage	0.5	0.3	0.2	0.1	Trace.

It appears, therefore, that there is a small and variable volume of unburnt gas in the flue-gases, which will account for the formation of carbonic acid and water after contact with the copper oxide, and does not necessarily point to the presence of carbonic oxide.

VI.—Analysis of the Gases drawn from the Middle of the Fire.

	I.	II.	III.	IV.	V.	VI.
Weight of carbonic acid (A)	Grms.	Grms.	Grms.	Grms.	Grms.	Grms.
Weight of carbonic acid (B) (oxidised carbonic oxide) ..	0.009	0.0675	0.1455	0.340	0.067	0.213
Weight of water (C)	0.424	0.2035	0.5705	0.6985	0.327	0.3585
Weight of water (C)	0.0875	0.1595	0.2675	0.634	0.627	0.1025
Percentage of carbonic acid	Determined by Hempel's apparatus, 5.07 percent.					
Percentage of carbonic oxide	13.81	14.02	12.65	0.935	15.74	5.43

VII.—Analysis of the Gases from above the Clay-Rings immediately after lighting the Fire.

Percentages.	I.	II.	III.	IV.
Carbonic acid	2.6	6.6	3.6	1.4
Olefines	Trace	Nil	Nil	Nil
Carbonic oxide	1.0	1.7	0.6	0.4

Comparison of the Heating Effect of Gas and Coal Fires.

Comparative determinations have been made with special reference to—

1. Rise of temperature of the air in different parts of the room.
2. Heating effect by radiation.
3. Dryness of the air.
4. Draught into the chimney.

The gas stoves tested were of the following kind:—

A. "Parisien" stove, the special feature of which is a perforated top, through the cylindrical apertures of which a constant circulation of air is effected, which then passes into and helps to warm the room.

B. "Comely" stove, similar to A, but without perforated top.

In both A and B the body of the stove is fixed in front of the old fire-grate, and the hot metal will assist more or less in warming the air.

C. "Canopy" stove. This is a new form of gas fire. It has eight instead of six atmospheric burners, as in A and B, but of rather smaller dimensions, and clay-rings; but it is fixed back in the old fire-place, and delivers not only its combustion products directly into the chimney, but the warm air from the hot metal also passes up the chimney. Further, it has a reflex and not a vertical fire-clay back, which is much longer than in A and B. In short, it is a shallow coal fire-grate burning gas and heating by radiation like a coal fire.

D. The ordinary old-fashioned coal fire-grate with vertical back, and both back and sides above the grate of cast iron. In moderately cold weather it consumes about 2 lb. of coal an hour; with hard firing that quantity would be doubled. Coal used was Haigh Moor best.

The gas-fires A, B, and the coal-fire, were tested on the same day and under approximately the same conditions.

Gas-fire C, which had not then been made, was tested on a later date along with B and the coal-fire.

The full details of the experiments will be found in the tables that follow.

The results may be briefly summarised as follows :—

Draught.—The chimney draught plays an important part in the heating of a room, and we will first refer to this :—

1. Although there is a rapid current of air, sufficient to extinguish a lighted taper, through the narrow exit into the flue of the gas-stoves A and B, which delivers the products of combustion to the chimney, the amount of air from the aperture only passes at the rate of about $3\frac{1}{2}$ cb. ft. per minute, measured by an anemometer.* The flow of air towards the front of a gas-stove was in these two cases so slow as to give no indication whatever with the anemometer.

Consequently, if the chimney space behind the gas-fire is blocked up, except for the flue-pipe, there is practically no ventilation of the room by way of the chimney.†

On the other hand, if the chimney is not blocked, the current of air is as follows :—

	Cb. Ft. per Minute.	
	Door of Room closed.	Door of Room open.
A burning 22—3 cb. ft. gas	105	123
B " " "	133	166
C " 20 " "	132	160
D " 2—3 lb. of coal { small fire. .	160	180
	200	235

Rise of Temperature of the Air.—The average rise of temperature indicated by thermometers (previously compared) and distributed through the room was as follows :—

	Mean Rise of Temperature in Degrees Centigrade.			Cb. Ft. of Gas burnt.
	1st Hour.	2nd Hour.	3rd Hour.	
A, January 3.	1'82	2'31	..	22½
B, " "	1'60	1'81	..	20
D, " "	1'00	1'37	1'4	..
				Moderately fired.
B, January 19	2'2	2'6	..	24
C, " "	1'4	1'6	..	19
D, " "	0'7	2'0	..	..
				Strongly fired.

The sets of experiments on the two days are not comparable, as the initial temperatures were very different, and the rise from the lower temperature in the second set was greater than in the first. As the room is over the kitchen, and gets a certain amount of heat from below, what was thought the least effective heating apparatus was tested last.

Dryness of the Air.—The first set of experiments were made when the outside air was nearly saturated with moisture (temp. 10·5; wet bulb 9·75). The difference between the wet- and dry-bulb thermometers in the middle of the room increased with rise of temperature of the air. The difference, as might have been anticipated, was greatest in the case of A and B in the first set and B and D in the second.

* The same anemometer was used throughout these experiments, and was roughly tested beforehand by fixing it on a long projecting plank in front of a railway carriage, driven forwards at a known speed, over an open track, on both up and down lines, for about five miles each way, so as to correct for the wind. The error of the anemometer for ten miles an hour was about 10 per cent. too low. We give the anemometer readings without corrections, as they are merely for comparison, and do not pretend to absolute accuracy. We have to thank the assistant engineer of the Lancashire and Yorkshire Railway, Mr. W. B. Worthington, for his assistance in making these tests.

† We have had no opportunity of testing the draught through gas-fire C, as it did not fit the fire-place, and air circulated around the sides and top and back. It would probably be much greater than in A and B, as it has a much wider aperture.

Difference between Wet and Dry Bulbs.

	Degrees.		Degrees.
A	5'0	B	5'3
B	5'0	C	4'2
D	4'5	D	5'2

Heating Effect by Radiation.—This was determined by suspending thermometers a yard from the fire at a height of 1 ft. and 3 ft. above the ground. There was little difference between the gas-fires and a bright coal-fire, except that the temperature was always rather higher near the floor than 3 ft. above in the case of the gas-fire, and often the reverse with the coal-fire. With an ordinary coal-fire a much lower temperature was obtained than with the gas-fire burning 20—23 cb. ft. an hour.

	1 Ft. above Ground.	3 Ft. above Ground.	
B	24'4	22'6	22—3 cb. ft. per hour.
C	23'0	22'0	20 " "
D	24'5	24'5	Bright fire.
	19'5	20'2	Rather dull fire.

Gas-Fire Experiments.

The room measured 14 ft. × 14 ft. × 10 ft. high, and, in addition, a small bow window.

The thermometers were compared for correction and distributed as follows :—

- a. Middle of the room, 3 ft. from ceiling.
- b. Middle of the inside side wall, 4 ft. from floor.
- c. Middle of the room, 4 ft. from floor; wet and dry bulb.
- d. Middle of outside side wall, 4 ft. from floor.

January 3, 1896.—Wet and dry bulb outside indicated at midday: wet, 9·75°; dry, 10·5°.

Temperature outside varied during the day 10°—11°.

One person was in the room during all the experiments.

The temperatures given are in degrees centigrade.

"Comely" Stove.

Time.	a.	b.	c.		d.	Gas consumed per Hour.
			Dry Bulb.	Wet Bulb.		
6 a.m.	18'0	18'1	18'25	14'25	18'2	..
7 " "	20'1	19'5	20'6	15'6	19'0	20 cb. ft.
8 " "	20'3	19'7	20'6	15'6	19'2	20 cb. ft.

The room was allowed to cool two hours and the stove changed.

"Parisien" Stove.

10 a.m.	18'0	17'7	17'7	13'9	17'7	..
11 "	19'6	19'4	20'4	15'5	22'2	22'5 cb. ft.
12 noon	20'25	20'0	20'7	15'7	19'4	"

The room was again allowed to cool and the coal-fire lighted.

Coal-Fire.

Time.	a.	b.	c.		d.	Coal consumed per Hour.
			Dry Bulb.	Wet Bulb.		
2.30 p.m.	18'25	17'5	17'75	14'0	17'7	} About 6 lb. of coal burnt in 3 hours.
3.30 " "	19'3	18'7	19'2	15'0	18'2	
4.30 " "	19'6	19'2	19'6	15'5	18'5	
5.30 " "	20'0	19'2	20'0	15'5	18'8	

January 19, 1896.—The outside temperature varied from 11·7° to 6·5° during the day.

"Canopy" Stove.

5.45 a.m.	15'8	15'5	15'3	11'5	15'3	..
6.45 "	17'4	16'6	17'2	13'0	16'3	19 cb. ft.
7.45 "	17'7	16'7	17'4	13'2	16'5	19 cb. ft.

"Comely" Stove.

Time.	a.	b.	c.		d.	Coal consumed per Hour.
			Dry Bulb.	Wet Bulb.		
10.35 a.m.	15.4	15.0	14.6	10.7	15.0	
11.35 "	17.5	17.2	17.6	12.5	16.6	24 cb. ft.
12.35 p.m.	17.9	17.1	17.8	12.5	17.3	24 cb. ft.

Coal-Fire.

Time.	a.	b.	c.		d.	Coal consumed per Hour.
			Dry Bulb.	Wet Bulb.		
2.30 p.m.	15.8	15.4	15.3	10.8	15.5	About 6 lb. of coal burnt in 2 hours.
3.30 "	16.7	16.3	15.8	12.0	16.1	
4.30 "	17.3	17.3	17.8	12.6	17.0	

The conclusions we arrive at from these experiments may be briefly stated as follows:—

1. The draught up the chimney plays an important part in the heating of a room.
2. If the fire-place behind the gas stove is closed, except for the flue-pipe, the greatest heating effect is produced; but there is then practically no ventilation by way of the chimney, unless by a special opening into it.
3. If the fire-place behind the gas stove is open, the draught up the chimney is considerable; but rather less than with a coal-fire.
4. In the last case the heating effect with gas stoves A and B is still greater than with the coal-fire, *i.e.*, the air of the room is warmed more quickly and to a higher temperature than with the coal-fire.
5. The heating effect of a gas-fire of type C is less than that of a coal-fire.
6. As regards relative cost in Leeds, roughly speaking, gas is three times as costly as coal comparing equal periods of heating; but, as regards heating effect, the cost of gas will be proportionately less. It is doubtful, even then, if gas is less than twice as expensive as coal.

There is no doubt that a higher heating effect with coal may be attained in modern modifications of the coal-fire on the "reflex" or "lean-to" back principle with small flue aperture, but we had no opportunity of testing this. In the case of a coal-fire the heating is mainly done by radiation and the air of the room is only slowly warmed by contact with walls, ceiling, &c., reaching, after a time, a maximum as is seen in the experiment on Jan. 3, when, during the third hour, no appreciable rise of temperature occurred. With gas stoves A and B, on the other hand, the air gets rapidly warmed and it is therefore necessary to guard against over heating of the air by ascertaining the temperature from time to time and adjusting the gas; for air warmed above a certain temperature is apt to cause a feeling of dryness and discomfort. If the fire-place behind the gas-fire is closed so as to get the maximum heating effect, some opening into the chimney should be contrived by making an aperture at the ceiling level. If the above conditions are observed, a gas-fire is a perfectly healthy heating appliance, more effective and more cleanly, although at the same time more costly than coal. It must be remembered that these experiments on the comparative heating effects of gas- and coal-fires, although carried out with as much care as the circumstances allowed, do not pretend to absolute accuracy. We believe that the general conclusions are correct.

DISCUSSION.

The CHAIRMAN said that it was difficult to make comparisons of the heating effects of the different fires on the same day, as the walls and other parts of the room accumulated heat slowly and only gave it out again slowly, thus tending to increase the effect in the later experiments. Much greater care was needed in the ventilation of a room heated by a gas-fire than when coal was used, owing to the smaller volume of air drawn through the room in the former case. He had found this volume about 10 times that of the gas burnt, while Dr. Cohen only found it about six times.

Prof. A. SMITHELLS said that the subject was one on which definite information was much needed. He had always been sceptical about the escape of carbonic oxide from gas-fires, but there was undoubtedly a difference in the hygienic effects of gas- and coal-fires. There was little doubt that where a flame burnt in contact with a cold surface, a certain amount of the gases escaped complete combustion, but in a gas-fire, where the combustion was in contact with a heated surface, this could hardly occur. It was true that Prof. V. Lewes had stated that unburnt gases (CO and C_2H_2) escape from a flame of coal-gas, burning freely in the air, but Mr. Lewis Wright and he himself had contested this statement, and Prof. Lewes had, in his last communication on the subject, admitted that the quantity was infinitesimally small, but still held that it might be sufficient to affect delicate constitutions. Dr. Cohen's experiments seemed, however, to show that the hygienic effects observed were rather due to the different ventilating effects.

Mr. W. McD. MACKEY thought that the main defect of gas-fires was that they did not secure efficient ventilation.

Mr. G. WARD thought that more satisfactory results would be attained if the experiments could be made with equal quantities of air passing up the flue.

Dr. J. B. COHEN, in reply to the Chairman, stated that he had purposely favoured the least efficient heating apparatus, viz., the coal-fire, by placing it last. Referring to Prof. SmitHELLS' remarks, he pointed out that the numbers which he had obtained showed that a gas-fire, when the fire-place behind it was not closed up, caused a flow of air through a room which was not very much smaller than that caused by a coal-fire. The difference in their hygienic effects was more probably due to the fact that the heating effect of a coal-fire reached a comparatively low maximum, while with a gas-fire the temperature might be raised much higher. If Mr. Ward's suggestion had been followed it would have defeated the object of the experiments, which was to find how the gas- and coal-fires as ordinarily used differed in their effects not only in heating but in ventilating a room. He also thought it was rather a grave error to regard a coal-fire as an efficient ventilating apparatus, for in the first place it produced a much more rapid exchange of the air in the room than is generally necessary, and secondly, this exchange is mainly near the ground, causing disagreeable draughts, instead of at the ceiling, where the ventilation is really needed.

APPARATUS FOR THE DETERMINATION OF THE RELATIVE LIABILITY TO SPONTANEOUS COMBUSTION OF OILS SPREAD ON COTTON WOOL.

BY WILLIAM McD. MACKEY.

In a paper read 30th Nov. last (Vol. XIV., 940) I described a method of examining cloth oils for their liability to spontaneous combustion when spread on cotton, but in the experiments then given I used an ordinary hot-water oven. Profiting by some of the suggestions made in the subsequent discussion, particularly one by Mr. F. W. Branson for an arrangement of tubes to induce a current of air, I have devised the apparatus now shown.

The apparatus consists of a cylindrical metal water-bath (this one is made of copper, tinned inside).

Section shown Fig. 1.

Dimensions:—Outside, 8 ins. high, 6 ins. diameter; inside, 7 ins. high, 4 ins. diameter. Pipes A and B, $\frac{1}{2}$ in. internal diameter and 6 ins. long, measured from the lid. The depth inside with the lid on is $6\frac{1}{2}$ ins. A lid (Fig. 2) packed with asbestos wool fits on the top, and the tubes A and B serve to ensure a current down B and up A. Care should be taken in using the apparatus that the steam from the water jacket is neither sucked down B nor warms A. C is a cylinder made of a piece of wire gauze (24 to the inch) 5×6 ins., forming a roll 6 ins. long and $1\frac{1}{2}$ ins. diameter. In the cylinder I place 7 grms. of cotton wool—ordinary

bleached cotton wadding—previously soaked with 14 grms. of the oil under examination, the wool occupying the upper $4\frac{1}{2}$ ins. of the cylinder.

Fig. 1.

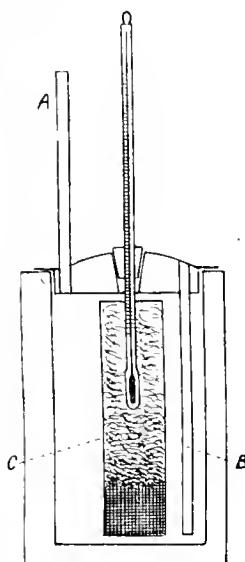
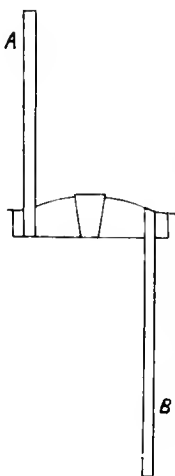


Fig. 2.



The water being brought to the boiling point, a thermometer is inserted in the oily wool contained in the gauze cylinder, which is then placed in the bath, the thermometer being allowed to protrude through a cork in the opening shown in the lid. The bath is left boiling and temperature read after one hour.

In the following table I give the result of experiments on various oils:—

Oil used.	Temperature in 1 Hour.	Temperature in 1 Hour 15 Mins.	Temperature in 1 Hour 30 Mins.	Maximum.
				H. M.
1. Cotton-seed (12)	125	242	..	242 in 1 15
2. " "	121	242	282	284 in 1 35
3. " "	128	212	225	225 in 1 30
4. " "	124	210	..	248 in 1 35
5. " "	116	192	200	200 in 1 30
6. " "	118	191	202	202 in 1 30
7. " "	117	190	194	194 in 1 30
8. " "	112	177	204	211 in 1 45
9. Olive fatty acids (3).	114	177	..	196 in 1 25
10. " "	105	165	..	203 in 1 55
11. " "	102	135	208	226 in 1 45
12. White Australian olein (13).	103	115	191	230 in 1 45
13. Olive (23)*	98	102	104	241 in 3 25
14. Olein (20)	98	101	102	110 in 2 8
15. 97 per cent. olein (17).	98	100	102	172 in 3 15
16. Belgian olein (19)	98	99	100	173 in 3 15
17. Olive (neutral) (21).	98	100	101	235 in 5 16
18. " "	97	100	101	228 in 4 30
19. " "	97	..	101	235 in 4 55

* Containing, roughly, 1 per cent. free fatty acids.

In my paper already referred to I pointed out that as a result of experiment with the apparatus I then used, any oil that either fired or attained a temperature of 200° C. in two hours might be regarded as dangerous.

In this table I give the result of experiments on some of the same oils (the numbers in brackets give the numbers for the same oils in table, Vol. XIV., 940). I should like to have included them all, but my stock of some of the trade oleins I had experimented on I found to be exhausted. I should state, however, that I give all the experiments made, so that 1 to 8, 9, 10, 11, and 17, 18, 19, form groups by which the reliability of the method may be judged.

From the results, then, of these experiments, I conclude that any oil tested in this apparatus, attaining a temperature of 100° C. before the expiry of one hour, may be regarded as dangerous. That would include 1 to 12.

These results tally with those given in my former paper, but the time for arriving at a conclusion has been considerably shortened.

I should state that I find the appliance very useful for testing various kinds of materials, such as oily waste, flocks, leather clippings, &c., suspected of being liable to spontaneous combustion.

DISCUSSION.

The CHAIRMAN said that the apparatus exhibited was very neat and compact, and the mode of experiment described was probably more trustworthy in its results than the actual firing of the oils, because if the heating were once checked it would not go on again. For experiments which were to be pushed to the point of actual firing, a larger apparatus would probably be more suitable.

Scottish Section.

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SESSION 1895-96.

Tuesday, March 3rd, 1896 (Glasgow).—Mr. D. R. Stuart. "The Standard of Flash Point for Mineral Oil."

Meeting held in the Philosophical Institution, Edinburgh, Tuesday, February 4th, 1896.

DR. J. B. READMAN IN THE CHAIR.

OPIMUM ASSAY.

By D. B. DOTT, F.R.S.E., F.I.C.

OPIMUM being one of the most valuable of drugs, and the source of one of the most important of the alkaloids, its accurate valuation has attracted much attention, involving extensive experimental work. The alkaloids of opium vary in proportion, but the following percentages given by Pietet ("Alkaloides végétaux," p. 173) may be regarded as not far wide of the mark:—

Morphine	10
Narcotine	6
Papaverine	1
Codeine	0.5
Thebaine	0.3
Narceine	0.2

The morphine is usually in larger proportion. The alkaloids exist in combination with sulphuric and meconic acids. Although codeine is the only one of the minor alkaloids which is presently in constant demand, further uses may yet be found for some of the others or their derivatives. For instance, while narcotine is of feeble activity, hydrocotarnine, which can easily be prepared from it, has a decided physiological action. But whatever may be the case in the future, opium is at present invariably assayed by determining the amount of morphine which it contains. The processes employed for the purpose have undergone a gradual evolution, so that the methods now in vogue compare very favourably with those of the earlier years of the century. Some of these earlier determinations are quite misleading as the

crude precipitate weighed as morphine does not afford any accurate indication of the amount of that alkaloid actually present. Even now there is by no means unanimity of opinion or uniformity of practice in regard to this matter, although we are rapidly coming to a clear understanding of the subject. Generally speaking, the difficulty attending an accurate assay of opium may be stated: that on account of the chemical conditions in which the morphine exists in the drug it is impracticable to precipitate the morphine in the pure state without an undue and uncertain loss of alkaloid. Various plans have been proposed and tried to overcome this difficulty. Firstly and most obviously, the treating of the crude morphia precipitate with benzene and the like to remove impurities. By this means narcotine and its allies, codeine and resinoid are removed, but the residue is far from being pure morphine. Moreover, it is found that the precipitate obtained by rendering alkaline a mere aqueous extract of opium does not contain the whole of the morphine, or, otherwise, that the separation is so gradual and irregular as not to be complete in a reasonable length of time. Then came the device of adding a relatively large amount of alcohol, or mixture of alcohol and ether to the aqueous solution before precipitating with ammonia. By this means the morphine separates much more readily, in a more crystalline and purer form, than from the watery solution. Petit's process and Flückiger's earlier process partake of this nature. In practice, such methods are quite unsatisfactory. The loss of morphine is considerable, and varies so greatly with the quality of opium, temperature, and circumstances that a true correction for loss is impossible. The introduction of lime in assaying opium is generally attributed to Mohr, and appeared to be a decided improvement. A modification of this process was official in the 1867 British Pharmacopœia. The first improvement on the process was to abolish the boiling with the lime, which was an unwise and decomposing performance; and now, as improved by various chemists, it is a method widely used, and is official in the present British Pharmacopœia. Briefly stated, it consists in triturating a weighed portion of opium with excess of lime and water, filtering, taking what is supposed to represent half the opium, adding to it alcohol, ether, and excess of ammonium chloride, collecting the precipitated morphine, which is dried and weighed. The assay processes for opium being elaborate and troublesome it was very natural that attempts should be made to devise a volumetric method. Morphine is readily oxidised by iodic acid, ferrie salts, permanganate, and bichromate. Mylius suggested the use of iodic acid, relying on the amount of iodine liberated as equivalent to a fixed proportion of morphine. I have tried the addition of excess of bichromate of potash in acid solution and titration with standard ferrous sulphate. But there is uncertainty in all these methods. In the first place, we do not know how much of the oxidation may be due to impurities; and secondly, there is no evidence that a further or secondary oxidation does not occur. Iodine is so apt to react with alkaloids that its liberation from iodic acid by morphine does not appear as a promising plan for the estimation of opium. Even when working with pure morphine I have not obtained very constant or satisfactory results, but I have only tried a few experiments. The subject has not been by any means thoroughly worked up; it is sufficient to say that these indirect methods are not at present of any practical importance. What the analyst now wants, is to get hold of the actual morphine in as pure a state as practicable and weigh it. The method of Teschemacher and Smith ("Chem. News," lviii.) is one of the best for that purpose, and is much relied on. The official U.S. process is substantially the same, and in its present form is mainly due to Dr. Squibb. It consists in exhausting the opium with water, concentrating, adding alcohol, ether, and excess of ammonia; collecting the precipitated morphine, washing with alcohol and with water (both being saturated with morphine), drying, washing with benzene, drying, and weighing. A correction for impurities may be applied by treating with lime-water, which dissolves the morphine and leaves most of the impurities behind.

Considering the useful work that has been done in this subject by American chemists, it was very appropriate that among the first papers contributed to the New York

section of this Society were two able communications on the assay of opium. These were given by Dr. Wainwright (this Journal, 1895, 254), and Dr. Kebler, (this Journal, 1895, 464), and were followed by instructive discussion. I propose to offer a few further comments. In the first place, I would note that the morphinate of lime and ammonium chloride process, formerly official in the United States and now official in the British Pharmacopœia, was condemned by nearly all the speakers, mildly by Dr. Wainwright and emphatically by Dr. Coblenz. The latter stated that the students at college obtained such discordant results by the process that it had to be abandoned, while now by the Squibb method very satisfactory numbers are obtained. Speaking from a more limited experience, I entirely concur in the condemnation. In the first place, the idea of taking half the solution as containing half the morphine of the opium is a delusion and a snare. It is a striking example of the danger of going by theory instead of by experiment. If a given weight of water be added to the drug, the variable amount of soluble matters increasing the volume of the solution will cause appreciable error. Similarly, if the mixture be made up to a given volume, the varying bulk of the insoluble portion will cause some error. But there is some further source of error, and it seems to me to be this. It is well known that it is always difficult to extract the last portions of alkaloid from plant tissues. The process is very little analogous to the washing, say, of a sulphate of barium precipitate, where the chloride becomes quickly so attenuated as to give no perceptible reaction. A vegetable powder after long-continued percolation, still persistently gives up small portions of alkaloid, so that, as a rule, it is not practicable to completely exhaust. This reluctance to part with the latter portions of alkaloid may in some cases be partly chemical, from a small amount of the alkaloid existing as a nearly insoluble salt. It is probably, however, far more generally a physical question due to the manner in which the alkaloid or its salt is fixed in the plant cells, very much in the same way as it is difficult or impossible to thoroughly wash an alkaloidal salt out of animal charcoal. Seeing that the powdered drug does not readily yield its alkaloid even to repeated fresh portions of solvent, it will do so much less readily and very tardily when merely kept in contact with a comparatively strong solution of the alkaloid, so that in any practicable length of time, the drug will not have passed nearly all its alkaloid into solution. The next source of error is the large proportion of solution from which the morphine is precipitated. Morphinate of lime is readily soluble in water, but it is necessary to use a relatively large bulk of water, so that the errors from mass of material, as above referred to, may not be inordinately increased. Thence it results that slight differences in the solvent power of the liquid due to variations in temperature, manipulation, and other circumstances, must distinctly affect the yield of morphine, which is in small proportion to the mother-liquid. In the next place, the larger the amount of morphinate of lime, the greater will be the amount of ammonia liberated by the ammonium chloride, and thus the quantity of morphine held in solution will be increased. It is assumed that morphine is insoluble in ether, but I know that when freshly precipitated and presumably partly amorphous, the alkaloid is by no means insoluble in ether. This is just a possible source of error. Another point as to which there is some doubt, is the proper proportion of ammonium chloride. The amount always prescribed is much in excess of theory, and there is good reason to believe that this excess interferes with the precipitation of the morphine. After all, the morphine obtained in this process, though usually very pure, cannot always be assumed to be the pure alkaloid. Wherefore some process of purification or estimation must be applied, and that brings the method into the same category as others in which the precipitate is rather less pure, but can be readily estimated.

In comparing the related processes of Teschemacher and Smith, of Squibb, and of Flückiger, we have no hesitation in rejecting the last mentioned. Its weak points are the taking of an aliquot portion of the filtrate, too much dilution, and too much alcohol. Dr. Squibb's method has

the advantage over that of Teschemacher and Smith, that it prescribes more definite directions, which tend to constancy of results, and are to be commended in an official process. On the other hand, the Teschemacher and Smith's method has the advantage of greater concentration during the precipitation, which minimises the loss of alkaloid in that operation, and the decided merit of titration of the precipitate with standard acid. There has been some discussion in England as to the inception of the idea of estimating the alkaloid by standard acid, as if it were a recent invention. It was in constant use by the late D. R. Brown, of Edinburgh, 25 years ago, as I had frequent opportunity of observing. All the speakers at the American meetings referred in terms of commendation of the Squibb process, and deservedly so. Dr. Wainwright found the results by the 1890 U.S.P. process to be always higher and more constant than by the 1880 U.S.P. process; the greatest difference of percentage 9.2 : 7.3, and the least 9.4 : 9.0. Admirable as the method is, and altogether superior to that presently official in the British Pharmacopœia, it is still not above criticism. It is rather elaborate, requiring too great an expenditure of time for ordinary practical purposes. I think also it gives results rather under the truth, particularly if corrected by the lime-water treatment. To precipitate about 1 gm. of morphine from over 30 c.c. of solution, containing nearly one-third volume of alcohol and excess of ammonia, is not possible without appreciable loss. Of course there must always be some loss in precipitating an alkaloid like morphine, but the point is that the loss ought to be as small and as constant as possible. This is to be sought for in keeping the solution concentrated and avoiding a large proportion of spirit. The assumption that alcohol saturated with morphine cannot dissolve a further quantity of morphine is not to be implicitly trusted when the spirit has become charged with other matters, and the morphine precipitate may not be entirely in the crystalline state. There is a slight element of risk in this washing with morphiated spirit, more especially should the precipitate be exceptionally impure. Dr. Squibb found the impurity to vary considerably, as indicated by the lime-water test, and Dr. Wainwright found that in a sample of Persian opium the 16 per cent. of morphine indicated was reduced to 11 per cent. when corrected by treatment with lime-water, so that the precipitate which is being treated is not a constant factor. In the American discussion Dr. Squibb received general support in his contention that the morphine should be dried at 60° C., so as to avoid loss of water of hydration. The British Pharmacopœia is certainly wrong in its instruction to dry at 96°–100°, meaning obviously in a water-bath. It has never been the custom to reckon morphine in the anhydrous state. Moreover, morphine loses its water very slowly at the temperature of a water-bath. If anhydrous morphine is desired, then dry at 110° in an air-bath. Of course, if the morphine is to be titrated with standard acid, it does not matter whether it is over-dried or not.

Dr. Kebler's paper entered very fully into the amount and nature of the mineral matter found in the morphine precipitate, and on the determination of the ash as a means of correcting for impurities. Several years ago Dr. C. H. Warden analysed the ash of Indian opium, and found ("Chem. News," xxxviii., 146) the following percentages: — 1.98 Fe₂O₃, 7.13 CaO, 2.31 MgO, 37.24 K₂O, 1.76 Na₂O, 23.14 SO₃, 10.90 P₂O₅, 15.27 SiO₂. In 1881 I contributed a paper (Proc. R.S.E., Jan. 1881) on the salts of meconic acid, and showed how readily that acid forms a basic calcium salt. I have since proved that this basic salt neutralises acids, as one would expect, and that its formation should if possible be avoided, as leading to a slight error in titrating the precipitated morphine with acid. Dr. Kebler found in the morphine (U.S.P. 1890 process) 0.9 to 1.4 per cent. of ash; of the composition: —

Soluble in water (K ₂ CO ₃ , K ₂ SO ₄ , NaCl)	27.88
Silica	0.83
Aluminium phosphate	0.43
Magnesium phosphate	13.45
Calcium carbonate	56.17

It is evident, therefore, that even if the calcium existed wholly as basic meconate, the error in titrating would not

be very serious. But there is a more interesting fact brought out in Dr. Kebler's results, which might almost have been anticipated from Dr. Warden's analysis. I refer to the considerable amount of potassium salt found in the ash. Dr. Kebler does not indicate, but I think there can be little doubt that the potassium would exist in the precipitate as the sparingly soluble potassium-magnesium-phosphate, which would be decomposed when ignited with the organic salts. There would therefore be a small error due to neutral-phosphate in titrating with standard acid. It is difficult to suggest a means of getting rid of this trifling error, which is not open to objection. The slight error due to basic-calcium-meconate may be eliminated by adding a small quantity of ammonium oxalate before precipitating. By this means the calcium is thrown down as neutral-oxalate, which does not interfere with the titration. Dr. Kebler inclines to the belief that determination of the ash, after calculating the carbonate into meconate, is the best means of correcting for impurity in the morphine precipitate, but he admits that titration with acid is nearly as accurate, and much more expeditious. It is evident that in the case of a precipitate containing a good deal of organic impurity, estimation by standard acid would be the better way; while if the precipitate contained basic mineral matter it might be more accurate to correct by an ash determination. The idea of washing the precipitated morphine with lime-water is a good one, though somewhat tedious. By this means the alkaloid is entirely dissolved, and most impurities left behind. I have used baryta-water for the same purpose. Being stronger it has a more powerful solvent action on the morphine, but possibly it also dissolves more colouring matter. Treatment with lime-water or baryta-water may sometimes be useful as a check, but practically I think titration with decinormal acid is the best means for estimating the morphine precipitate.

In the "Pharmaceutical Journal" I have described two methods of opium assay, (XXII. 740 and XXIV. 847) which I have since slightly modified. As they appear to have some advantages, they may be here briefly described.

A. 10 grms. of opium are exhausted with spirit of "proof strength" (920 sp. g.). Evaporate to one-fourth volume. Dilute this with half its volume of water containing .05 gm. of ammonium oxalate, then cautiously neutralise with ammonia so as to leave just perceptibly acid. Allow to stand for an hour, filter, and concentrate to 8 c.c., then transfer to a flask or bottle holding 100 c.c. by means of 2 c.c. water and 3 c.c. alcohol, afterwards adding 2.5 c.c. solution of ammonia (960 sp. g.) and 25 c.c. ether. The flask is corked and shaken occasionally during the next hour. After 18 hours the ether is decanted as completely as possible, the precipitate collected on counterpoised filters, washed with morphiated water and dried. It is then washed with chloroform and dried about 60° C. Finally it may be titrated with standard acid. The success of this method depends chiefly on the careful neutralisation of the solution, avoiding any considerable amount of free acid on the one hand, and avoiding also, on the other, any precipitation of morphine. If these conditions are observed a very pure precipitate is obtained, the treatment with standard acid being almost superfluous. This method is very suitable for the estimation of tincture of opium. I have been accustomed to use neutral litmus paper as indicator in acidifying the morphine. Farr and Wright recommend to add excess of acid, and titrate back with $\frac{N}{10}$ soda, using methyl-orange as indicator.

B. 10 grms. of opium are digested with 30 c.c. water, until all soluble matter has apparently passed into solution. 1.8 gram barium chloride dissolved in 10 c.c. water is added, the mixture diluted and well stirred. It is then filtered, and washed till practically exhausted. The filtrate is warmed, dilute sulphuric acid added in quantity just sufficient to precipitate the barium, the solution filtered and set to evaporate, sufficient ammonia being added to nearly neutralise. When concentrated to 8 c.c. (.05 gm. ammonium oxalate added) it is allowed to cool, mixed with 1 c.c. alcohol and 1 c.c. ether, and then ammonia added till no further precipitate is produced, and a distinct odour of ammonia is present after stirring, and breaking down any lumps that

may have formed. After four or five hours the precipitate is collected on counterpoised filters, washed with morphiated water and dried. It is then powdered, washed with chloroform, dried and weighed. A weighed portion of the precipitate is neutralised with standard acid, and the percentage calculated. The former method gives a purer morphine precipitate which on that account is more easily accurately neutralised than that obtained in the latter method. On the other hand the neutralisation of the solution before concentrating, in order to precipitate resinoid, &c. must be carefully conducted. Should the addition of ammonia be carried rather far, acetic acid must be added to perceptibly acid reaction, so as to ensure that all the morphine is in solution.

The method (B.) has the advantage of being more expeditious, and requiring less work than probably any of the others. The precipitated morphine, however, contains much impurity, rendering the exact neutralisation with standard acid somewhat difficult. Yet it is a good practical process, and sufficiently accurate for most purposes. It may be modified so as to give a purer morphine by first exhausting the opium with water and then adding the barium chloride to the filtrate. This necessitates an additional filtration, but gives an ultimate precipitate containing less colour and impurity. In the case of a comparatively pure morphine, such as is usually obtained in the B.P. or U.S.P. processes, it may make little practical difference whether the correction is by treatment with lime-water or by acidifying with standard acid; but in the case of a less pure precipitate the difference is very marked, as the following figures show. The purified precipitate obtained in method (B.) above described, indicated by washing with baryta water 94 per cent. of morphine, while by titration with $\frac{n}{10}$ acid it indicated only 83 per cent. The same precipitate, after washing with morphiated spirit, indicated by titration 87.8 per cent. of morphine, showing that that method of purification is of very limited value in such a case. It is interesting to note that Dr. Squibb in his "Ephemelis" and Dr. Geisler at the New York meeting have both given numbers which confirm the truth of a note I published (*Pharm. Jour.*) some years ago, to the effect that the formula of hydrated morphine is $B_2(H_2O)_9$, and not BH_2O as generally stated. Dr. Geisler found 6.8 per cent. as the average loss on drying, $B_2(H_2O)_9$ requiring 7.1, and BH_2O requiring 5.9. This gives 305 as the equivalent instead of 303.

It was suggested by Rutherford Hill at one of the evening meetings of the Pharmaceutical Society, that amylie alcohol might afford a good means of separating the morphine in the assay of opium. That is a well-known method of separating small amounts of morphine and similar alkaloids in the analysis of medicines. I have tried it in several different ways, wet and dry, with quite unsuccessful results, largely due to the fact that morphine is very sparingly soluble in that menstruum. It seems scarcely possible to devise an amylie alcohol method which will offer any advantages either as to accuracy or expedition over the best of those presently in use. At least, that is the conclusion at which I arrived.

As regards the extraction of opium with water, my experience does not agree with that of Endemann. It must have been a very exceptional sample of opium which yielded a considerable amount of morphine to dilute sulphuric acid, after being practically exhausted with water. Excess of acid may facilitate the exhaustion, requiring less water for total extraction, but that is the most that can be said. At all events, I have never met with an opium which did not give an acid reaction, and it would be very strange if the morphine could not be extracted by water from such a drug. It is difficult to state exactly the amount of water required to exhaust a given weight of opium, as it depends on the manner in which the extraction is conducted, and on the degree of accuracy desired in the analysis. Less water is required if the opium is exhausted by the pharmaceutical method of percolation than if treated on an ordinary filter. As a rule I regard the 10 grms. of opium as exhausted when the filtrate or percolate amounts to 120 c.c., the opium having been digested with about 40 c.c. of water before percolating.

I append results of assay of a sample of Turkey opium by each of the methods referred to, the numbers representing percentage of morphine hydrate:

B.P.	U.S.P.	T. and S.	A.	B.
11.45	11.23	12.20	12.23	12.43

As regards the purity of the precipitate obtained in these processes, the first three were practically pure morphine, A. indicated 98 per cent. and B. 82 per cent. It is not to be inferred that the relative value of the methods is always exactly as indicated above. The B.P. process is specially liable to give varying results, and is generally relatively lower than above. A process which gives a different result, according as it has been conducted on a cold day or a warm day, or has been continued for 48 hours instead of 24, is of limited value. It is a great fallacy to attach value to a method because it gives concordant results in two experiments conducted under identical conditions. In practical working these conditions cannot be attained. This applies very truly to the morphinate of lime and ammonium chloride process presently official in the B.P. Quite recently several chemists working independently have obtained fairly concordant results with the methods A. and B., but considerable discrepancies with the method B.P. I agree with our American friends that it is not a trustworthy process, and that a process on the lines of the U.S.P. is to be preferred. At the same time I should prefer the method of Teschemacher and Smith, or that described as A., as representing more truly the full morphine-content of the opium, and giving nearly as pure a morphine precipitate. Indeed, if it is permissible to wash the variably impure morphine with morphiated spirit on the assumption that the precipitate loses no morphine or always a constant slight amount (a proposition which I doubt), then the T. and S. process is perhaps as good a one as we possess. I would only suggest the evaporation to a definite quantity, say, seven grams, instead of "a syrupy consistence," and the addition of .05 grm. ammonium oxalate before precipitating. The method A. has the advantage that the morphine is not exposed to the risk of washing with morphiated alcohol, most of the impurities being got rid of by having the morphine first in a spirituous and then in an aqueous solution, and particularly by neutralising the latter. The question naturally arises, may the results of these methods of assay not be vitiated by the presence of certain adulterants? It would be much more difficult to adulterate than at first sight appears. Any inorganic salt added with the intention of increasing the ammonia precipitate and neutralising the volumetric acid, would infallibly give a precipitate with the meconic acid and so draw attention to its presence by the unusual appearance. Probably all the cheaper alkaloids are soluble in chloroform, and would be removed on washing with that menstruum. I am not going to say what I think would be the most likely method of adulteration to escape detection. But in any case of doubt, it would be well to divide the morphine precipitate into three portions; one to be neutralised with standard acid, the second to be washed with baryta water, and the third to be incinerated and the ash weighed. By so proceeding it is scarcely possible that the result could be in error. In conclusion, I wish to express my indebtedness to the writers of the papers before referred to, and to those who took part in the discussions at the New York meetings.

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Meeting held Monday, January 20th, 1896.

MR. A. H. MASON IN THE CHAIR.

THE DETERMINATION OF CAFFEINE IN TEA.

BY E. H. GANE.

THE exact determination of caffeine in tea leaves is attended with great difficulty. Numerous processes have been devised, but as will be seen later, most of these have been based on inadequate information, and are valueless for the purposes intended. The process hitherto almost universally adopted is that devised by Paul and Cownley, which consists in treating the powdered leaves with MgO , and exhausting the dried mixture with alcohol. Two years ago, Allen in an exhaustive paper on caffeine (*Pharmaceutical Journal* LII., p. 213), hinted that this process was open to suspicion, the complete exhaustion with alcohol being in some cases impossible. Having occasion recently to determine the caffeine content of a large number of samples of tea, I have made a thorough study of the above and other processes, and the results are embodied in the present paper.

At the outset I would say that a large portion of my work has been merely confirmatory of the work published in Allen's paper, previously referred to, a paper which I venture to say has not in this connection received the attention it merited. This work may be briefly summarised as follows:—

1. Aqueous solutions of caffeine can be concentrated by boiling, and subsequently evaporated to dryness in a water oven without any loss of alkaloid.

2. Boiling caffeine with lime causes decomposition, the loss varying under different conditions from 20 to 50 per cent. Boiling with magnesia causes practically no change.

3. Admixtures of powdered tea leaves with lime or magnesia cannot be completely exhausted by percolating with solvent, such as chloroform, ether, &c. This fact was first pointed out by Paul.

4. Determinations of caffeine, based on treatment of the leaves with lime and subsequent boiling with water, are valueless owing to decomposition of the alkaloid.

As the above facts have been previously pointed out, a detailed account of confirmatory experiments is not necessary. Finally, as the result of my own observations, based on the examination of a very large number of samples of tea, I have come to the conclusion that the process of determining caffeine in tea by treating with magnesia and exhausting with alcohol, is open to considerable error and should be abandoned.

The difficulty met with in extracting caffeine from the leaves is probably due to its association in the leaf with other bodies, possibly, as suggested by Allen, in the form of a glucoside similar to that occurring in kola nuts; or possibly owing to combination with some tannoid body. Experiments with a view of elucidating this point have met hitherto with but little success.

Zoller (*Zeitschr. Anal. Chem.* XII., p. 106) supposes that the cellular structure of the tea leaf causes the obstinate retention of part of the caffeine, and has suggested a process based on the destruction of the cellulose with sulphuric acid and subsequent exhaustion with alcohol after neutralisation with lead oxide. This process gives accurate results, but owing to the retention of the caffeine by the charred tissue, prolonged treatment with large quantities of the solvent is necessary. This process is too tedious for every-day work.

Herlant's process, based on the solubility of caffeine in sodium benzoate is open to objection that complete extraction cannot be obtained under two weeks' time.

Squibb's process, consisting in boiling the tea leaves for a few minutes with magnesia, is one of the most satisfactory yet devised, the only objection being that the boiling is not continued long enough. Several hours' boiling is necessary to ensure complete extraction.

The method finally adopted as the most satisfactory, and as yielding the best and most concordant results, was that suggested by Allen. The process is as follows:—Six grms. of finely powdered tea are boiled with 500 c.c. of water, using a reflux condenser, for six hours. The decoction is filtered, and the filtrate made up to 600 c.c. Heat to boiling, and add 4 grms. of acetate of lead. Attach to a reflux condenser and boil for 10 minutes. Filter, take 500 c.c. and evaporate to about 50 c.c. Remove the excess of lead by means of sodium phosphate, and finally concentrate to about 40 c.c. The caffeine is then removed by shaking 4 or 5 times with chloroform. Four extractions are absolutely necessary to ensure complete extraction, and it is advisable to use a fifth.

This process I have found to give excellent results. Paul's objection to it that it does not extract all the caffeine seems to be unfounded, for after examination of over 50 samples of tea, I have not in any case found the process yield a less amount than the alcohol process, whilst in some cases it yielded considerably more. From the numerous determinations made, using both Paul's and Allen's methods, I have selected 12 samples as showing the variation in the two processes. The remaining samples yielded practically the same result by both methods. Appended the results are tabulated:—

Sample.	Yield of Caffeine.	
	Paul's Process.	Allen's Process.
	Per Cent.	Per Cent.
1. Black tea dust	2.51	2.55
2. Black whole tea, Japan	2.56	2.89
3. Black Anoy, whole leaf	3.06	3.14
4. Green dust	1.67	2.58
5. Black Congou, whole leaf	3.18	3.36
6. Green Hyson, whole leaf	1.11	2.10
7. Green sweepings	1.52	1.70
8. Black Assam	3.05	3.35
9. Green dust	1.24	2.22
10. Assam, whole leaf	3.93	4.01
11. Ceylon, whole leaf	3.98	4.12
12. Black dust, Japan	1.98	1.96

In the case of samples 4, 6, 9, it will be seen that the yield by Paul's process is very low, compared with that yielded by boiling with water. Complete extraction could not in these cases be obtained with alcohol, although 5 grms. of the tea and magnesia mixture were in these cases treated with 3,000 c.c. of alcohol. Even in ordinary cases, where complete extraction by this method is obtainable, from $\frac{1}{3}$ to 2 litres of alcohol has to be employed to secure extraction of 5 grms. of tea. This in itself makes the process objectionable from its expense. The residual caffeine could readily be extracted from the mixture by boiling with water.

The caffeine isolated by Allen's process can be obtained in a state of perfect purity very readily, but when using the alcohol process it is a matter of considerable difficulty to remove the whole of the green colouring matter. In all cases the residue obtained from the chloroformic solution was purified as carefully as possible. In the case of those obtained by Allen's process the residues were snow white and showed the melting point of caffeine. In carrying out this latter process I have found it advisable in some instances to continue boiling it with water for eight hours, though as a rule, six is amply sufficient. Owing to the slowness with which the decoction filters, I prefer to boil the tea with the whole of the 600 c.c. of water, and to add the acetate to the solution before filtration. This saves considerable time.

In conclusion I would say that the results above given show Paul's statement that water will not completely extract tea leaves to be erroneous. Allen's process is cheaper to work, less tedious, and gives more accurate results than Paul and Cownley's method.

DISCUSSION.

Mr. R. C. Woodcock said that some years ago he had a number of estimations of caffeine to make, and that he

boiled the tea with dilute acid and treated it with magnesia and made the extraction afterwards with alcohol, a most troublesome process. It occurred to him that perhaps the Prolius method might be applied for this purpose; but the difficulty was to break up the combination with the tannin.

Dr. H. SCHWILTZER asked Mr. Gane whether he had tried any other solvents than ether, chloroform, and alcohol for the extraction of caffeine, and whether it was not possible to extract those 5 grms. of tea in the Soxhlet apparatus instead of using 4 or 5 litres of alcohol?

The CHAIRMAN said that Mr. Gane evidently very closely agreed with Mr. A. H. Allen in the whole of his investigations. In some of his statements he thought Dr. Paul agreed with Mr. Allen. The results which Mr. Gane obtained from his samples of tea were very low in comparison with what he had seen reported elsewhere, for whereas by the water process Mr. Gane only spoke of 1.41 as the yield, it had been found as high as 4.30. The only alteration Mr. Gane would recommend to Mr. Allen's process was that the extraction be continued for eight hours instead of six. He considered this subject of great importance to those interested in chemical industries in America. Caffeine was imported to an enormous extent, and if it could be made by such a simple process without the use of alcohol, and enough of it obtained from the sweepings of the tea warehouses, he saw no reason why it should not be manufactured in the United States. He would also like to ask whether acetone had been tried.

Mr. Jas. HARTFORD agreed with the Chairman as to the increase in the consumption of caffeine. Within the last four years it had grown enormously, and it was a matter of surprise that it had not yet been manufactured in America. Two firms had undoubtedly started its manufacture, but gave it up, for what reason he did not know. At that time caffeine was just as dear as it is now. With regard to the sweepings of tea warehouses they did not now play such an important part as formerly, for the demand for caffeine had gone beyond the supply from this source, and the manufacturers now used damaged tea as their raw material.

Dr. G. M. STILLWELL said that his experience was that the extraction of these soluble compounds was facilitated, not by contact with the solvent itself, but with its heated vapour. The solvent did not remain continuously in contact with the material, but was boiled, and the hot vapour passed up through the material and was then condensed again.

Mr. GANE said in reply, that he had tried extracting the tea by boiling with dilute acid, but with no better result than by simply boiling with water. By using alcohol for extracting according to Paul's method it was extremely difficult to get rid of the green colouring matter, as it required several solutions and precipitations to remove it. In reference to the yield, the illustrations he gave were samples of tea dust and could not yield more than 2 or 3 per cent. In some cases the yield from tea had run up to 4 and even 4½ per cent. The tea which was imported into America (mostly Chinese) yielded less than the Ceylon teas reported upon in England. In reference to the manufacture of caffeine in America, he doubted if it were possible, on account of the low yield of caffeine for one reason, and also on account of the small amount of refuse tea obtainable. Very little damaged tea arrived; the bulk being of high price, and of a quality which it did not pay to use for extracting caffeine. The Prolius method he had not tried. He had tried the Soxhlet process, but when mixing the tea with an alkali it was advisable not to apply heat. A better extraction was obtained by using a cold solvent.

Mr. A. H. ALLEN writes that Paul and Cowley's process was the only one previously published by which fairly reliable determinations of caffeine in tea could be made; and he confirms the observation that when tea is made into a paste with lime or magnesia and water, and dried at 100°, chloroform fails to extract the whole of the caffeine, however continued the treatment. Paul and Cowley stated that when magnesia was used alcohol effected complete extraction, their proof of this being that subsequent treatments with alcohol failed to extract more alkaloid. Allen finds that on then treating the mixture with water more caffeine is dissolved out, sometimes in small quantity, but in

other cases as much as 10 per cent. of the whole. Continental chemists still profess to give the total caffeine in tea, though their methods are now proved to yield only from one-third to two-thirds of it.

BESSEMERIZING NICKEL MATTE.

BY H. W. EDWARDS.

From 1891 to 1894 the writer was in charge of a nickel smelting plant, situated near Sudbury, Ontario. The plant consisted of two blast furnaces and a set of Bessemer converters (Manhes' modification) with all the usual equipment.

The ore to be treated for the extraction of the nickel was very typical of the district, a massive pyrrhotite, magnetic iron pyrites, containing in its pure state about 1 per cent. nickel, which occurred as a replacement of an equivalent quantity of iron; copper also occurred to the amount of 2 per cent., in the form of chalcopyrite. As delivered to the furnaces the ore contained about 60 per cent. pyrrhotite and about 40 per cent. gangue, an easily fusible diorite, the assay of the stock thus standing at about 2.4 per cent. nickel and 1.2 per cent. copper. The greater part of the iron in the ore was oxidized by burning in heaps, in the usual way, there being nothing remarkable about this part of the operations except the great size of them. Heaps of 2,000 tons were common and 1 once built one containing upwards of 4,000 tons of ore. Such a heap would burn four to six months and smaller ones eight to 14 weeks. The sulphur contents would be reduced from 22 or 23 per cent. down to 5 or 6 per cent. This burnt ore was fused in the blast furnace in the usual manner at the rate of 90 to 100 tons daily. The products of the blast furnace operation were a slag consisting of a mono-silicate of iron containing from 0.1 to 0.2 per cent. nickel, and a matte containing from 10 to 15 per cent. nickel, 5 to 7½ per cent. copper, both present as sulphides and 65 to 75 per cent. sulphide of iron. It was required to oxidize in the converter the whole of this latter component, or as much of it as could be accomplished in one operation. The blast furnaces were elevated some 6 feet above the general floor level of the smelting shed, each upon a terrace secured by stone retaining walls. We were thus enabled to arrange for the molten matte to run direct from the blast furnaces to the converter.

The converters were of the ordinary Manhes' type mounted upon a travelling carriage. This type has been several times figured in technical publications (for example "Engineering and Mining Journal," New York, Volume 52, page 307) so that it is not necessary to illustrate it again in connection with this paper. Its leading dimensions were—length 7 ft. 3 in.; diameter 5 ft. 8 in.; number of twyers 12; diameter of twyers ¾ in.; capacity, newly lined, 1½ ton, with an old lining three tons. The blowing engine was a double cylinder, simple slide-valve, length of stroke 30 in.; diameter of air cylinders 28 in.; diameter of steam cylinders 16 in.; 25 revolutions per minute would maintain a pressure of six pounds of air per square inch when blowing one converter.

The lining of the converters is the principal point upon which the economical success of the process depends. Its function is not only to protect the body of the converter from fusion, but to supply silica for the formation of a silicate of iron slag. All attempts hitherto (and my experience agrees with that of others), to supply silica in other ways have proved fruitless. If thrown in loose during the progress of the operation the silicious flux merely floats upon the surface of whatever slag is present and has little or no chance to come into contact with the ferrous oxide being formed at the lower portion of the charge. If supplied below the surface, through one or more twyers along with the blast for example, it immediately floats up to the surface of the slag, a small pro-

portion only being able to combine with ferrous oxide during its momentary passage upward. There are also mechanical difficulties in the way of this latter course. Meanwhile, until persistent effort shall result in a better system, it is important to have a cheap supply of satisfactory silicious material. Quartz, sandstone (if sufficiently infusible), or quartzite give excellent results crushed to pass through a sieve having openings of $\frac{1}{4}$ in. or $\frac{1}{2}$ in. in diameter. At Sudbury I used tailings from an abandoned copper mine some 75 miles distant along the railway. These tailings consisted almost entirely of white quartz containing occasional particles of chalcopryite. The material had been pulverised to pass through a sieve of four holes per linear inch.

Analysis of a typical sample—

	Per Cent.
Magnesia.....	1.2
Alumina.....	1.7
Copper.....	0.6
Iron.....	1.7
Sulphur.....	0.35
Moisture.....	4.75
Silica, by difference.....	89.6

Another sample showed 1.2 per cent. copper.

The other ingredient of the lining is clay. Its office is merely to supply the plasticity permitting the mixture to be moulded to the correct shape for forming the lining and holding it in place; of course it has to be an infusible variety. Plasticity is as important as infusibility since, everything

else equal, the more plastic the clay the more quartz can be incorporated into the mixture. Both qualities, plasticity and infusibility, should be of a high order as they have a surprising effect on the life of a lining, the most expensive clays not infrequently giving the cheapest results. Below I give a table showing the costs of 130 linings made of 13 different mixtures with various kinds of clay and quartz.

Description of clays:—

No. 1. White sandy clay containing some undecomposed felspar (albite), slightly fusible at incipient white heat; plasticity moderate: cost per ton delivered at the works, 3 dols. 75 cents.

No. 2. A red clay containing much oxide of iron: very plastic: softens at a full red heat: cost per ton delivered at the works, 4 dols.

No. 3. A grey coloured clay from Silver Creek, Ohio: very infusible: more plastic than No. 1, but not so plastic as No. 2. Cost per ton delivered, 5 dols.

No. 4. From Stourbridge, England: very plastic and very infusible: cost per ton at works, 10 dols.

Description of Quartz:—

A. Massive milky white with much (about 20 per cent.) albite. Cost per ton at works, crushed, $3\frac{1}{2}$ dols.

B. Tailings from the Bruce Copper Mine. Cost per ton delivered, $2\frac{1}{2}$ dols.

C. River sand, very fine, silica 97 to 98 per cent. Cost per ton delivered, 2 dols.

D. Glassy quartz, very pure. Cost per ton delivered at works, crushed, 4 dols.

Mixture.	Clay used for 10 Linings.	Quartz used for 10 Linings.	Cost of the Clay for 10 Linings.	Cost of the Quartz for 10 Linings.	Number of Charges blown on the 10 Linings.	Cost per Charge blown.		
						For Clay.	For Quartz.	Total.
						Dol. Cents.	Dol. Cents.	Dol. Cents.
Clay No. 1 with Quartz A.....	Lbs. 13,500	Lbs. 37,000	Dol. Cents. 25 31	Dol. Cents. 64 75	53	. 48	1 22	1 70
" 1 " B.....	15,000	41,500	28 12	51 87	60	. 47	. 86	1 33
" 1 " C.....	18,500	40,000	34 69	40 00	37*	. 94	1 08	2 02
" 1 " D.....	14,000	36,000	26 25	72 00	82	. 32	. 88	1 20
" 2 " A.....	12,700	38,000	25 40	66 50	51	. 50	1 30	1 80
" 2 " B.....	13,200	41,000	26 49	55 87	39	. 68	1 43	2 11
" 2 " C.....	16,000	40,500	32 00	50 62	34	. 94	1 49	2 43
" 2 " D.....	13,000	38,000	26 00	76 00	48	. 54	1 58	2 12
" 3 " A.....	12,000	39,500	30 60	63 87	81	. 38	. 79	1 17
" 3 " B.....	13,500	41,500	34 42	51 87	75	. 46	. 69	1 15
" 3 " C.....	12,500	38,000	31 87	76 00	86	. 37	. 88	1 25
" 1† " B.....	17,000‡	42,000	31 87	52 50	31§	. 86	1 12	2 28
" 4 " C.....	12,000	43,500	60 00	87 00	98	. 61	. 89	1 50

* Three linings failed altogether on blowing their first charge—want of adhesion.

† In these two cases the clay was mixed to a slurry, and then crushed quartz added. All other mixtures made by mixing dry pulverized clay with crushed quartz.

‡ Estimated weight.

§ Four linings had to be rebuilt before converters left re-lining shop, the overhanging parts falling away while drying.

The quartz and clay, together with sufficient water, are thoroughly mixed in a mortar-mill, or in an ordinary brick-pug-mill. The wet and plastic mixture is rammed into the converter to the proper thickness, and dried in the usual manner.

All the foregoing remarks apply equally to lining converters for Bessemerizing copper matte. Owing to the high percentage of sulphide of iron in low-grade nickel matte the question of linings is much more important than with copper matte where they often have no more than 20 per cent. of sulphide of iron present.

The molten matte is accumulated in the blast furnace in a suitable reservoir, and the converter is placed in position. On tapping the furnace the matte runs into the converter by an iron trough coated with clay. The only objection to this direct method as opposed to its alternative, casting the matte into pigs and remelting it specially for the converters, arises from the inconvenience of not knowing the relative quantities of nickel, copper, and iron sulphides present in the charge. The blowing would be over before one could make any satisfactory assay. Nevertheless, with practice, a fairly regular product was turned out.

The converter, now charged, is wheeled to a bell-mouthed iron chimney, supported on four pillars, where the blowing operation is conducted. Air connection between converter and engine is made by a pair of well-finished flanges fitted

with three bolts and thumb-screws, one flange fixed upon the twyer-box of the converter, and the other to 3 or 4 feet of leather hose leading from the air-receiver. The engine is now started and the twyers immersed beneath the surface of the charge by partial rotation of the converter. The process proper now commences.

Starting with a pressure of air 5 lb. per sq. in., the first stage is marked by brilliant scintillations from the mouth of the converter accompanied by little or no flame or fumes, the agitation being at first very violent, in fact more violent than later on at 7 lb. The brilliant display usually lasts five to ten minutes, but is occasionally much prolonged if the amount of sulphide of iron exceeds 70 per cent. of the charge, and the action would be more violent in proportion as the initial temperature of the charge is higher, and also to the size of the charge. In such circumstances the blast pressure is reduced, sometimes as low as $3\frac{1}{2}$ lb. per sq. in., and the twyers raised so as to present less resistance. I usually found a height of 30 in. of matte above the twyers gave the best results, but in the case of such violent action as I have just mentioned we sometimes had to work for a while with only 10 in. The quieting down was aided by the addition of cold matte to the charge, sometimes in surprising quantities, 30 per cent. of the weight of the charge in more than one instance, all of which would be fused by the heat developed.

The first stage of the operation being over, white fumes and flame begin to appear. The air pressure is then raised to 7 lb. per sq. in., and the twyers immersed to their deepest below the surface of the charge. Now the temperature of the charge begins to rise rapidly, and at this period part of the sulphur seems to be given off as SO_3 , while when the temperature has reached its maximum, or increases but slowly, the proportion of SO_2 appears to diminish or cease. SO_2 is, of course, given off copiously all the time. The flame at first is red; but as the temperature increases it becomes blue or green according to the size and temperature of the charge. The appearance and colour of the flame is no indication of what is going on inside the converter; it can be relied upon only for negative indications. So long as the flame is red, or has any red or pink border, and so long as white fumes are mingled with the flame, there is still a considerable amount of iron in the converter as yet unoxidized; but as both of these appearances cease when the operation is but little more than half accomplished, they are not much practical guide. As the operations progress the fumes decrease and finally cease, leaving the flame of a transparent blue or green colour which is maintained to the end. The end of the operation is judged rather by a perceptible diminution of temperature, not only of the flame, but also of the particles splashed or blown out of the converter, and by the appearance of these particles, which gradually become more frothy, and at last issue in flakes about the size of the open hand. The twyers are then raised above the level of the charge and the blast stopped. After a few moments' rest, to permit the slag and enriched matte to separate, the slag is emptied off, by rotation of the converter, into cast-iron pots, and the rich matte, so far as possible free from slag, into separate pots. The resulting rich matte usually contains but little sulphide of iron, sometimes less than 2 per cent. The slag consists of silicate of iron, the silica being derived from the quartz of the lining, as before explained. The lining lasts from five to seven charges, when it has to be renewed, that is to say, sufficient quartz and clay rammed in to bring the interior cavity of the converter to its original size. For this it is not necessary to remove any more of the old lining than will give a solid bearing for the new material.

The amount of nickel oxidized is trifling, the copper and nickel in the slag being invariably present in the same proportions as in the original and final matte, showing it to be due merely to grains of matte entangled in the slag.

ANALYSIS OF THE RESULTING PRODUCTS.

Final Matte.

	Per Cent.	Per Cent.	Per Cent.
Nickel sulphide	63.8	64.7	64.9
Copper sulphide	32.4	32.1	33.8
Iron sulphide	3.8	3.2	1.3

Slag.

	Per Cent.	Per Cent.
FeO	66.6	67.1
SiO_2	28.5	27.9
Cu	1.1	0.8
Ni	1.9	1.6
S .....	.5	.4

Cobalt when present is perfectly scorified with but little oxidation of nickel, forming a very ready means of commercially separating these two metals. Zinc, antimony, and arsenic in particular are completely volatilized. Bismuth, silver, and gold are completely concentrated along with the copper and nickel.

In treating a lot of very cupreous ore containing copper about 8 per cent., and nickel about $1\frac{1}{2}$ per cent., I succeeded in producing in the converter a crude metallic alloy containing copper 76 and nickel 15 per cent. Another lot from ore slightly different, gave an alloy of 68 per cent. copper and 28 per cent. nickel. Several carefully arranged experiments with ore of similar tenour indicated that with proper modifications, there would be no difficulty in regularly producing a crude metallic alloy of half nickel and half

copper, or two-thirds nickel and one-third copper. The principal modification I would recommend would be the considerable increase in the size of the converters, say, to 5 tons per charge, in order that there might be a greater quantity of heat developed, so that the increased temperature required by the nickel alloy may be attained. It is in some such manner as this that we may hope for cheaper supplies of nickel from the Sudbury district, where immense water power is available for the electrolysis of a crude alloy so obtained. I see no reason why nickel could not be put on the market in some such way as this for about the same price as copper, supposing that the latter were being produced from an ore of similar richness.

The slag from the converters is in every instance returned to the blast furnace along with succeeding quantities of burnt ore. 1,264 tons of coarse matte, containing an average of 70 per cent. sulphide of iron, yielded 300 tons of bessemerized matte, and 1,356 tons of slag. As all the latter product has to be remelted, it will be evident that any efforts to diminish the proportion of slag produced by the converters, will, if successful, have a very important bearing upon the industrial aspect of the process. It naturally occurs to the mind that a basic, or at least neutral, lining in the converter would be beneficial. Unfortunately my experiences with basic linings were not very successful; and I believe repeated experiments by others, treating copper mattes by this process (some of whom had much more favourable conditions than I could command at Sudbury), have been failures. According to my own experiences one great obstacle would seem to be the retarding of the process itself. For example, a normal charge, estimated to require 50 minutes blowing on the ordinary siliceous lining, required $1\frac{1}{2}$ hours on a lining of lime. Such a retardation of the process it will readily be perceived almost halves the capacity of the converter plant while the running expenses for labour and steam power are unaffected. It is rather an interesting feature, and one worthy of a critical examination, this delay in the oxidation of the sulphide of iron in a case where there is no substance at hand to combine with the ferrous oxide as soon as formed. I attribute it to the reduction of the ferrous oxide to the metallic state by the undecomposed ferrous sulphide, a portion of the iron thus having to be oxidized twice over; the reduction, of course, absorbing heat, which still further delays matters, a hot charge being essential for rapid work. A few linings of crushed coke and clay gave, as would be expected, even poorer results, reduction of iron again no doubt. As before explained, efforts to add siliceous flux through the mouth or twyers were not encouraging.

Several years ago details of experiments in this process were published, see "Engineering and Mining Journal" New York, December 29th, 1883 (which quotes from "Le Genie Civil"). I am not able to follow the figures quoted as the results of M. Jules Garnier's experiments. This gentleman appears to have lost half of his copper while obtaining a very satisfactory enrichment of nickel. This is quite contrary to my own experience. Here are his figures. Starting with 50 lb. charges of nickel matte from Sejeu, Norway, containing nickel 16.3 per cent., and copper 5.86 per cent., he gets—

	Per Cent.	Per Cent.
After blowing 5 minutes	Cu 11.00	Ni 30.73
" 10 "	Cu 14.13	Ni 50.80
" 15 "	Cu 11.3	Ni 70.06

the iron being reduced from 22.4 per cent. in the original material down to 1.2 per cent. after blowing for 15 minutes. In the slags he gets:—

	Per Cent.	Per Cent.
After blowing 5 minutes	Cu 0.05	Ni 1.51
" 10 "	Cu 0.50	Ni 3.0
" 15 "	Cu 0.3	Ni 4.0

Now to preserve the same ratio of copper to nickel that he had in his initial charge, he should have finished with a matte of 19.48 per cent. Cu after 15 minutes' blowing, and

not 11.3 per cent. The fact that M. Garnier reports 0.3 per cent. copper in his slag at the end of the operation does not account for it unless his 50 lb. initial charge yielded something like 9 cwt. of slag. Experiments of this kind are not very useful to the general public unless the experimenter publish not only the analysis of his various products, but the weight of each product also.

Another notice in the "Annales Industrielles," 1885, page 290, is about a dozen lines in length announcing that M. Pierre Manhes proposes to treat nickel and cobalt mattes in his recently patented converter for the production of a rich matte free from iron.

These two notices are the only references I can find, and, I think, constitute the literature of the subject up to date.

DISCUSSION.

In reply to a question from the Chairman,

Mr. EDWARDS stated that they had no rapid method for detecting nickel, especially in the presence of a large amount of iron.

AMERICAN PHOSPHATES IN 1895.

BY SAMUEL PEACOCK.

THE annual consumption of commercial fertilisers in the United States is something above two million tons, making use in its manufacture of about 600,000 tons of crude phosphates. Of this quantity about 60,000 tons are imported in the form of phosphatic guanos and the phosphates of Curaçao, Grand Comnetable, &c. The deposits of North Carolina supply about 9,000 tons, and Canada still sends a few thousand tons of apatite over the border. The greater part of the 600,000 tons of phosphates comes from the deposits in Florida, Tennessee, and South Carolina in the following proportion:—

Florida	15
Tennessee	10
South Carolina	75

The quantity mined in 1895 was much below that of 1894, Tennessee alone showing an increased production. On January 1st, 1895, the total Tennessee production had not greatly exceeded 15,000 tons; the production of 1895 was very nearly 50,000 tons.

Though there are many deposits of phosphates in the Western hemisphere, only those in the United States are of considerable importance, so far as is yet known, of which Florida, Tennessee, and South Carolina are the chief. These three deposits have special characteristics, which will serve to keep them all in operation, though any one of the three could perhaps easily supply the whole demand. South Carolina produces a relatively low-grade phosphate, which by ordinary acidulation processes makes an acid phosphate containing from 12 to 14 per cent. soluble phosphoric acid. The situation of the deposit is very favourable for water transportation to all the large cities on the Atlantic coast line, and it is at these cities that the great bulk of the commercial fertilisers are manufactured. Thus, South Carolina must always hold a fair share of the coast-line trade, but it can hope for but little of the consumption of the interior or the foreign demand.

Florida produces a higher-grade phosphate, well adapted for the requirements of the foreign markets, as it is suitable for the manufacture of concentrated superphosphates. Through the five shipping ports, Tampa, Brunswick, Savannah, Fernandina, and Punta Gorda, the foreign market is easily reached, but the local transportation from the mines to the ports is limited by traffic charges.

Tennessee supplies the best crude phosphates of the three fields. It is not only high grade and works up well under the crude manufacturing methods in this country, but it is very cheaply mined and occupies an excellent position for distribution. The fertiliser consumption in the States west of the eastern coast range is rapidly increasing, and the Tennessee phosphates will supply almost the total demand. Of all the three fields, Tennessee alone was practically sold up on the 1st of January; in fact, the

output of 1895 would have been much larger but for a lack of freight cars for shipment. The stocks on January 1st were less than 4,000 tons.

Whatever may have been the cause, and there are many reasons assigned, the American phosphate trade of 1895 was very unsatisfactory. Twelve months ago the (Charleston, S.C.), prices were approximately 3.75 dols. to 4 dols. for crude rock, 4.25 dols. to 4.50 dols. for hot-air dried rock, and 6.50 dols. for ground rock. At present the prices quoted are 2.75 dols. for crude, 3.10 dols. for hot air dried, and 5 dols. for ground, and extensive sales have been made below these figures. The trade conditions at present are such that in South Carolina many of the mining companies have closed their works indefinitely, and the State phosphate inspector recommends a reduction in the royalty of one-half.

In Florida the conditions are scarcely better. Since January 1895 the ruling prices have dropped from 1d. to 1½d. per unit—1.50 dols. to 2 dols. less per ton. Within this month sales are reported as low as 1.90 dols. per ton, which is very probably below *f.o.b.* cost to most of the mines of the State. While the Florida shipments have about equalled those of 1894, the stocks are reliably reported as still very high. At present many of the mines are closed pending some systematic arrangement of the business. Several attempts have been made towards an organisation of the various mining interests, but the condition of the industry at present is such as to practically defeat the best intentioned efforts. There are many small operators who merely surface mine on a royalty, and who abandon the work when the cost of extraction begins to increase. While the individual output may be small, the aggregate counts heavily in the trade, and is used by the manipulators to bear prices.

In Tennessee the producers are hampered somewhat by a lack of capital; a condition likely to be short lived. Production is under the orders, and the immediate business prospects are good. This field is destined to play a very important rôle in the domestic consumption. The annual supply of bone and packing-house phosphates is even now inadequate to supply the fertiliser demand of the West, though this production amounts to above 150,000 tons per year. The fertiliser manufacturers of this section are compelled to use mineral phosphates, and the Tennessee deposit will obviously supply the demand.

DISCUSSION.

Mr. H. W. EDWARDS said that he thought the exports of phosphate to Europe would be largely affected by the increased use of basic slag. Since the introduction of the Thomas-Gilchrist process there had been many thousand tons of this slag produced, the bulk of which was available for fertilising purposes. There were several such works in Pennsylvania and in the south.

Mr. R. C. WOODCOCK called attention to some very interesting results obtained by the direct application of this slag to the land in an exhaustive paper by Mr. Watson Smith, published in the Journal 10 years ago (1886, 464).

Mr. H. W. EDWARDS said that this fertiliser was readily assimilated merely on fine grinding. His information agreed with that of Mr. Woodcock.

Dr. G. M. STILLWELL said that it was a well-known fact that rock phosphates in fine division had been used to a large extent, but the difficulty was that they did not give the same quick return. The fertiliser manufacturers probably did not care to push the sale of these slags. The great object of manufactured fertilisers was to get quick results.

Dr. H. SCHWEITZER corroborated the statement that basic slag was largely used in Europe for fertilising purposes. It had only a small quantity of direct available phosphoric acid, and the large amount needed on the soil might sometimes be very injurious to plant life. If used judiciously, it was of great value, as experiments had proved.

Dr. G. M. STILLWELL added that these raw phosphates were more valuable as top-dressing for grass lands than for arable lands.

DISCUSSION ON PRESERVATION OF FRUIT.

Mr. H. W. EDWARDS stated that he was trying a few experiments on the shipping of fruit from Southern California, and as it seemed to him that the method at present employed was rather crude. Large cars are used, in which is placed more ice than fruit. He understood the freight on a car load of fruit, including ice, from California to New York, was something like 400 dols. He had tried putting the fruit in hermetically sealed cars with nitrogen and other gases, but he would be glad to have suggestions from members as to a more economical method and one which would not affect the flavour or delicate colour of the fruit.

Mr. MAXIMILIAN TOCH said that according to his experience the cheapest method was the use of sterilised air, for if certain germs were not excluded the fruit would begin to decay. He had preserved an apple for several months in air filtered through cotton and heated to a temperature of 300°.

Dr. H. SCHWEITZER stated that he had read a very interesting report on experiments which were carried out in France, and in which that very subject was reported (this Journal, 1895, 880). Grapes and other fruit were hung in a chamber in which was a dish containing a small quantity of alcohol. The fruit kept perfectly for some months without a trace of decomposition.

Dr. W. M. D. HORNE stated that he had had occasion to experiment on similar lines. A large shipper of olives asked his assistance in finding a method for preserving them. Olives are not picked until they are about ripe, and are then treated with salt water. After about three weeks they are very apt to spoil. It occurred to him that this was due to micro-organisms, so he carefully washed the salt water off, and then put the olives into sterilised water in sterilised bottles, with a small amount of antiseptic, 80 per cent. alcohol, boric acid, salicylic acid, and so on; but the olives became mouldy and spoiled. Successive sterilisations at low temperatures were more successful. The olives remained perfectly good in appearance until the water had all evaporated. He was inclined to think that this was a more promising method of preserving fruit than in salt water.

Dr. H. ENDERMANN stated that the method of preserving olives must be entirely different from that employed for food, which was always acid. In the case of the olives the treatment which they received rendered them alkaline. After the olives have been harvested they are laid in an alkaline solution and a good deal of tannin is extracted, and if the olives are examined it is found that the exterior of the olive has no alkaline reaction. It would be easier to preserve food, which is acid, than to preserve these alkaline foods.

Mr. E. H. GASE recommended the use of chloroform vapour.

Dr. H. SCHWEITZER stated that he had also had some correspondence on this subject of the preservation of olives. One of the largest growers in the country told him that first the olives were put into an alkaline liquid and after they were taken out they were treated with hydrochloric acid until a faint acid reaction was obtained.

Dr. H. ENDERMANN stated that this neutral reaction was only on the surface. Inside the olive the reaction was decidedly alkaline.

Mr. R. C. WOODCOCK said that a 1 per cent. solution of formaldehyde would keep any food perfectly, and that it was not improbable that it might be used with advantage for the preservation of fruit.

Dr. H. SCHWEITZER stated that its poisonous qualities would hinder its being used.

Mr. R. C. WOODCOCK said he thought not in such small quantities.

Mr. M. TOCH stated that he knew of no method which would yield more favourable results than that of sterilisation, and that fruit with an unbroken rind was impervious to germs.

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I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Acid-resisting Lining for Metallic Vessels, A New or Improved. R. Preston and T. Thornley, Bury. Eng. Pat. 21,477, Nov. 8, 1894.

This acid-resisting lining is formed by a mixture, in various proportions, of commercial asbestos, litharge, and a solution of silicate of soda or potash, or both, with or without the addition of either or both an insoluble silicate such as slag or sand, and a suitable insoluble sulphate such as sulphate of lime or of barium.

The following proportions have been found to give the best results in practice:—Asbestos, 20 parts; litharge, 10 parts; crushed slag, 70 parts. These ingredients are ground or mixed together, and a sufficient quantity of the silicate solution is added to form a paste, which, when applied to the walls of the vessel, adheres firmly thereto, dries quickly, and when dry, resists the action of ordinary mineral acids, and the effects of changes of temperature.—S. P. E.

Filtering of Liquids, Improvements in or relating to. A. J. Boulton, London. From A. Haacke, Celle, Germany. Eng. Pat. 1407, Jan. 21, 1895.

WHEN it is desired to clean the filtering medium or filter on which is deposited a coating of intercepted impurities, steam or air is applied in an opposite direction to that of the normal flow of the liquid through the filter, whereby the coating with the accumulated impurities is removed, without opening the filter casing. If steam be used, the filter is also sterilised.—R. S.

Heating, Evaporating, Distilling, and Condensing [principally Sugar Juices], Improvements in Apparatus for. F. H. Eydman, Weg Delft, Holland. Eng. Pat. 2723 Feb. 7, 1895.

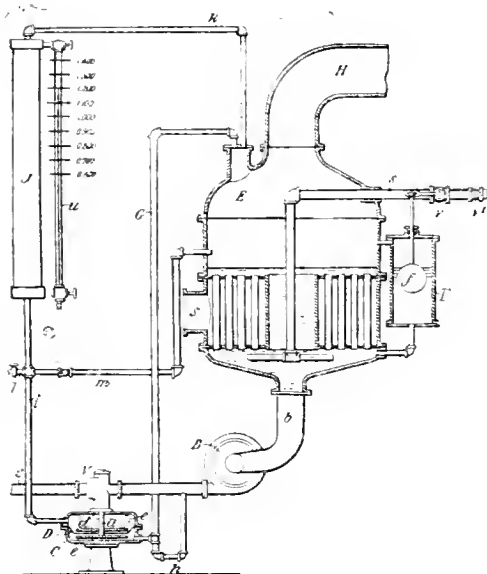
In tubular heating, evaporating, distilling, and condensing apparatus as usually made, where the steam is outside, and the liquid passes through the tubes, there are two great disadvantages: (a) The accumulation of a film of condensed

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reade Lack, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

water on the outsides of the tubes, which film acts as a non-conductor of heat, and (b) The deposition of solid matter on the insides of the tubes. The former objection is obviated by arranging troughs, gutters, flat sheets, or channels below the tubes to collect and carry away condensed water; and to ensure that the condensed water is rapidly passed into the troughs, looped-shaped wires, thin flanges, or helical flanges are arranged on the tubes and dip into the troughs or the like. The latter objection is obviated by not allowing the liquid to evaporate within the tubes, but in a separate evaporating chamber, to which it is led by a tube provided with a self-acting valve. The liquid is forced through the tubes so as to completely fill them, and preferably travels at a speed of from 5 to 10 feet per second. To prevent priming and loss of material, a safety arrangement is employed in the evaporating chamber, consisting of layers of corrugated or coiled wire-cloth with meshes of different sizes, the corrugations in the various layers being arranged crosswise. This wire-cloth takes up the whole space above the boiling liquid to the vapour outlet. When no deposit is formed on evaporating, the apparatus may consist only of a tubular heater below and an evaporator with wire-cloth above. The arrangement can be used with multiple-effect apparatus, or with apparatus having the steam inside the tubes and the liquid outside; and is suitable for treating sugar juice, for surface condensers for steam engines, and for other purposes.—R. S.

Continuous Concentration of Liquids, Improvements in Methods and Apparatus for. S. M. Lillie, Philadelphia, U.S.A. Eng. Pat. 2824, Feb. 8, 1895.

THIS invention relates to apparatus in which the solution undergoing concentration has a practically continuous flow through the evaporating apparatus, the rate of flow varying with the rapidity with which the apparatus is working and with the degree of concentration desired. The rate of flow is regulated, and consequently the density of the concentrated solution, automatically, by means of the weight of the solution leaving the apparatus.



In the vacuum evaporating apparatus shown, the liquid enters by a tube *s*, provided with a hand valve *v*¹, and another valve *v*, automatically controlled by the float *f* in the chamber *F* and by connecting levers, the chamber being in communication with the bottom of the evaporating chamber *E*, so that as the level of liquid in this vessel rises or falls, the supply is cut off or increased, whereby the level is kept constant. The pan *E* is provided with two plates connected by tubes, and steam is admitted by the main *S* to the space between the plates surrounding the

tubes, while the vapour evolved passes away through the main *H*. The concentrated liquid is carried away through a tube *b*, and driven by the centrifugal pump *B* through the tube *c*, a balanced piston valve *V* regulating the flow. This valve is operated automatically by the rise and fall of a weighted flexible diaphragm *D* in the air-tight chamber *C*. The lower part of this chamber is connected by a tube to an upright tube *G*, which is open at the top to the space above the liquid in the pan *E*, while below, it is connected to the liquid outlet therefrom. The liquid rises in the tube *G*, and thus there is a greater or less tendency, according to its density, to raise the diaphragm, and thereby cut off or open the flow of liquid past the valve *V*. The upper part of the chamber *C* is connected to a vertical tube *i*, and water or counterpoise column *J*, the top of which is also in communication with the vapour space in the pan, and is provided with a gauge-glass *u*, marked for specific gravities. By means of the valves in the water connection *l* and in the drain pipe *m*, the column *J* may be filled to any height with water, and the level of the latter changed as required, whereby it will be seen that the density at which liquid can flow through the valve *V* will also be varied as desired. Various modifications are described and illustrated. The improvements may be applied to multiple as well as to single effect apparatus, and are also applicable to extractors or any apparatus in which solutions of substances are made, and in which the density of the resulting solution depends upon the rate at which it is run through the apparatus.—R. S.

Filtering Apparatus, Improvements in. A. Cabane, Adge-Hérault, France. Eng. Pat. 3,510, Feb. 18, 1895.

THESE improvements relate to filtering apparatus operating with or without pressure, and filtering without the use of felt or woven fabric, any quantity, from a centilitre to the largest quantities required, of any non-corrosive liquids, according as use is made of paper pulp, asbestos powder, or sheets of special filter paper. The apparatus consists of a cylindrical body closed by a cover making a hermetic joint, and having a central union for receiving either a pipe when filtering large quantities, or a funnel for small quantities. Below the cover is a perforated disc for distributing the liquid over either reversed cones of wire gauze, a double disc of perforated sheet metal and wire gauze, or a single disc of wire gauze.—R. S.

Drying Superphosphates and other Granular Materials, Improvements in and relating to Apparatus for. C. Zimmermann, Harburg; O. Rupert, A. Borgnis, C. von Merck, and E. Merck, Hamburg, Germany. Eng. Pat. 4429, March 1, 1895.

THE apparatus consists of a vertical chamber provided with a chimney at the top. The material to be dried is shot through a delivery pipe from a conveyor, on to the top inclined shelf of the shaft. It subsequently falls from shelf to shelf owing to the shake imparted to each by a rod which passes through the wall of the shaft and is actuated by a belt pulley and eccentric. The shelves are suspended by chains, the length of which is adjustable from outside the apparatus, so that the inclination of the shelf may be varied in order to accelerate or retard the duration of the drying process according to the nature of the material. The contents of each shelf can be viewed through doors situated on opposite sides of the shaft. At the bottom, the material falls on an inclined plane, and thus passes out of the chamber; the heating furnace is set laterally to facilitate this removal.—A. G. B.

Alarm-Thermometers, and Apparatus connected therewith, for the Automatic Transmission to a Distance of Signals indicating Deviations or Fluctuations of Temperature beyond Predetermined Limits, Improvements in. E. Tempel, Bremen, Germany. Eng. Pat. 13,647, July 16, 1895.

THE thermometer is made with a number of small platinum rods or pins passing through and sealed into the glass tube, namely, two passing into the bulb, and as many as required at any desired distance apart along the stem. These pins project inwardly into the bulb or into the mercury column,

and also outwardly beyond the outer surface of the glass. Two contacts are adjustably arranged upon the glass tube or upon a parallel insulating rod or bar, one for the upper or predetermined maximum temperature, and one for the lower or predetermined minimum temperature. It is necessary, therefore, to signal when the temperature falls below the minimum or rises above the maximum, and to do this the maximum contact and one of the bulb pins form an open circuit through a battery and bell, which circuit is closed when the mercury in the thermometer rises to make the maximum contact; while the minimum contact and the second of the bulb pins form a continuous or constant circuit through a bell working on the closed circuit system and battery; but when the temperature falls below the minimum, the relay armature in the bell leaves its position of rest and closes a circuit through the bell, the first-mentioned battery, and the two bulb pins, thereby sounding the signal.—R. S.

Bituminous Compound Material, Improvements in or appertaining to Apparatus for, and the Art of Treating, Working, and Handling Bituminous or Similar Compounds and Articles made therefrom. E. F. Badgley, A. R. Green, and A. Crockett, San Francisco (Cal.), U.S.A. Eng. Pat. 13,761, July 18, 1895.

The material employed by these patentees consists of various mixtures of asphaltum, bitumen, or petroleum residuum, with earthy and siliceous matter. These ingredients are heated together in a covered vessel and the lubricating and greasy constituents of the petroleum are distilled off. The still is provided with an agitator, and the operation is assisted by passing a blast of hot air through the mass under treatment.

More or less of the oily distillates are removed, according to the use to which the material is to be put; thus, for pavements, enough to prevent the compound from softening under solar heat; whilst for pipes and conduits, which are to be used under ground, more oils may be left in the mass.

When it is desired to make articles, such as "pile covering or armour, fence posts, panels, floor-tiles, slabs for various uses, flower-pots, electrical insulators, railway ties, &c., &c.," the mixture is allowed to flow over sheets of perforated paper, canvas, open-mesh cloth, wire-cloth, or sheet metal unwound from a reel on to a table, which is heated below by a furnace. The sheet is cut up as desired, either by a cutting wheel or by a plate working in a groove. Pipes are made by winding the sheet material one or more times round a core or mandrel.

The patentees' material is readily worked, as it does not stick to tools, &c., if these be hotter than itself, or if they be kept wet.

As soon as shape has been given to the articles under manufacture, they are cooled and permanently consolidated.

The patentees especially claim that greater uniformity of product is obtained by their method than by the older methods.—E. R. B.

Waste Oil or other Fluids, A New or Improved Apparatus for Filtering. T. Atkins and T. A. Harris, London. Eng. Pat. 14,431, July 30, 1895.

This apparatus consists of an outer vessel to contain the impure fluid, and an inner cylinder into which the filtered oil passes. Within the inner cylinder is a filter chamber, which can be screwed down from above into a socket containing a valve. The act of screwing down the filter chamber opens the valve and allows the unfiltered material to pass upwards through the filter and into the inner cylinder, whence it can be run off by means of a tap. The filter chamber contains the filtering material, such as charcoal, sand, &c., placed on perforated plates, "separated by spiral springs of graduated strengths, to enable the filtering material to be compressed to different densities by means of a winged nut and bolt or other suitable means." The whole filter chamber can be removed without disturbing the contents of either the inner or outer cylinders. In order to avoid disturbance of the unfiltered liquid which may be clarifying by precipitation, the unfiltered fluid is carried to the bottom by means of a tube. A layer of water placed below the impure oil facilitates the deposition of heavy particles.—C. A. M.

Evaporators for obtaining Common Salt, and for Analogous Purposes, Improvements in or relating to. T. Scott, Edinburgh. Eng. Pat. 15,197, Aug. 13, 1895.

This specification describes means for operating and cleansing evaporating vessels for concentrated saline solutions when worked by steam heat, by regular and frequent flushing with fresh or nearly fresh water, to dissolve and remove "salt-scale."

Specially constructed evaporators heated by close steam are described and claimed, and also the method of using hot distilled water from the secondary pans of salt evaporators for the purpose of dissolving rock salt to form brine.—R. S.

Vaporising Hydrocarbons or other Volatile Liquids, and Mixing the Vapour with Air for Use in Motors, Improvements in Apparatus for. B. W. Grist, Philadelphia, Penn., U.S.A. Eng. Pat. 16,096, Aug. 27, 1895.

See under 11., page 105.

II.—FUEL, GAS, AND LIGHT.

Coal Ash, Relation between Fusibility and Chemical Composition. E. Prost. Monit. Scient. 1895, 560—565.

THAT the ash be sufficiently refractory, is an important requirement in regard to coal intended for use as boiler fuel. The principal constituents of coal-ash, variations in which influence its fusibility, are— SiO_2 , Al_2O_3 , Fe_2O_3 , CaO , MgO . In a table, the molecular composition of a series of samples (Belgian) is given, together with notes regarding the behaviour of the latter when heated. Three approximately known test temperatures were employed: $1,160^\circ$, $1,350^\circ$ and $1,450^\circ$ — $1,500^\circ$ C.

From these results it is concluded that the degree of fusibility depends on the ratio of—(1) Al_2O_3 to SiO_2 , (2) Remaining bases (CaO , MgO , Fe_2O_3) to Al_2O_3 . In general, the melting point decreases as the percentages of SiO_2 and bases (excepting Al_2O_3) increase, and in this respect Fe_2O_3 has a greater influence than CaO . In presence of very large proportions of "bases"—which are *per se* highly refractory—the fusibility again decreases.

—H. T. P.

Petroleum Oils, The Quality of. R. Kissling. Zeits. angew. Chem. 1895, 563.

A CIRCULAR has recently been issued by Messrs. Dirks and Möllmann, Osnabrück, embodying the results of tests of illuminating petroleum made by B. Kohlmann during the last 12 years, in which it is sought to substantiate the statement that there has been a steady depreciation in the quality of these oils supplied to the German market. The tests, however, as pointed out in the present communication, are limited to "flash points," upon which it is contended there is no public opinion to substantiate. The following table of Kohlmann's results, rearranged from the original, shows that he fails even to establish a steady lowering of the flash point:—

Percentage of Oils with Flash Point under 21°	Year.	Percentage of Oils with Flash Points between 21 and 26°	Year.
6.0	1886	95.4	1894
5.1	1883	93.1	1884
4.6	1892	95.0	1885
3.7	1890	94.7	1893
2.5	1885	91.5	1891
1.4	1888	91.3	1899
1.1	1890	93.0	1889
0.5	1881	88.6	1892
0.5	1887	87.9	1886
0.0	1889	86.9	1883
0.0	1891	83.8	1887
0.0	1893	80.0	1888

Kohlmann's proposal to raise the legal minimum from 21° , as at present, to 37.5° , which is stated to be the Austrian legal minimum, is adversely criticised.—C. F. C.

Nitrogen and the Nitrogen Products derived from Coal. Knublauch. J. f. Gasbeleuchtung, **38**, 753 and 769.

See under III., page 106.

Acetylene, The Toxicity of. L. Brœiner. Comptes rend. **121**, 773—774.

See under XVIII. B., page 131.

Acetylene, The Poisonous Properties of. N. Gréchant. Comptes rend. **121**, [1^{re}], 564.

See under XVIII. B., page 131.

PATENTS.

Water-Gas, Improvements in Apparatus for Generating and Carburetting. W. A. Forinness, Manchester. Eng. Pat. 14,885, Aug. 3, 1894.

The generator has a hollow cylindrical conical-topped base of cast-iron, the cylindrical walls of which are perforated.

The blast (with steam) is admitted to the interior of the base, and is heated by impinging against the lower side of the conical top, upon the upper side of which the mass of hot fuel rests. It issues through the perforations in the wall, into an annular flue surrounding the base, and thence passes up through the mass of fuel.

The carburettor consists of a cast-iron cylinder set in an annular flue, the top of which communicates with the generator, and into which the oil spray for enriching is injected. The iron cylinder has an exit pipe above, and at the bottom, is open to the flue surrounding it.

It is filled with a number of perforated grids, which store the heat required for "fixing" the enriching vapour as it passes, along with the water-gas, through them.

As the producer-gas passes up through these grids, it is completely burnt by an air blast admitted at the lower part of the carburettor. The mode of working is that usually followed.—R. B. P.

Carbides and Illuminating Gas derived therefrom, Improvements in the Production of Metallic. G. B. Ellis, London. From T. L. Willson, New York, U.S.A. Eng. Pat. 16,342, Aug. 27, 1894.

PULVERULENT lime and coke, or coal, are mixed in the proportions of 9 to 6 and heated in an electric furnace consisting of a carbon hearth or crucible, which forms one electrode, and an upright carbon pencil forming the other. Under the intense heat obtainable, calcium carbide is formed, which solidifies in crystalline masses, and on being brought in contact with water, generates acetylene. The calcium carbide produced in this manner is stated to be distinguished from that hitherto produced by its being in the form of a crystalline mass instead of being amorphous and incapable of aggregation into a solid mass, and also by its "almost complete purity." Each pound of carbide will produce 5.8 cb. ft. of acetylene (at atmospheric pressure).

—R. B. P.

Carbides, Improved Metallic, applicable for Use in the Production of Acetylene, and Means of producing the same. T. L. Willson, New York, U.S.A. Eng. Pat. 16,705, Sept. 1, 1894.

The subject-matter of this patent appears to be identical with Eng. Pat. 16,342 (see foregoing), but the third claim is modified.—R. B. P.

Gas [Acetylene] for Illumination, Heating, and other Purposes, and in Apparatus therefor, Improvements in the Manufacture, Distribution, and Use of. T. L. Willson, New York, U.S.A. Eng. Pat. 21,222, Nov. 5, 1894.

This invention relates to the general utilisation of acetylene gas in the place of ordinary coal-gas.

The production of the gas is effected by bringing a suitable metallic carbide in contact with water, and the gas may be mixed with a suitable quantity of air to cause it to burn with a clear flame. The following points, amongst others, are claimed. Distributing the gas under high pressure, and a method of automatically adjusting the rate of production to that of the consumption.—R. B. P.

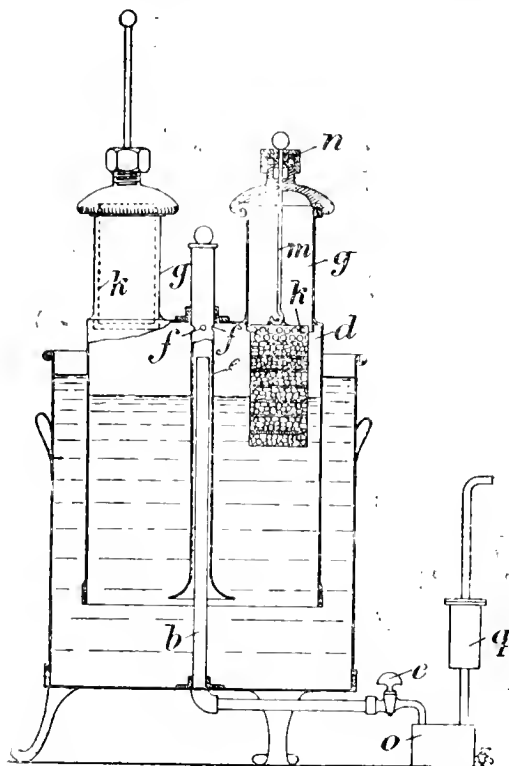
Calcium Carbide, Improvements in Apparatus for Decomposing. H. Gabe, Copenhagen, Denmark. Eng. Pat. 17,746, Sept. 23, 1895.

The patentee's apparatus is shown in central vertical section in the figure, where *d* is a gas-bell, to the crown of which two or more charge-chambers, *g g*, are attached.

The charge-holders, *k k*, are cylindrical vessels with perforated walls, and contain layers of calcium carbide separated by discs of waterproof material.

In using the apparatus, the gland *n* is slackened and the rod *m* depressed so far that the lowermost layer of calcium carbide is immersed in the water; acetylene is now evolved, and the bell and its attached structures rise. If *c* be opened, the gas escapes by the apertures *f f* into *e*, and thence, by *b*, reaches *o*, where it deposits any water carried over; *q* is a filter. The layers of carbide may be successively brought into contact with the water, by manipulating the gland, and, when the charge-holder is exhausted, another may be brought into use.

The above apparatus is intended for domestic use; for larger uses, the same structure of charge-holder is employed, but it is now suspended in a fixed position from the interior of a bell, which is kept immersed in water. The water inside this bell, according to the amount of acetylene



generated, is more or less displaced. There are gas exits, both from the top and from near the bottom of the bell, the latter conducting to a holder, and being for use in the event of the charge retaining water and so continuing the generation of acetylene, at a time when none, or a less quantity of acetylene, is being removed direct from the bell, for use.

—E. R. B.

Acetylene, Automatic Gas-generating Lamp. C. Kaestner, Halle-on-Saale, Germany. Eng. Pat. 18,824, Oct. 8, 1895.

This lamp consists of an upper vessel containing water, attached to a lower one containing calcium carbide. The connecting piece, joining the two vessels, contains an elbow or bent pipe in which is a cock and a non-return valve. This pipe delivers the water to a felt filter; underneath which is a plate, with a single funnel-shaped downward extension. The aperture of the funnel "is made of a size to

correspond with the consumption of gas by the lamp, and in such a manner that only a single drop can form at this place." The acetylene formed by the reaction of the water upon the calcium carbide escapes to the burner by a pipe also provided with a cock. To extinguish the lamp the water is first turned off and then the gas cock.

To prevent the flame from smoking, the gas is made to escape at the burner through "extremely fine holes."

—E. R. B.

Gas, Manufacture of [Petroleum], and Apparatus therefor, Improvements relating to the. J. M. Bosselaar and J. F. M. van der Elshout, Brussels. Eng. Pat. 23,278, Nov. 30, 1894.

THE patentees especially aim at obtaining a relatively very perfect vaporisation of the petroleum immediately upon its introduction to a retort, heated to a "sombre red heat" (800—900° C.). It is, according to them, "not sufficient for the atmosphere merely of the retort to have this temperature; it is necessary that there shall be contact between the petroleum and a suitably heated wall." If the petroleum arrive in the heating chamber in a liquid state at all, it must be drop by drop, or, however thin the wall may be, there will be local lowering of its temperature, and vaporisation of an improper kind will result. Much of such vapours so produced will not be dissociated upon their subsequent contact with the hot walls of the retort, but will condense as soon as they are brought to a lower temperature.

The inventors describe apparatus suitable both for industrial and for domestic installations. The latter has the shape of a doubly-convex lens, and is contained by a protective vessel of like shape. The nozzles of two or more Bunsen burners penetrate the periphery of the outer vessel (the apparatus is disposed with its longest radii in a horizontal plane), and discharge their flames upon the inner vessel, so that this latter is entirely enveloped in flame, and its temperature is raised thereby to the desired red heat. Drop by drop, petroleum is now allowed to fall into the interior of the inner vessel, the orifices of the tubes admitting the petroleum being provided with conical plugs attached to rods passing down the tubes, which rods may be regulated by manipulating screws suitably arranged.

The industrial apparatus consists of two retorts communicating with each other at the end remote from the feed and the gas take-off; the retorts are entirely enclosed in a furnace.—E. R. B.

Gas Generators, Improvements in Oil-feeding Apparatus for. O. N. Gulllin, Fort Wayne, U.S.A. Eng. Pat. 23,455, Dec. 3, 1894.

THE arrangement patented is for automatically controlling the quantity of oil used for enriching water-gas. A meter is used to measure the quantity of oil employed, a steam-pump for forcing the oil into the superheater, and an automatic governor on the steam-inlet of the pump, by the action of which a uniform pressure is maintained in the oil-delivery pipe.—R. B. P.

Liquid Hydrocarbons, and the Production therefrom of Gas and Valuable By-Products, Improvements in and Apparatus for the Treatment of. P. Dvorkovitz, London. Eng. Pat. 23,671, Dec. 5, 1894.

ACCORDING to this invention, by causing petroleum (or other liquid hydrocarbon) to flow through an extensive series of retorts, in which it is progressively subjected to temperatures ranging from 300° C., or even as low, in some cases, "as 150° F.," up to 1,000° C. (dull red heat), it is possible to obtain from it not only gas, but also "valuable liquid by-products, which are in part of a novel character, consisting as they are said to do, of unsaturated hydrocarbons of hitherto unknown series, and containing also benzol, toluol, xylol, and the like." No coke and but very little pitch is produced.

The retorts are arranged in inversely-inclined positions, the lower end of each retort communicating with that below it by connecting-pipes.

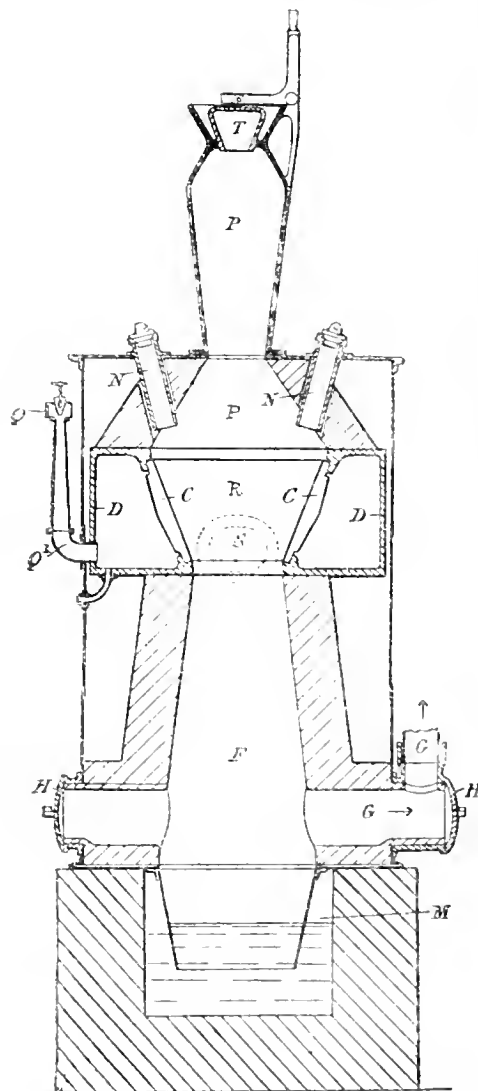
The retorts are contained in a chamber connected with the furnace, the chamber being so divided up into flues that the heated products of combustion from the furnace raise

the lowest retorts to temperatures not exceeding 1,000° C., whilst the uppermost retorts in the bench may have temperatures as low as 300° C. These retorts are of great width and small depth.

The pipes which traverse the upper part of the chamber conduct the, now warmed, hydrocarbon to the first retort. The gas formed and the liquid hydrocarbon products pass from retort to retort and finally escape by a down-pipe from the lowest retort in the bench (nearest the furnace) into a main, where any heavy condensed matter collects. A rising pipe conducts the gases from the main to the condensers, &c., where the unsaturated hydrocarbons are deposited, the permanent gas passing on to the gasometer.—E. R. B.

Gas from Carbonaceous Matter, Improvements in Apparatus or Furnaces for Producing. C. W. Pinkney, Smethwick. Eng. Pat. 2017, Jan. 29, 1895.

THIS patentee claims, for gas-producing furnaces, a vertical 3-zoned fuel chamber, such that into its upper part (or zone), P P, raw fuel may be fed by the hopper T, and incandescent fuel exist in its lower part F, while at its intermediate part or zone R the fuel is acted upon by



steam (superheated or otherwise) and air. To carry out this latter process, the intermediate part is provided with vertical and, generally, inclined grate bars C C, and the

whole of this part of the furnace is surrounded by the annular chamber D D, to which air and steam are admitted by Q Q.

The gas exit is at G, the course of the gas having been downwards through the fuel in F. Clinker may be removed at the doors H H, while ash and clinker, when the furnace is working continuously, falls into the water-seal chamber M, which closes the bottom of the furnace. Any ash produced in the middle zone R of the furnace, may be removed at the door S. N N are stirring holes.—E. R. B.

Line-Light, Improved Ether Saturator for the Production of. W. Houldershaw, Liversedge, York. Eng. Pat. 2195, Jan. 31, 1895.

This invention relates to a mechanical stand for the usual gas and spirit jets; to a special form of diffusion chamber having fluted gas passages to distribute the gas uniformly through the saturated material; to an arrangement of spiral tubes for splitting up and vaporising the ether particles; and to various other points connected with optical lanterns in which a burning jet of oxygen and ether (or petroleum spirit) vapour is used in conjunction with a cylinder of lime.—R. B. P.

Mingling Gas or Air and "Acetylene Gas" or other Enriching Gas for Illuminating Purposes, Improved Methods of and Apparatus for. H. H. Lake, London. From E. N. Dickerson, New York, U.S.A. Eng. Pat. 11,848A, June 18, 1895.

THE present invention mostly concerns a novel means of remedying a certain difficulty, the existence of which is now announced, according to the patentee, for the first time. It is stated that, unlike other enrichers, acetylene "will disappear, in part at least, if it remain in contact with water-gas for a considerable time; as, for instance, during the period in which gas is stored in gasworks until its delivery to the consumer." The gases must therefore be mixed at the place of consumption.

The apparatus for mixing the gases consists of three ordinary bell gas-holders of like structure, two of which contain respectively acetylene and water-gas (or air), and communicate with the third, which is thus the mixing chamber. By employing, on the tubes delivering acetylene and water-gas respectively, cocks the ports of which have known areas, and by keeping the pressures under control, definite proportions of the gases may be automatically delivered into the mixing chamber.

For the proper burning of acetylene in ordinary burners, "either equal parts of acetylene and air, or proportions varying from 40—50 of air, to 60—50 of acetylene," should be employed.

The patentee also describes means for the mixing of the gases under high pressure, whereby the expanding power of one of the gases is utilised to accomplish the compression of the other.—E. R. B.

Burners and Mantles for Incandescence Gas Lighting. Improvements in. A. Taylor and W. S. Taylor, both of Glasgow. Eng. Pat. 1577, Jan. 23, 1895.

THE burner is constructed so that it can be used as an ordinary burner in the event of the mantle breaking. According to one modification, the mantle is made from a suitable fabric which is first dipped in a weak solution of hydrobromic acid 40 per cent., ammonium bichromate 40 per cent., uranium acetate 10 per cent., and potash alum 10 per cent., and then in a strong solution of calcium carbonate, or in a solution containing 60 per cent. of calcium carbonate and 40 per cent. of magnesium carbonate. The supporting fabric is then burnt away in the usual manner. Phosphoric acid, acetic acid, or ammonium chloride may be substituted for the hydrobromic acid.

—R. B. P.

Incandescent Gas Lamps, Improvements in. A. Farkas, Paris. Eng. Pat. 14,404, July 29, 1895.

THE improvements claimed are:—(a) A special form of burner in which the air and gas become thoroughly mixed before ignition; (b) A cone of fireproof material situated

inside the mantle, the object of which is to increase the temperature of the air and gas, and, by acting as a reflector, the amount of light given off; (c) A circular groove surrounding the burner to receive the lower edge of the mantle and protect it from breakage; (d) A method of securing the chimney so that it is not affected by shocks or vibrations; (e) A central draught which makes it possible to add a larger quantity of air to the gas in order to raise the temperature of the flame, at the same time reducing the consumption of gas.—R. B. P.

Incandescent Lamps for Vaporised Liquid Fuel, Improvements in. A. Baermann, Berlin, Germany. Eng. Pat. 16,343, Aug. 31, 1895.

THE lamp has an ordinary burner, incandescing body, and chimney, the latter being, however, considerably shorter than usual. The combustible liquid is fed from a suitable closed reservoir by the capillary action of a tube filled with an absorbent material, into a vaporising chamber placed over the chimney, and becomes converted into vapour by the heat of the lamp. The vapour then passes through another tube to the burner. The chief claim is the utilisation of the heat from the lamp itself, instead of using a separate flame to vaporise the liquid.—R. B. P.

Incandescent Gas Lamps, Improvements in. W. L. Voelker, Elizabeth, N.J., U.S.A. Eng. Pat. 17,795, Sept. 24, 1895.

A FRAME, or carrier, made of porcelain or of a "porcelainous" compound, is used to support the incandescing oxides.

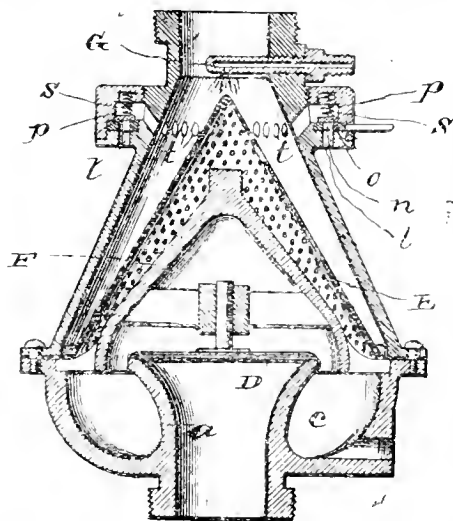
The frame is constructed of threads made from a mixture of finely-powdered kaolin, quartz, felspar, and sugar syrup, by squirting through a die.

The hood is then dried and baked at a high temperature, dipped in a suitable solution, and finally oxidised.—R. B. P.

Vaporising Hydrocarbons or other Volatile Liquids, and Mixing the Vapour with Air for Use in Motors, Improvements in Apparatus for. B. W. Grist, Philadelphia, Penn., U.S.A. Eng. Pat. 16,096, Aug. 27, 1895.

THE inventor's apparatus, which is intended to be interposed in the path of the incurrent air of gas-motors, is represented, in vertical section, in the figure.

It consists essentially of a cone E, which is perforated with numerous minute apertures, and which is kept wet by hydrocarbon dropping from G. The inflowing air arriving by a, traverses the minute apertures of the cone, becomes



carburetted, is mixed with further air (arriving by the apertures *t t*), and passes on to the cylinder of the gas-engine. F is a deflector, preventing the inflowing air from merely blowing through the apex of the cone. *p* is an annular chamber communicating with the exterior by a

series of apertures *l l*, and with the interior by the passages and apertures *l l*. It conducts the supplementary air of the charge; the amount of this latter being regulated by an annular valve, *a*, which is provided with ports or passages, *n n*, registering with the passages *l l*.

This valve, as also *D*—that regulating the main air supply—is opened by the induction stroke of the piston of the gas-engine, and the two valves close automatically, the former by the springs *s s*, the latter by gravity. Any excess of hydrocarbon falling through the cone is caught in the chamber *c*.—E. R. B.

Gas Generators, Improvements in Oil-atomising and Carburetting Apparatus for. O. N. Gublin, Fort Wayne, U.S.A. Eng. Pat. 16,927, Sept. 10, 1895.

THIS is an injector for feeding finely-divided or "atomised" hydrocarbon oil into a water-gas carburetting apparatus.

The injector consists of a tube terminating in a conical end, in which is situated the exit orifice. A plug, with a conical end forming a valve for wholly or partially closing the exit orifice, is mounted on a screwed spindle, by adjusting which, the amount of oil injected can be controlled. Projecting lugs on the plug, guide it in the body of the injector, and at the same time break up the stream of oil into fine particles.

From the shape of the lowest set of lugs, a "whirling" motion is given to the particles as they leave the injector.

—R. B. P.

Fuels, An Improved Method of and Apparatus for Vaporising Solid and Liquid, and Utilising the Vapour for Heating Purposes. J. E. Pfeil, Vienna. Eng. Pat. 17,268, Sept. 16, 1895.

THIS invention relates to the production of smokeless flames of relatively high temperature, from petroleum, rape-oil, olive-oil, &c., or from stearin, paraffin wax, &c., while the "heating purposes" contemplated include the rendering incandescent of a mantle.

According to the patentee, the liquid or molten fuel is sucked up by a solid wick of relatively large diameter, which is surrounded at its upper end by an annular flame. The heat emitted by this flame vaporises the fuel brought up by the inner part of the wick. The fuel vapours so formed enter a chamber, whence after being mixed with a suitable quantity of air, they can escape through a grating at the top, and, upon ignition, yield a colourless flame.

The apparatus, by means of which the vaporisation of one part of the liquid fuel by the combustion of the other part is accomplished, is illustrated and described.

In the case where the colourless flame is used to render incandescent a mantle, the patentee uses a chimney, as usual; and, by means of a metal cap, causes most of the air which enters the chimney to take a definite path between the edge of the metal cap and the burner, and by this means he secures a more active combustion in the outer portion

of the flame; moreover, the shape of the flame becomes the more constant. Both these causes conduce to a higher degree of incandescence.—E. R. B.

Hydrocarbon Liquids, Improvements in Gasifying and Distilling. S. Pitt, Sutton. From La Société Internationale des procédés Adolphe Seigle, Levallois-Perret, France. Eng. Pat. 19,036, Oct. 10, 1895.

By means of a spray producer, or otherwise, an "emulsion of water and hydrocarbon" is produced, and this is led through a metallic worm heated in any suitable manner. Here, is successively effected the reduction of the water by the carbon resulting from the dissociation of certain of the hydrocarbons, and the carburation of the poor gas so produced, by other of the hydrocarbons and by certain stable hydrocarbons produced at the moment when the others were dissociated. By introducing carbon, or coke, into part of the worm, the quantity of poor gas may be augmented.

"Any apparatus suitable to the object in view, may be employed."

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Nitrogen and the Nitrogen Products derived from Coal. Knublauch. J. f. Gasbeleuchtung, 33, 753—758 and 769—773.

THE author describes in detail the results of experiments and observations made during a number of years at the Cologne gasworks, and subsequently in his laboratory.

The amount of nitrogen is very variable in different coals and even in the same kind. There is from 1.3 to 1.6 per cent. in Westphalian coal. The proportion converted into valuable compounds, however, forms only from 0.2 to 0.25 of the weight of this coal. The amount of coal distilled daily in gasworks and coke ovens over the whole globe is estimated at 1,000,000 tons, corresponding to 10,000 tons of ammonium sulphate, taking the nitrogen recovered as ammonia at 0.2 per cent. of the coal. The coal used at Cologne introduces annually into the gas retorts alone about 1,000 tons of nitrogen, of which 200 tons are recovered as ammonia and cyanogen, and these calculated as sulphate may be valued at 12,500*l*. Experiments showed that the ammonia completely extracted from the gas in the gas liquor yielded only from 9.74 to 10.15 lb. of ammonium sulphate per ton of coal, corresponding to a percentage of nitrogen in the coal of approximately 0.2 only. Estimations of the nitrogen in the coal showed seven to eight times that quantity. Attempts to convert more nitrogen into ammonia were so far successful, but, on the other hand, disadvantages accrued, and the new processes were abandoned. As an illustration, the author refers to the addition

Source of Coal.	Number of Tests made.	Cubic Feet of Gas per Ton of Coal.	Percentage of Coke.	Percentage of Tar.	Percentage of Ammonia.	Pounds Weight of Ammonium Sulphate per Ton of Coal.
		Average.	Average.	Average.	Average.	Average.
Westphalia (a) Gas coal.....	6	10,482	71.52	4.53	0.2521	10.55
" (b) Cannel coal.....	3	11,709	58.80	7.70	0.1862	7.81
" (c) Coke-oven coal.....	9	10,018	79.72	2.53	0.2670	11.16
Upper Silesia (a) Gas coal.....	1	10,612	66.10	2.92	0.3407	13.70
" (b) Coke-oven coal.....	8					
Lower Silesia (a) Gas coal.....	2	10,513	70.87	4.60	0.1865	7.81
" (b) Coke-oven coal.....	3	9,716	75.91	2.60	0.2020	8.52
Saar (a) Gas coal.....	1	10,150	68.59	3.82	0.1982	8.32
" (b) Coke-oven coal.....	5					
England Gas coal.....	3	11,325	61.16	4.63	0.3385	16.64
Belgium Gas coal.....	1	9,360	70.75	4.60	0.1646	6.90
Moravia Coke-oven coal.....	3	9,960	81.13	2.96	0.2579	10.78
Russia Gas coal.....	1	8,463	62.65	6.50	0.2875	11.98
North America Gas coal.....	10	10,613	70.63	3.77	0.2272	9.54
South America Gas coal.....	1	10,849	61.25	4.50	0.3240	13.53
Italy Lignite character.....	2	11,676	55.15	2.80	0.6351	29.33
Bohemia Gas coal.....	2	11,027	44.82	9.65	0.1788	7.54
Scotland Cannel coal.....	2	12,163	47.25	8.90	0.1914	8.92
Spain Gas coal.....	1	8,154	87.25	10.80	0.0544	2.30
Australia Gas coal.....	2	11,098	33.97	13.85	0.0469	1.92

of lime to coal before distillation (this Journal, 1887, 503), and the passage of steam over the incandescent fuel.

Of the balance of the nitrogen, a very small quantity occurs as cyanogen in the gas and as nitrogenous bases in the tar, but by far the largest quantity is found in the gas and the coke. Having devised an apparatus for carbonising coal in the laboratory, it was found that the yield of ammonia, generally possible, could be determined for different coals, and the variations made were dependent only on the choice of the coal. It was further proved that the percentage of nitrogen contained in the coal and its distribution among the various products, is by no means proportional. The yield of ammonia may, for instance, be much greater from a coal containing a small percentage of nitrogen than from one very rich in nitrogen. The same remark applies to the other nitrogen products. These variations are frequently very great with coal of different origin, and often slight with the same kind, though even then they are at times very considerable.

The same question has been investigated by Foster for English coals, whilst subsequently Schilling also made some experiments with various kinds (this Journal, 1887, 652), the yield of ammonia found being confirmed in the three series of observations. The author has made a large number of distillations of various kinds of coal to ascertain the yield in the various products.

The average yield of gas, coke, tar, and ammonium sulphate from 15 different sources is shown in the table on preceding page.

The distribution of the nitrogen among the different products is shown by the results given in the following table:—

	Percentage of Nitrogen on the Coal.		Percentage of Nitrogen on Total Nitrogen.	
	Westphalian Coal.	Saar Coal.	Westphalian Coal.	Saar Coal.
Coke.....	I. 0.4680 II. 0.8560	0.7516 0.6964	I. 30.0 II. 55.0	35.6 47.1
Gas.....	0.1850 0.0268	0.2086 0.0268	11.9 1.8	14.1 1.8
Ammonia.....	0.0212	0.0450	1.3	1.4
Cyanogen.....				
Tar.....				
Coal.....	1.5500 1.4790	1.1760	100.0 100.0	100.0

With regard to the quantity of cyanogen formed in the retorts, numerous experiments carried out at various times with Westphalian coal, indicate that 74 to 79 grains of hydrocyanic acid per 100 cb. ft. are present in the gas, or about 0.15 per cent. by volume of the acid in the state of vapour. This corresponds to from 2.9 to 3.1 lb. of potassium ferrocyanide per ton of coal. It is generally less at the coke ovens. The nitrogen of the cyanogen therefore amounts to only 0.02 to 0.03 per cent. on the coal, corresponding to 1.8 per cent. of the total nitrogen of the coal.

The following is the average composition of crude gas from Westphalian coal, expressed in per cent. by volume:—Hydrogen, 50.00; methane, 31.00; carbonic oxide, 9.00; ethylene, 2.50; benzene, 1.25; carbonic anhydride, 2.00; hydrogen sulphide, 0.75; nitrogen, 2.25; ammonia, 1.10; hydrocyanic acid, 0.15; sulphur compounds (other than hydrogen sulphide), carbon bisulphide, &c., about 0.01.

In summarising the results of these experiments the following conclusions are drawn, based on Westphalian coal:—(1.) About 50 per cent. of the nitrogen remains in the coke, and is only of interest inasmuch as an increase in its amount results in a corresponding decrease in free nitrogen present in the gas. (2.) About 30 per cent. of nitrogen is contained in the gas, and must be considered injurious as reducing the illuminating power. (3.) From 12 to 14 per cent. is converted into ammonia, corresponding to 10.55 lb. of ammonium sulphate per ton of coal. (4.) Not quite 2 per cent. (0.027 per cent. on the coal) combines with carbon and hydrogen to form hydrocyanic acid, corresponding to 1.42 lb. of potassium ferrocyanide per ton of

coal. Of this quantity, at least two-thirds should be recovered from the oxide. (5.) Finally in the tar as nitrogen bases, there is about $1\frac{1}{2}$ per cent. (equal to 0.02 per cent. of the coal). (6.) Only 0.2 to 0.25 per cent. of the nitrogen of the coal forms products of marketable value; but the quantities dealt with being large, it is nevertheless possible to obtain a revenue of 14l. per million cubic feet of gas.—D. B.

Anthracene, Formation of, in the Distillation of Crude Carbohc Acid. H. Köhler. Zeits. f. angew. Chem. 1895, 16, 476—477.

IN a recent discussion on the condensation products derived from the distillation of phenoloid aluminium compounds, Zmerzlikar asserted that their study promised the dissipation of an erroneous theory, adduced by Schulze some time ago, relating to the formation of anthracene.

The author states that, although Schulze based his views as to the formation of coal-tar on the observation that the phenols separated from anthracene oil, when subjected to distillation, yield liquid hydrocarbons with liberation of water, no reference as to the production of anthracene has ever been made by this chemist. The author, however, on one occasion, in working up the high boiling portions of crude carbohc acid, obtained anthracene in the distillate, which was carefully examined by Luck's method and found to contain 35 per cent. of pure anthracene. It is, he thinks, difficult to confuse the "pyrocresols" observed by Zmerzlikar, with anthraquinone, and to imagine that these substances could have yielded anthraquinone on oxidation with chromic acid.—D. B.

Naphtha, Crimean. Properties of. A. L. Potylitzin and B. Bernstein. J. Russ. Chem. Soc. 27, 279—282.

ABOUT 800 tons of naphtha (crude petroleum) were produced in the Crimea in 1891, chiefly at Chengelek, where the borings attain a depth of 400 metres. A specimen from that source was of a dark brown colour with greenish fluorescence, and had the sp. gr. 0.888 at 17°.—J. W.

Mineral Oil Refining, Theory and Practice of. R. Zoloziecki. Chem. Rev. Fett u. Harz Ind. 1895, [30], 1—4.

THE influence of temperature on the acid purification process has been already discussed by the author (this Journal, 1895, 563), who now points out that his remarks were intended to apply only to actual distillates, and not to decomposition products. As the heavy oils must be considered as belonging to the latter category, the limitation of the range of temperature to about 0° C. is not applicable to them, but in any case it is desirable to keep the temperature as low as is possible consistent with the attainment of the necessary fluidity to ensure thorough intermixing of oil and acid. The most favourable temperature, therefore, depends on the viscosity of the oil, and will require to be separately ascertained for each particular quality. For oils of equal viscosity it is probable that the temperatures will coincide.

Concerning the influence of light on asphalt, recorded by Windisch (this Journal, 1895, 1039), the author agrees that the susceptibility to light is probably in direct relation to the amount of sulphur present in combination, but considers that, as the effect of light on these sulphur compounds in the acid tar is to render them insoluble, some other explanation of the deepened colour of the oil must be sought. In his view—in support of which he quotes the results obtained by Ostrejko and Charitschkow (this Journal, 1896, 24, 26)—the effect is due to the oxidation of the acid tar, a process furthered by the action of light on the oil, and the simultaneous solution of some of the resulting asphalt products.—C. S.

Petroleum Industry, Importance of Uniform Methods of Testing. L. Gans. Chem. Rev. Fett u. Harz Ind. 1895, [28], 2—3.

See under XXIII., page 138.

PATENT.

Bituminous Compound Material, Improvements in or Appertaining to Apparatus for and the Art of Treating, Working, and Handling Bituminous or Similar Compounds and Articles made therefrom. E. F. Badgley, A. R. Green, and A. Crockett, San Francisco, Cal., U.S.A. Eng. Pat. 13,761, July 18, 1895.

See under I., page 102.

IV.—COLOURING MATTERS AND DYES.

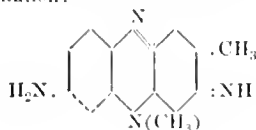
Parafuchsine, New Synthesis of, and of its mono-, di-, tri-, and tetra-alkylated Derivatives. M. Prud'homme. Comptes rend. 121, 1895, 891—893.

THE careful reduction of nitrobenzene gives phenylhydroxylamine, which is converted by mineral acids into *p*-amido-phenol. The same reaction can be carried out with the *p*-nitrodiamidodiphenylmethanes, although the position para to the nitro group is occupied by the central carbon atom. When dissolved in dilute hydrochloric acid and treated in the cold with zinc dust, the following transformation takes place:— $\text{O}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2\text{A}_2$ (nitro compound); $\text{HO} \cdot \text{HN} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2\text{A}_2$ (hydroxylamine); where A represents C_6H_4 , NH_2 , NR , R being an alkyl radicle. Under the action of hydrochloric acid at a moderate temperature, a reaction takes place between the hydroxyl group and the hydrogen attached to the methane carbon, forming a derivative of a tri-amido-carbinol, which is converted into a colouring matter by the interchange of the hydroxyl group for an acid radicle:— $\text{H}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{CA}_2\text{OH}$ (colour base); $\text{H}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{CA}_2\text{Cl}$ (colouring matter). The addition of sodium acetate precipitates the nitro or amido leuco bases, and after filtration the zinc is eliminated by caustic soda, the base of the colouring matter crystallising from alcohol in a state of purity. The method has been applied for the synthesis of parafuchsine and its mono-, di-, tri-, and tetra-alkyl derivatives. The *p*-nitro-methanes from which *p*-fuchsine and its tetra-alkylated derivative are produced, are obtained by condensing one molecule of *p*-nitro-benzaldehyde with two molecules of aniline or of a dialkylated aniline. In a similar manner the mono- and tri-alkylated compounds are formed by condensing alkylated *p*-nitrodiamidodiphenylhydrol with aniline or a dialkylated aniline. In the case of the dialkylated fuchsines the two alkyl groups may be present in the same or in different benzene nuclei. Those in the former class are produced by condensing one molecule of *p*-nitrobenzaldehyde with two molecules of a monalkylated aniline, whilst the latter are obtained by condensing dialkylated *p*-nitro-amidodiphenylhydrol with aniline. The shades produced by this series of fuchsines approach the violet end of the spectrum in proportion to the number of alkyl groups present, and it is noteworthy that two alcohol radicles in two different benzene nuclei produce a more violet shade than when they are both contained in a single nucleus.—T. A. L.

New Safranines. G. F. Jaubert. Comptes rend. 121, 1895, 947—948.

THE simplest safranine hitherto known is Witt's phenosafranine, which is a diamidophenazine phenylated in the azine ring. The author describes several new safranines containing other radicles, such as methyl, ethyl, α - and β -naphthyl, in place of the phenyl in phenosafranine, which he designates metho-, etho-, α - and β -naphthosafranines.

Methosafranine.—By oxidising a mixture of *p*-phenylene diamine and methyl-*m*-phenylene diamine, mono-methyl-phenylene red is obtained in place of the desired safranine, since the position para to the substituted amido group in the *m*-phenylene diamine is unoccupied. By using the mono-methyl derivative of *m*-cresylene diamine a good yield of metho-2-tolu-safranine is obtained, having the following constitution:—



This product dyes mordanted cotton ponceau - red, dissolves in water with a red colour and yellow fluorescence, whilst in hydrochloric acid it dissolves with a blue and in sulphuric acid with a green colour. Nitrous acid gives a diazo derivative.

Etho-2-tolu safranine is obtained in a similar manner from ethyl-*m*-cresylene diamine. Etho-safranol is formed by reacting with nitroso-phenol on ethyl-*m*-amidophenol, and in the same way the α - and β -naphthosafranols are produced from nitrosophenol and *m*-hydroxy-phenyl- α - and β -naphthylamine. A sulphonic acid of phenosafranol can be obtained by using a sulphonated *m*-hydroxydiphenylamine.—T. A. L.

Researches on Tertiary Benzenoid Amines. I. Derivatives of Dimethylaniline. Clara de Brereton Evans, B.Sc. Proc. Chem. Soc. 1896, [158], 235.

It is now established in the case of primary and secondary benzenoid amines, that the production of derivatives containing a substituent in the hydrocarbon nucleus is often preceded by that of the corresponding derivative in which the substituent is present in the amido-group; and inasmuch as compounds of the latter readily pass over into those of the former class, it is not improbable that their formation is a necessary step in that of many derivatives of benzenoid amines. As it is impossible, however, that similar derivatives should be formed from tertiary amines, the behaviour of these is of interest as throwing light on the influence which nitrogen itself exercises; and that this may be altogether different from that of nitrogen associated with hydrogen is clear from a comparison of benzenoid amines with *azophenes* (compare Proc. Chem. Soc. 1892, 128) such as pyridine and quinoline, as these latter manifest a comparative indifference towards agents generally which is quite remarkable.

The experiments to be described have brought to light the fact that tertiary benzenoid amines manifest a somewhat similar indifference.

Dimethylaniline is readily sulphonated by means of chlorosulphonic acid, yielding only the *para*-acid; it is somewhat less readily, but yet easily sulphonated by means of a single molecular proportion of ordinary sulphuric acid, but if a larger proportion of acid be used, the action takes place less readily, sulphonation being incomplete at the end of twelve hours at 180° when 5 molecular proportions of acid are used, although it is complete within five hours when a single proportion is taken. Practically nothing but the *para*-acid is formed. To procure the *meta*-acid, it would seem that it is necessary to use fuming sulphuric acid—a point of some interest in connection with the moot question as to the manner in which isomeric sulphonic acids are generated. The behaviour of diethylaniline is similar to that of dimethylaniline.

The behaviour of the *para*-acid towards bromine is remarkable. It first yields a *monobromo*-acid, and on further bromination a *perbromide*, readily and simply deprived of its bromine by exposure to air, by boiling with water, and in contact with ammonia, sulphurous acid, or potassium iodide. Under no condition, apparently, does it yield a *dibromosulpho*-acid or *tribromodimethylaniline*; in this respect its behaviour is most remarkable in comparison with that of ordinary sulphanilic acid, which is extremely sensitive to the action of bromine, being very readily converted into *tribromaniline*.

The *meta*-acid, in like manner, readily yields a *parabromo*-acid, identical with that obtained on sulphonating *parabromodimethylaniline*, and this is converted into a *dibromo*-acid by the further action of bromine. But all attempts to prepare a *tribromo*-acid corresponding to that which is so readily obtained from *aniline*-*meta*-sulphonic acid, were unsuccessful. No *perbromide* is obtained from the *meta*-*bromo*-acids.

On nitration, *dimethylaniline*-*para*-sulphonic acid yields a mixture of *ortho*-*para*-*dinitro*-*dimethylaniline*, together with *ortho*-*nitro*-*para*-sulphonic acid, the latter being the chief product. The *meta*-sulphonic acid yields a *dinitrosulphonic* acid.

The behaviour of the *diethylaniline*-sulphonic acids is similar to those of *dimethylaniline*. The *perbromide*

derived from the bromoparasulphonic acid is better characterised even than that derived from the dimethylated acid.

2 : 1 β -Naphthylaminesulphonic Acid and the corresponding Chloronaphthalenesulphonic Acid. H. E. Armstrong and W. P. Wynne. Proc. Chem. Soc. 1896, [158], 238.

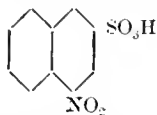
TOBIAS has recently shown (this Journal, 1894, 800) that the acid obtained by one of us (Armstrong, Ber. 15, 1882, 202) by the action of chlorosulphonic acid on β -naphthol at the ordinary temperature, is 2 : 1- β -naphtholsulphonic acid, and has described the amido-acid obtained by heating the hydroxy-acid with strong aqueous ammonia under pressure at 220°–230°.

This amido acid was converted by the Sandmeyer method into the corresponding 2 : 1- β -chloronaphthalenesulphonic acid, which has not hitherto been described, and is the 12th of the 14 isomerides which it is theoretically possible to isolate. The chloride, $\text{Cl} \cdot \text{C}_{10}\text{H}_6 \cdot \text{SO}_2\text{Cl}$, crystallises from a mixture of benzene and light petroleum in large, tabular forms, and from acetic acid in diamond-shaped scales melting at 76°: it yields an amide crystallising in slender needles melting at 153°, and on distillation with phosphorus pentachloride is converted into 1 : 2-dichloronaphthalene, melting at 35°.

On sulphonation with four times its weight of cold 20 per cent. anhydro-sulphuric acid, the 2 : 1- β -naphthylaminesulphonic acid is converted into the 2 : 1 : 4'- β -naphthylaminedisulphonic acid, previously described by the authors as the minor product of sulphonation of the Dahl 2 : 4'- β -naphthylaminesulphonic acid under similar conditions (this Journal, 1890, 800).

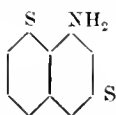
1 : 3- α -Naphthylaminesulphonic Acid and the corresponding Chloronaphthalenesulphonic Acid. H. E. Armstrong and W. P. Wynne. Proc. Chem. Soc. 1896, [158], 238–240.

IN the course of their study of the formation of isomeric naphthalene derivatives, the authors had occasion to attempt the repetition of Clève's work on the nitration of naphthalene- β -sulphonic acid, since of the three acids obtained by him in this way, one was stated to have the constitution—



the other two being the isomeric heteronuclear- α -nitro-acids. Whilst successful in obtaining two heteronuclear acids, of which they determined the constitution, they were unable to prepare the homonuclear compound by the nitration of potassium naphthalene- β -sulphonate (Proc. 1889, 17). Subsequently it came to their knowledge that the homonuclear acid also could not be detected in the product obtained on nitrating sodium naphthalene- β -sulphonate on the large scale. Moreover, Erdmann and Süvern have failed to obtain the corresponding chloride by nitrating naphthalene- β -sulphonic chloride (Annalen, 275, 252).

The authors record the fact that the so-called [7-] naphthylaminesulphonic acid which Clève prepared by reducing the homonuclear nitro-acid he obtained by nitrating sodium naphthalene- β -sulphonate (Ber. 19, 2179; 21, 3271) is identical with the 1 : 3- α -naphthylaminesulphonic acid of Kalle and Co.'s German Patent 64,979, prepared from α -naphthylamine-[ϵ]-disulphonic acid—which the authors have shown has the constitution—



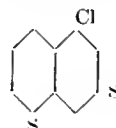
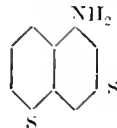
(this Journal, 1890, 283)—by partially hydrolysing it with diluted sulphuric acid, and which, as Friedländer has recently shown, may also be obtained by partially reducing the said disulphonic acid with sodium amalgam (Ber. 28, 1951).

The experiments the authors have made with this disulphonic acid confirm Clève's statements as to its properties, and the derived 1 : 3- α -chloronaphthalenesulphonic acid, in every particular. The authors have been able to carry the identification of the acids a stage further, since they find that the dichloronaphthalene, melting at 61.5°—obtained from the chloronaphthalenesulphonic chloride melting at 106°—on sulphonation gives products characteristic of 1 : 3-dichloronaphthalene (Proc. Chem. Soc. 1890, 82), and not of the 1 : 2'-isomeride of about the same melting point with which it was for a while confused.

Tri-Derivatives of Naphthalene No. 15, Studies on the Constitution of. The Disulphonic Acids obtained by sulphonating 1 : 3- α -Naphthylamine and 1 : 3- α -Chloronaphthalene Sulphonic Acids. H. E. Armstrong and W. P. Wynne. Proc. Chem. Soc. 1896, [158], 240–241.

As already announced (this Journal, 1890, 284, 801, 802; Brit. Assoc. Report, 1893, 382, footnote), the authors are engaged on experiments having for their object the determination of the comparative influence exercised by the radicles Cl , OH , and NH_2 in naphthalene derivatives on the formation of disulphonic acids (this Journal, 1890, 800 *et seq.*). Progress was retarded so long as the characteristics of the reference compounds—the trichloronaphthalenes—were in doubt. The 14 theoretically possible isomerides are now known and characterised (Proc. Chem. Soc. 1895, 84), and, in view of the interest attaching to the 1 : 3- α -naphthylaminesulphonic acid, the authors think it well to put on record the results obtained on sulphonating it and the corresponding chloro-acid, so far as their experiments have gone.

From these results the authors say that, under the conditions described, the disulphonic acids obtained both from the 1 : 3- α -amido- and the 1 : 3- α -chloro-monosulphonic acids have a corresponding constitution expressed by the symbols—



PATENTS.

New Blue Colouring Matters for Dyeing and Printing, Improvements in the Production of. Read Holliday and Sons, Ltd., and R. Holliday, Ilkley, Leeds. Eng. Pat. 2504, Feb. 5, 1895.

ROSANILINE, when heated with *p*-phenylene diamine and aniline in presence of benzoic or other suitable organic acid, is converted into a soluble blue colouring matter, which, as hydrochloride, is suitable for dyeing and printing. In place of aniline, α - or β -naphthylamine may be used, and the shade may be varied by increasing the quantities of *p*-phenylene diamine and diluent employed. The solubility of the colour depends upon the amount of *p*-phenylene diamine used and also upon the temperature. About 100 lb. of rosaniline, 200 lb. of *p*-phenylene diamine, 400 lb. of aniline, and 5 lb. of benzoic acid, are heated at about 150° C. until a sample dissolved in alcohol and acetic acid and spotted on filter paper, gives the blue shade required. The melt is then cooled and sufficient hydrochloric acid added to render it soluble in hot water. From this solution, the colouring matter is salted out, when it is filter-pressed and dried; or the treatment may be repeated to remove any traces of amines. In order to obtain the dyestuff as concentrated as possible, the aqueous solution, free from amines, is precipitated with an alkali, the colour base being then filtered off and subsequently dissolved in the quantity of hydrochloric acid sufficient to render it soluble.—T. A. L.

Colouring Matters [Safranines], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 2900, Feb. 9, 1895.

THESE safranines are prepared from alkylated *o*-toluidine, and give colouring matters which in some cases are equal

in brilliancy to the rhodamine dyestuffs. Any of the known processes for the production of safranines may be employed, the following being a typical example:—A solution of 18·6 kilos. of nitrosomethyl-*o*-toluidine hydrochloride in 500 litres of water is converted by means of zinc-dust and hydrochloric acid into *p*-amido-methyl-*o*-toluidine, and, after neutralisation, 15·8 kilos. of methyl-*o*-toluidine hydrochloride dissolved in water are added, the whole being oxidised in the cold with 20 grms. of potassium bichromate as a 5 per cent. solution, with constant agitation. When the indamine is completely formed, 14·5 kilos. of *o*-toluidine hydrochloride dissolved in water are added, and the solution is heated until the original bluish-green colour has become red. A further quantity of 20 kilos. of potassium bichromate is then added, and the heating is continued until the formation of the colouring matter is complete. After filtering, the residue is extracted with water, and the filtrate from this operation having been mixed with the first one, the safranin is salted out in the usual manner. It gives on tanned cotton, bright bluish-red shades, very similar to those produced by rhodamine S.

—T. A. L.

Naphthfluoresceine, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 3497, Feb. 18, 1895.

NAPHTHARESOREINOL (*m*-dihydroxynaphthalene), which is obtained from 2,4,1'-amidonaphthol sulphonic acid or from 2,4,1'-dihydroxynaphthalene sulphonic acid by heating with dilute mineral acids at high temperatures, can be converted into naphthfluoresceine by heating with phthalic anhydride in presence of a condensing agent such as concentrated sulphuric acid, zinc chloride, phosphoric anhydride, or oxalic acid. One method is illustrated in the following example:—45 kilos. of naphtharesoreinol, 25 kilos. of phthalic anhydride, and 20 kilos. of zinc chloride are heated for 10 hours to 200° C. After cooling, the melt is powdered and extracted with boiling water containing a small quantity of hydrochloric acid, the residue being dissolved in dilute soda-lye, from which the crude naphthfluoresceine is precipitated by sulphuric acid. The product is then filter-pressed and digested with ether, which extracts a black residu, leaving naphthfluoresceine in small brown crystals, which can be purified by recrystallisation from alcohol. The new colouring matter separates in small red needles with a greenish metallic lustre, is insoluble in benzene, sparingly soluble in ether, but easily soluble in alcohol. The solution in alcohol shows an intense green fluorescence on the addition of a small quantity of acid. The product dissolves in alkalis to a magenta-red solution with a yellow fluorescence; it gives rose shades on silk having a yellow fluorescence; and it is further observed that it can be used for the production of other dyestuffs.—T. A. L.

Blue Safranine-azo Dyestuffs, Manufacture of. S. Pitt, Sutton. From L. Cassella and Co., Frankfort-on-the-Maine, Germany. Eng. Pat. 3488, Feb. 18, 1895.

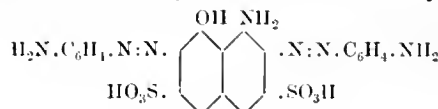
DIAZO-SAFRANINE, when combined with β -naphthol under ordinary conditions (in presence of an excess of alkali), forms a dyestuff which, on account of its insolubility, is of little technical value. If, however, the reaction be carried out in presence of a free organic acid, especially acetic or carbonic acid, the resulting dyestuff is freely soluble in water. About 35 kilos. of safranine 8 dissolved in 1,000 litres of water are diazotised with 25 kilos. of hydrochloric acid and 7 kilos. of sodium nitrite, yielding an easily soluble blue diazo compound, which is added to the following solution:—1,000 litres of water, containing 4 kilos. of sodium hydrate and 14·4 kilos. of β -naphthol, is made faintly acid with hydrochloric acid, so as to precipitate the naphthol in a finely-divided state, 20 kilos. of sodium acetate being then added. After adding the diazo compound and allowing the mixture to stand several hours, the formation of the dyestuff is complete, and the product is precipitated with brine, when it is filter-pressed and dried. Sodium bicarbonate may be employed in place of sodium acetate, care being taken that the mixture is maintained at a low temperature, in order to keep the solution saturated with carbonic acid.—T. A. L.

New Dihydroxynaphthalene, The Manufacture or Production of a, and of certain Sulphonic Acids derived from this Dihydroxynaphthalene or from the corresponding Amidohydroxynaphthalene. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 3580, Feb. 19, 1895.

By fusing sodium 2,4,1'-amidonaphthalene disulphonate with twice its weight of potash and 0·4 part of water for six hours at 215° C. in an autoclave, it is converted into a new 2,4,1'-amidonaphthol sulphonic acid, and can be separated by acidulating the melt with dilute hydrochloric acid. This acid is sparingly soluble in cold water, whilst its salts dissolve easily, giving green fluorescent solutions. It remains unchanged on adding ferric chloride or bleaching powder. With nitrous acid it is converted into a soluble yellow diazo compound, which is unchanged when added to sodium carbonate solution. The acid will also combine with diazo compounds, yielding azo dyestuffs. When heated with five times its weight of water for four hours to 200°—210° C. in an autoclave, the amido group is replaced by the hydroxyl group, the resulting solution containing the ammonium salt of 1,4,1'-dihydroxynaphthalene sulphonic acid (naphtharesoreinol sulphonic acid). This acid is very soluble and can only be crystallised from very concentrated acid solutions. Solutions of its neutral salts are yellow with a greenish fluorescence, and the combination with diazobenzene chloride gives a yellow azo dyestuff. An isomeric dihydroxynaphthalene sulphonic acid can be obtained by heating 2,4,2'-amidonaphthol sodium sulphinate with five times its weight of 5—10 per cent. dilute sulphuric acid for four hours at 210° C. The resulting dihydroxynaphthalene sulphonic acid is readily soluble in water, but can be salted out of a concentrated acid solution by the addition of salt. Its neutral salts give greenish fluorescent yellow solutions. Ferric chloride added to a solution of the acid produces a green coloration, which rapidly turns yellow, whilst bleaching powder gives a yellowish-brown coloration. The acid can be employed for the production of azo colouring matters, and when combined with tetrazodiphenyl chloride in an alkaline solution, it gives magenta-red shades, whilst in an acid solution blue shades are obtained. When 2,4,1'-amidonaphthol sulphonic acid is heated with five times its weight of 5 per cent. sulphuric acid for four hours to 215° C., the sulphonic acid group is split off, and there results a new *m*-dihydroxynaphthalene (naphtharesoreinol) which differs from all its isomeric compounds. It is very soluble in all solvents, and crystallises from water in groups of hexagonal plates melting at about 124° C. In place of the amidonaphthol sulphonic acid employed, the corresponding amount of the 2,4,1'- or 1,3,1'-dihydroxynaphthalene sulphonic acid may be used.—T. A. L.

Direct-dyeing Colouring Matters [Blue-Blacks], Manufacture of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 4018, Feb. 25, 1895.

By reacting with two molecular proportions of *p*-nitrodiazobenzene on one molecular proportion of 1,1',3,3'-amidonaphthol disulphonic acid and reducing the product obtained with sodium sulphide, there results the compound,



which can be converted into a tetrazo derivative and combined with various amines and phenols. The same compound can also be produced by employing acetyl-*p*-phenylene diamine in place of *p*-nitraniline, the resulting product being subsequently hydrolysed instead of reduced. The amido compound obtained by either method forms a black metallic powder, soluble in water with an indigo-blue colour, and in sulphuric acid with a bluish-black colour, which, on diluting with water, changes to pure blue, excess of water giving a precipitate of the free colour acid. The formation of a dyestuff is illustrated in the following example:—14 kilos. of the amido compound are converted into the tetrazo

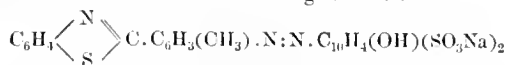
compound by treatment with 3.5 kilos. of sodium nitrite and 20 kilos. of hydrochloric acid (20° B.). The tetrazo compound formed dissolves tolerably readily in water with a bluish-black colour, and this solution is poured into a cold solution of 6.1 kilos. of tolylene diamine kept alkaline with sodium carbonate. After a short time the dyestuff is salted out, filter-pressed, and dried. It forms a blackish metallic powder, tolerably soluble in cold and easily in hot water to a blackish-violet solution, which becomes more blue-black on adding caustic soda. The solution in concentrated sulphuric acid is greenish blue-black, which, on adding water, first turns violet-blue, and on further dilution the free colour acid is precipitated in dark flakes. The dyestuff gives deep black shades on unmordanted cotton from an alkaline or soap bath, fast to light, air, and soap. Other dyestuff components may be substituted for the tolylene diamine mentioned above— β -naphthol, for instance, giving a colouring matter which dyes bluish-black shades on cotton. Similarly, mixed tetrazo dyestuffs may be obtained by using dissimilar components, as, for example, the tetrazo compound may be combined with 1.4-naphthol sulphonic acid, and subsequently with tolylene diamine (one molecular proportion of each), when a blue-black colouring matter is produced.—T. A. L.

New Amido Base [Amidotolucylamidothiophenol], The Manufacture and Production of, and of Colouring Matters therefrom [Cotton Bluish-Reds]. A. G. Green and R. Jansen, Manchester. Eng. Pat. 4418, March 1, 1895.

THE base described is a higher homologue of that already referred to in Eng. Pat. 21,786 of 1891 (this Journal, 1895, 962), and is obtained by heating together equimolecular proportions of aniline and *m*-xylydine together with four atoms of sulphur. The base has probably the following constitution:—



($\text{C}_6\text{H}_3\text{CH}_3\text{CH}_3\text{NH}_2 = 1:3:4$), and the method employed for its production is as follows:—A mixture of 95 kilos. of aniline, 121 kilos. of *m*-xylydine, and 128 kilos. of sulphur is heated for 10–12 hours until about 102 kilos. of hydric sulphide have been evolved and the temperature of the melt has slowly risen from 200°–240° C. The melt so obtained may be employed directly for the production of colouring matters, but in order to purify it, it is distilled, crystallised from benzene, and recrystallised from amyl alcohol, from which it separates in short prisms melting at 196° C. Its acetyl derivative melts at 210°–211° C. On treatment with fuming sulphuric acid, it is converted into a sulphonic acid, of which the ammonium salt is easily soluble. Both the base and its sulphonic acid yield colouring matters on combining their diazo compounds with amines and phenols and their derivatives, and of especial value are the dyestuff components alluded to in Eng. Pat. 21,788 of 1891 (this Journal, 1895, 962), which are naphthalene derivatives containing a sulphonic acid and a hydroxyl group in the meta position. In the case of certain derivatives, containing a diazotisable group, as, for example, in those colours derived from the 1.3'.3'-amido-naphthol sulphonic acid and the 1.3'.3.4'-amidonaphthol disulphonic acid, the dyed fabric may be diazotised and combined with amines and phenols, forming very fast shades. The following example describes the production of one of the colouring matters:—The diazo compound from 24 kilos. of the new amido base is allowed to run slowly into a solution containing 35 kilos. of the sodium salt of α -naphthol- ϵ -disulphonic acid, kept alkaline by sodium carbonate. After heating to 70° C., the dyestuff is salted out and dried. It has the following formula:—



and dyes cotton from an alkaline or neutral bath, giving bluish-red shades which are bluer than the corresponding colour from dehydrothio-*p*-toluidine.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Oils for Greasing Wool. A. Merstone. Chem. Rev. Fett u. Harz Ind. 1895, [29], 1–2.

See under XII., page 122.

Cellulose, Quantitative Estimation of. G. Lange. Zeits. angew. Chem. 1895, 561.

See under XXIII., page 137.

PATENTS.

The Utilisation of a Waste or Nearly Waste Product [Locust Beans], Improvements in or appertaining to, and the Manufacture of a Useful Gum or Gummy Compound therefrom. P. C. D. Castle, Liverpool. Eng. Pat. 24,877, Dec. 21, 1894.

See under VI., page 112.

Purifying the Water of Hat Felting or Sizing Tanks, Improvements in means for. G. Wells, C. Swartz, and W. B. Hubbard, all of South Norwalk, Connecticut, U.S.A. Eng. Pat. 19,369, Oct. 15, 1895.

See under XVIII. B., page 132.

Removing Gummy and other Matters from Vegetable Fibres, Improved Method of and Apparatus for. C. Wetherwax, Best, New York, U.S.A. Eng. Pat. 22,817, Nov. 28, 1895.

WITHIN a digesting vessel is a cage supporting a series of baskets, each provided with a spirally arranged partition. In the compartments so formed, the fibre is placed in a winding position and subjected to the "action of a heated liquor," which circulates in a downward direction through the fibres in the series of baskets. The gummy and resinous matters, contained in the solution finally drawn off, form a valuable commercial product.—R. B. B.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Vegetable Fibres, Direct Fixation of Certain Metallic Oxides on. A. Bonnet. Comptes rend. 1895, 121, 700–701.

EXTENDING his earlier work upon the dissociation of certain lead compounds in presence of vegetable fibres (this Journal, 1894, 34), the author finds that the hydroxides of copper, zinc, cobalt, and iron (ferrie), like that of lead, can be fixed directly by vegetable fibres. Cotton immersed in an ammoniacal solution of cupric oxide retains after washing only traces of the oxide; but by repeating the operation in the same solution after the addition of a little sodium (or potassium) hydroxide, the fibre is found to have fixed the oxide so well that even prolonged washing in running water removes none. Ammoniacal oxide of zinc (or of cobalt) alone leaves an abundant deposit in the fibre, but the amount is increased by an addition of the hydroxide of an alkali metal. Sodium ferrate also deposits ferric oxide, but oxidises the material energetically. A cupro-chromic solution, made by dissolving copper chromate in ammonia, mixed with soda or potash, fixes oxides of copper and chromium on the fibre.—W. G. M.

β -Naphthol Preparations on Cotton Fabrics, Preservation of. C. Kurz. Monit. Scient. 1895, 9, 638

THE difficulty of preserving cotton fabrics, prepared with sodium β -naphtholate, so as to keep white for a suitable length of time, has been overcome by the author in the following manner:—

The essential part is the employment of a double salt of fluoride of antimony and sulphate of ammonium (47 per cent. Sb_2O_3), which is added to the preparation of sodium β -naphtholate.

The following example gives the quantities generally employed:—40 grms. of β -naphthol are dissolved in 1 litre of water and added to 80 c.c. of caustic soda of 38° B.;

10 grms. of the crystallised antimony salt, dissolved in 50 c.c. of boiling water, are then added gradually, stirring meanwhile, until the flocculent precipitate of oxide of antimony formed, is completely redissolved.

Cotton fabrics prepared in this preparation will keep white for more than eight days. This process is also good for the preparation of cotton yarns. The preparation is employed chiefly for such substances as α - and β -naphthylamine, benzidine, toluidine, &c. Also, for similar proportions of paranitraniline, β -naphthol, and β -naphthol R., for metanitraniline, dianiline, &c., with or without the addition of sulphocyanates to the preparation.

For printing with the basic colouring matters on tannin under azoic colours, the presence of the antimony salt facilitates the fixation of these colours, by forming tannate of antimony on the fibre. Nevertheless, this process is imperfect, inasmuch as the presence of caustic soda in excess is detrimental to the formation and to the complete fixation of the tannate of antimony, and results nearly alike were obtained in this way, whether the cloth prepared with tannin was passed through a solution of sodium naphtholate containing a salt of antimony or not.

The author states that this process has been in actual use now for more than a year.—T. W.

β -Naphthol Preparations on Cotton Fabrics, Preservation of. Reply to C. Kurz by L. Caberti. Monit. Scient. 1895, 9, 772.

C. Kurz states that the excess of caustic soda is detrimental to the formation and fixation of basic colours. But the author points out that in his process, a certain quantity of glycerin is added, whereby the quantity of caustic soda employed to redissolve the oxide of antimony precipitated, is reduced to a minimum, and in consequence the fixation of the basic colours is not impeded by any excess of alkali, as it would be according to Kurz's process. Glycerin in presence of alkalis, it is pointed out, is a very good solvent for certain metallic oxides, such as the oxides of iron, chromium, tin, &c. In certain cases it is even indispensable for the purpose of dissolving any appreciable quantity of metallic oxide—in the present case, oxide of antimony.

The author denies that in his process the same results are obtained, whether the pieces prepared with tannin are treated with sodium naphtholate solution, either containing a salt of antimony or not.—T. W.

Tannic and Gallic Acids, Absorption of, by Silk. L. Vignon. Comptes rend. 121, 1895, 916–919.

EXPERIMENTS have been made under varying conditions of time, temperature, and dilution as to the behaviour of silk skeins when immersed in tannin and gallic acid solutions, and the following conclusions arrived at:—1. Ungummed silk can absorb gallic and tannic acid. 2. The absorption of gallic acid at a temperature of 80° C., which, with a 1 per cent. bath, is practically nil, can amount to 7–8 per cent. of the weight of the silk when the bath contains 4 per cent. 3. Tannin is absorbed much more readily than gallic acid, the limit being about 25 per cent. of the weight of the silk. 4. In the case of solutions containing gallic and tannic acids in equal quantities, only the latter is absorbed, and the increase in weight of the silk corresponds to the strength of the solution in tannic acid. The results can be applied as methods for estimating tannin in products employed for dyeing and weighting silk.—T. A. L.

Chrome Leather, the Alizarin Colours applied to. H. Burgess. Leather Trades Circular and Rev. 1896, 396–397.

THE success which has attended the application of the alizarin dyestuffs to wool mordanted with chromium compounds is well known. When it was attempted to use these dyestuffs for bark and sumach tanned leather, it was found that the high temperature (about 60° C.), which was necessary, even in an alkaline bath, caused irretrievable damage to the leather. Since chrome leather will withstand a higher temperature than will bark or sumach tanned goods, the author performed some experiments in the hope that the alizarin dyestuffs might be successfully applied to

the new leather. The expectation that the leather itself, being a chromium compound, would act as its own mordant, and be dyed directly, was not realised; for the dyeing was found to be very partial at any temperature below 100° C., and this is too hot even for chrome leather. By mordanting and dyeing in baths at moderate temperatures, however, much better success was obtained. The leather is introduced into the cold bath, and the temperature raised—in the mordant bath, to 40° C., and in the dyeing bath to 60° C.—in the course of 20 minutes, and maintained at the same point for another 20 minutes. The dyeing bath contained the dyestuff dissolved in 5 per cent. ammonia (1 c.c. for each grm. of dyestuff).

The following are among the results quoted, the quantities of mordants and dyes being percentages on the weight of the dry leather:

Alumina Mordant.—19 per cent. $Al_2(SO_4)_3 + K_2SO_4$ (sic) and 2 per cent. of $C_2H_2O_4$.

Dye: 25 per cent. Alizarin W.B.—A deep rich crimson shade.

25 per cent. Alizarin W.R.—Same as W.B., but not quite so blue.

25 per cent. Alizarin Orange.—A bright red shade, much brighter than either Alizarin W.B. or W.R.

30 per cent. Anthracene Brown.—A dark brown, almost black.

25 per cent. Anthracene Brown.—Dark brown.

15 per cent. Anthracene Brown.—Chocolate.

5 per cent. Anthracene Brown.—A very pretty iron grey shade.

15 per cent. Alizarin Orange, and 10 per cent. Anthracene Brown.—A deep rich claret.

3 per cent. Cærulein.—A deep green (yellow shade).

5 per cent. Alizarin Blue.—A full bright blue.

5 per cent. Cærulein.—Same as with 3 per cent., but much deeper shade.

Tin Mordant.—5 per cent. $SnCl_2$ and 2 per cent. $C_2H_2O_4$.

Dye: 25 per cent. Alizarin W.B.—Redder than with alumina mordant.

25 per cent. Alizarin W.R.—Redder than with alumina mordant.

25 per cent. Alizarin Orange.—Yellower than with alumina mordant.

With anthracene brown—quantities as with alumina mordant in each case—good shades were obtained, slightly redder brown than with alumina mordant.

Iron Mordant.—8 per cent. $FeSO_4$ and 2 per cent. $C_2H_2O_4$.

Dye: 25 per cent. Alizarin W.B.—Dark maroon.

25 per cent. Alizarin W.R.—Dark maroon.

25 per cent. Alizarin Orange.—Dark crimson.

20 per cent. Anthracene Brown.—Dark brown, as dark as the shade obtained with 30 per cent. on alumina mordant.

2 per cent. Anthracene Brown.—A very pretty stone drab.

2 per cent. Alizarin Blue.—Full blue shade, not so good as with alumina mordant.

3 per cent. Cærulein.—Dark olive green, very good shade.

The best chromium mordant proved to be 3 per cent. $K_2Cr_2O_7$ and 2 per cent. $Na_2S_2O_3$ with 1 per cent. H_2SO_4 .

Combinations of colours may be successfully used in order to still further vary the shades, and for the same purpose almost any of the acid dyestuffs may be applied.

The alizarin blue and cærulein dyes are quite fast. The action of light is under investigation.—A. G. B.

PATENTS.

The Utilisation of a Waste or Nearly Waste Product, [Locust Beans], Improvements in or Appertaining to, and the Manufacture of a Useful Gum or Gummy Compound therefrom. P. C. D. Castle, Liverpool. Eng. Pat. 24,877, Dec. 21, 1894.

THIS is a development of Eng. Pat. 8793, 1893 (this Journal, 1894, 410), describing the treatment of the beans of the locust or carob tree for the preparation of a gum

to replace tragacanth. The beans are extracted twice with 15 to 20 times their weight of water for 3 or 4 hours at a temperature not exceeding 82° C. The liquid is separated in a centrifugal machine, mixed with 1 part per mille of phenol, filtered through silk—as used in flour dressing—5 per cent. of farina added, and the whole well agitated for half an hour. The apparatus is lined with lead, aluminium, or silver. The gum is used for sizing, colour printing and dyeing; and if prepared without antiseptic, may be employed for confectionery.—E. H. L.

Printing of Cotton or Linen Warps or Warp Yarns. Improvements in, in connection with Sizing or other Treatment thereof for Weaving Purposes. T. Pickles, Burnley. Eng. Pat. 2676, Feb. 7, 1895.

AFTER bleaching, dyeing, or otherwise preparing upon the warp beam, the warps pass to a drying cylinder, where all moisture is driven off, and then through suitable printing apparatus and steam box. The bad effects of the pressure required in printing, when the warp yarns are in rope form, are thus avoided. From the steam box the warps pass to the sizing machine with or without the interposition of a second drying cylinder.—R. B. B.

Dyeing of Cotton or Linen Warps or Warp Yarns. Improvements in, in connection with Sizing or like Treatment thereof for Weaving Purposes. T. Pickles, Burnley. Eng. Pat. 2764, Feb. 8, 1895.

SEE Eng. Pat. 2676 (foregoing). The warps are prepared on the beam, pass around a drying cylinder and thence either to the sough box containing a mixture of dye and size, or to a separate dye box. In the latter case the warps may be caused to pass several times through the dye box until the desired colour is obtained, and afterwards sized and dried in the ordinary manner.—R. B. B.

Dyeing or Colouring Asbestos Cloth or Fabrics. Improvements in. L. Cresswell, Calderley, Yorks. Eng. Pat. 3123, Feb. 13, 1895.

THE object of this invention is to dye on asbestos fire-screens or fireplace blinds, colours which are not affected by exposure to very high temperatures. For this purpose, after dyeing by some known process, the cloth is passed through a bath containing ammonio-nitrate, acetate, or tartrate of silver together with dextrin in solution. It is then dried by the action of heat, e.g., by ironing, with a sheet of parchment between the cloth and the heated iron. Indelible dark colours are thus produced.—R. B. B.

Chemically Cleansing Wool and Woollen Fabrics and Rugs. A Process for. E. Lasbordes, Castres, France. Eng. Pat. 3590, Feb. 19, 1895.

THIS is a modification of the carbonising process for removing vegetable substances from wool. Panama, hawthorn, or similar wood broken into fragments is soaked in water for 2 hours. In this bath the wool is steeped for at least 4 hours, after which it is drained and dried. To prepare the acid bath, calcium sulphate is added to H_2SO_4 at 13°–15° B. to remove nitrous compounds, and after standing some time the liquid is decanted and diluted to 2·5°–5° B. Sulphurous acid and sodium bisulphite are added, with the result that during carbonisation sulphuric acid is formed, and in its nascent state is more than usually active. After steeping in acid, carbonisation takes place at a temperature not exceeding 50° C. Another bath of Panama, and one of dilute sodium carbonate, complete the process. For goods which are to be dyed, the acid bath may consist of hydrochloric and tannic, instead of sulphuric and sulphurous acids.—R. B. B.

Saving Dyestuff in Dyeing with Indigo Blue, A Process for. E. Cabiati, Milan, Italy. Eng. Pat. 14,704, Aug. 2, 1895.

FOR goods to be dyed a plain blue, a net-shaped groundwork is printed in aniline black on one or both sides of the material, which is then dyed in the indigo vat. For prints in the reserve style the resist is first printed, and then the aniline black, before dyeing. When printing with mordants, the black is applied after the mordant.—R. B. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Tartaric Acid and Alkaline Tartrates, Some Reactions of. L. M. de la Source. Comptes rend. 121, 774–776.

THE addition of a small quantity of tartaric acid to a dilute solution of potassium acetate, produces immediately a precipitate of acid potassium tartrate, but with a concentrated solution of the acetate no such precipitation occurs. A neutral alkaline tartrate is decomposed by acetic acid when subjected to spontaneous evaporation in the cold, and under similar conditions an alkaline acetate is decomposed by potassium acid tartrate. Calcium sulphate in excess decomposes neutral alkaline tartrates forming calcium tartrate and an alkaline sulphate. Potassium sulphate and chloride evaporated with tartaric acid lose part of their respective acids.—J. G. W.

Calcium Chromite, Neutral, Crystallised, Production of. E. Dufau. Comptes rend. 1895, 121, 689–691.

A MIXTURE of 115 grms. of chromium trioxide and 45 grms. of quicklime, acted upon by a current of 700 amperes and 50 volts in the electric furnace, gave a green crystalline mass containing two kinds of crystals, yellowish, similar to those prepared by Moissan ($4\text{CaO} \cdot \text{Cr}_2\text{O}_3$), and dark needles, several millimetres in length, occurring in groups; the cover of the furnace was also covered with these crystals. The crystallised portion treated with strong hydrochloric acid gave out much heat, with a copious evolution of chlorine, and the production of a green colour in the liquid. Finally the crystals were treated with boiling hydrochloric acid until they were no longer attacked. The residue consisted of prismatic needles with metallic reflection, giving a clear green powder; the smaller crystals being transparent. Their hardness was about 6, and their density 4·8 at 18° C. The formula was $\text{CaO} \cdot \text{Cr}_2\text{O}_3$, and thus agreed with that of the olive-green powder obtained by Gerber in 1877. Chlorine at a red heat decomposed the chromite with superficial formation of calcium chloride (oxygen being evolved), the chromium oxide being unattacked. HCl and HF give calcium fluoride and chloride at a red heat, leaving the chromium trioxide crystallised. The hydrochloric acid gas acting with incandescence and at a low red heat. HNO_3 and SO_2H_2 are without action. —W. G. M.

Boric Acid, The Methyl-Alcohol Process of Separation simplified. H. J. and Dupasquier. Monit. Scient. 1895, 709.

See under XXIII., page 136.

PATENTS.

Chlorates of Sodium and Potassium, Improvements in the Manufacture of. J. Hargreaves, Farnworth-in-Widnes, and T. Bird, Cressington. Eng. Pat. 18,526, Oct. 1, 1894.

SODIUM chlorate is produced by passing chlorine through a series of absorbing vessels, charged with caustic soda or with sodium carbonate or bicarbonate solution. The excess of chlorine is utilised by passing it through a coke-packed tower, into which a weak soda solution is run. The sodium chloride precipitated in the process is drawn off into a filtering vessel with a perforated bottom, a current of steam being forced downwards to dissolve out the sodium chlorate mixed with the salt. The solution is concentrated, and the salt removed as it falls, until a liquor of sp. gr. 100° to 120° Tw. is obtained, from which sodium chlorate is crystallised. Potassium chlorate is obtained from sodium chlorate by the addition of an equivalent of potassium chloride in solution, followed by crystallisation.

The absorbing vessel is divided, by a perforated partition, into an inner and outer compartment, the chlorine passing into the former—whence, by the action of an agitator, the soda solution is forced to a higher level in the outer compartment, and continually returns as foam to be acted upon by the chlorine. When sodium carbonate solution is used, bicarbonate is formed in part, and precipitates; but this, with undissolved carbonate, is kept in constant suspension and in contact with the gas. The absorbing vessels, arranged in series, are interchangeable.—E. S.

Ammonia from Sewage Effluent and other Weak Ammoniacal Liquors, Improvements in the Recovery of. T. Twynam, Egham, and F. E. Matthews, Englefield Green, Surrey. Eng. Pat. 2625, Feb. 6, 1895.

SEWAGE effluent, or other weak ammoniacal solutions, are filtered through a mixture of ferric hydroxide and phosphate, or of hydrated phosphoric iron ore, which may be mixed with an inert substance, or the latter may be superposed. The filtering material may be placed within a hollow metallic jacket for convenience of expelling the ammonia after the filtration by means of steam or hot air, the ammonia being suitably condensed. Or the ammonia-charged material may be used directly as a fertiliser. The filters are arranged in series.—E. S.

An Improved Detergent or Washing Powder. J. T. A. Walker, Rishton, near Blackburn, Lancashire. Eng. Pat. 3466, Feb. 18, 1895.

IN order to obtain a harmless yet active preparation of ammonia for laundry purposes the inventor mixes a salt of ammonium, preferably the sulphate, with commercial sodium carbonate, in the proportion of one molecule of the former to two of the latter. To avoid loss of ammonia the salts are mixed in an anhydrous state, or are coated with a substance such as paraffin wax. The preparation may be used alone or with a super-fatted soap base. In the latter case 10 per cent. of the detergent powder is added to the soap base. Where artificial perfume is desired, a trace of nitrobenzene may be added. By the use of sodium bicarbonate, acid ammonium carbonate is produced and all risk of injury to the hands obviated.—C. A. M.

Caustic Lyes of the Alkalis, Process for the Production of. O. Imray, London. From The Chemische Fabrik Rhenania, Aachen, Germany. Eng. Pat. 3185, Feb. 18, 1895.

CAUSTIC alkalis are produced by first treating alkaline carbonate liquors with a mixture of calcium carbonate and caustic lime, and then treating the separated imperfectly causticised lye with fresh lime to render it completely caustic. In practice, crude lye diluted to about 17° B. with weak liquors (washings, &c.) is placed in a vessel having iron gratings at the top, provided with a central opening for the introduction of a sieve-like vessel containing lime, suitably suspended. Steam is then blown in from the bottom until the temperature rises to 70° C., when the lime is admitted. After settling, the lye is drawn off and fresh lye is added, to be boiled together with the remaining sludge of calcium carbonate and hydrate. This second operation converts the sludge wholly into carbonate, which is removed after the partially causticised lye is withdrawn. The lye is then treated as in the first operation, with fresh lime, and the liquid obtained is converted into solid caustic soda. The resulting sludge of calcium carbonate and hydrate is again used as described.—E. S.

Chlorine, Manufacture or Production of, Improvements in. J. Y. Johnson, London. From Verein Chemischer Fabriken of Mannheim, Germany. Eng. Pat. 4267, Feb. 27, 1895.

THIS invention is an addition to and development of Eng. Pat. 10,601, 1891 (this Journal, 1895, 483), for producing chlorine by reacting in a series of (A) chambers upon hydrochloric acid by nitric acid, communicating with a second series (B) traversed by strong sulphuric acid for decomposing the NOCl formed in the A chambers, and with a third series (C) constituting the regenerating apparatus, besides supplementary vessels, shown in the drawing given with the abstract of the earlier patent. These vessels, which before were in each series superposed, are now shown arranged side by side. When the reaction chambers (A) are used, the acid mixture assigned to them is successively proportioned as 69:23:8, for adjustment to the quantity of HCl gas reaching each; but the chambers are shown equal in size, so that the acid mixture after use may be saturated in each chamber with HCl. The acid running off from the A chambers is conducted to a closed vessel to be heated to 130° C. to free it from nitrogen compounds. The nitrous

sulphuric acid discharged from the B series of chambers, and containing a certain proportion of chlorine, is taken to another closed vessel, which may be of cast iron, to be heated to 130° C., when most of the chlorine in solution will escape as HCl and NOCl, and the gases are led into one of the B chambers. Also, the nitric acid regenerating column is divided at about two-fifths of its height, at which point as much nitric acid containing chlorine is drawn off as corresponds to the quantity of chlorine remaining behind in the nitrous sulphuric acid previously heated.—E. S.

Cyanides, Process for Manufacturing out of Molasses and Lyes resulting from Beetroot Molasses. H. Reichardt and J. Bueb, Dessau, Germany. Eng. Pat. 7171, April 8, 1895.

THIS process consists in directly leading the gases resulting from the dry distillation of lyes and molasses through a system of fire-brick channels raised to a bright red or white heat. The nitrogen contained in the gas is converted into ammonium cyanide mixed with a small amount of ammonium carbonate. The gas is then passed through a solution of iron salts, the ferrocyanide so obtained serving as an initial material for the production of yellow prussiate, or cyanide of potassium. The carbonic acid and hydrocarbons which are present in large quantities in the products of distillation, are entirely freed from nitrogenous compounds, and can be utilised in any suitable manner.

—J. L. B.

Obtaining Cyanides from Gases [Coal Gas], Improvements in Apparatus for. W. Foulis, Glasgow, and P. F. Holmes, Huddersfield. Eng. Pat. 15,168, Aug. 12, 1895.

APPARATUS is shown for use in the process for obtaining cyanides from gases, forming the subject of Eng. Pat. 9474, 1892 (this Journal, 1893, 511). Scrap iron is treated with hydrochloric acid in tanks, and the iron liquor is pumped to an elevated storage tank, whence it is taken to precipitation tanks, for treatment with an alkaline carbonate. After settling, and withdrawal of the supernatant liquor, alkali and water are added, and steam is blown in, and the liquid, with the iron carbonate in suspension, is taken through pipes by a steam lifter to a mixing chamber fitted with agitators, immediately over a pair of scrubbers of the horizontal rotary type. Gas, freed from ammonia, but retaining cyanides, is passed through the scrubbers, after admission of the mixture. The outflowing liquor contains an alkaline ferrocyanide in solution, and is passed into a settling tank, whence the liquor is taken to a pair of pans, one over the flue and the other over the fire, the thin liquor being passed into the latter and the thicker liquor into the former. The cake obtained is treated as described in the former patent.—E. S.

Evaporators for obtaining Common Salt, and for Analogous Purposes, Improvements in or relating to. T. Scott, Edinburgh. Eng. Pat. 15,197, Aug. 13, 1895.

See under 1., page 102.

IX.—BUILDING MATERIALS. CLAYS, MORTARS, AND CEMENTS.

Cement for Metals, Experiments with. M. Rudeloff. Mitt. aus d. Königl. techn. Versuchsanstalt zu Berlin. 13, (6), 290—302.

THIS material is a hard, brittle substance, containing much sulphur, and is intended for use in a fused state to fix iron stay braces in stone, brickwork, or cast iron, as well as for filling up and repairing fissures in foundations, &c., faults in iron castings, setting machinery and stuffing collar joints in gas or water pipes. These purposes it is claimed to be adapted for by its property of fusing at a low heat to a watery consistency, whereby it is enabled to penetrate into cracks and holes, where it expands on cooling and adheres firmly to stone, brick, metal, or wood, and is said to resist the action of acids, moisture, and oils.

A particular make when tested gave the subjoined results:—

Fusion occurred at $119^{\circ}\text{C}.$; when heated further the substance became thicker, but fluidity was regained on cooling, accompanied by stirring. To avoid ignition, the fusing should be effected otherwise than over a naked flame. The cooled material quickly sets, and its volume decreases some 0.37 per cent. at the same time. When poured into cold iron moulds, it sets with a concave surface. It does not adhere to cold metallic surfaces, but if they have been warmed, sets fast, and can only be chipped off with a hammer. Used for setting stay braces in iron, the resulting power of resistance is about equal to that of sulphur—provided the hole be about 125 mm. deep and rather wide compared with the diameter of the rod—and superior to both lead (by some 15–20 per cent.), and Portland cement (by 65–75 per cent.).

The cement in question was able to withstand a pressure of 4.95 kilos. per sq. mm. when in the form of cubes, and of 10.3 kilos. per sq. mm. when in the condition of flat blocks $10 \times 80 \times 80$ mm. It is found to make a thoroughly sound packing for collar joints in iron piping, but can withstand neither dilute sulphuric acid nor mineral oils. Atmospheric conditions, however, have but little influence.

—C. S.

PATENTS.

Fire-Clay, Refractory and Non-Conducting Bricks and Blocks, Building Bricks, or the Like, Improvements in or relating to the Manufacture of. F. Young, Walton, Lancashire. Eng. Pat. 3608, Feb. 19, 1895.

THE new article of manufacture has as ingredients, silica with only sufficient alumina or alkali to cause it to firmly adhere. Two good recipes for its composition are as follows:—

1. Sand or other silica, 50 to 80 per cent.; waste from alkaline silicate manufacture, 5 to 15 per cent.; a good aluminous fire-clay, 5 to 15 per cent.

2. Silica, 60 to 85 per cent.; the waste product of silicate of soda manufacture, 5 to 15 per cent.; aluminate of soda, 2 to 5 per cent.

An extremely refractory brick is thus obtained, and waste material is utilised.—V. C.

Fireproof and Insulating Compounds, Manufacture of. A. Inschenetzky, St. Petersburg. Eng. Pat. 5254, March 12, 1895.

THE basis of these materials is asbestos, which is cemented together by means of silica introduced in a soluble form from which it separates either in the form of the colloid hydrate, or by chemical combination with other bodies introduced into the mass. If the material is required to be waterproof it is saturated with rosin or other suitable material, and subsequently heated sufficiently to drive off any volatile matter.

When used for insulating purposes the material is termed "Megohmite," when used for other purposes it is called "Uralite."—V. C.

X.—METALLURGY.

Silicon, Action of, on Iron, Chromium and Silver. H. Moissan. Comptes rend. 121, 621–626.

EXPERIMENTS upon the action of silicon on the three above-named metals show that the action may take the three following courses:—

1. The solid silicon, owing to its vapour tension, unites with the solid metal at a temperature of $1200^{\circ}\text{C}.$ and yields, by an action analogous to cementation, a true silicide, the melting point of which is lower than that of the metal.

2. The liquid silicon unites with the liquid metal.

3. The silicon dissolves in the liquid metal but does not form a combination with it, or produces a very unstable one, and separates out in the crystalline form at the moment of solidification of the metal.

The two first reactions apply to iron and chromium, which form silicides of the composition SiM_2 , whilst the

latter applies to silver which does not form a compound with silicon.

Iron silicide occurs in small prismatic crystals, with a density of 7. It is attracted by a magnetic needle. Hydrofluoric acid in aqueous solution attacks it readily, but it is only acted upon slowly by hydrochloric acid, even when powdered finely. Nitric acid has no appreciable action; but aqua regia attacks it with the formation of silica.

Chromium silicide resembles iron silicide very closely in its properties. It is harder than quartz and even than corundum.—J. G. W.

High Silicon Iron in the Blast Furnace, Working of. J. S. Kennedy. Eng. and Mining J. 1895, 61, 42.

MANGANESE, apart from its value in protecting silicon from oxidation in the cupola mixture, acts as an aid in the manufacture of high silicon or "soft" irons. A hot furnace and basic slags are essential to the combination of manganese with iron. The presence of manganese both in the iron and in the basic slag, tends to an increase of their fluidity, and allows of high furnace heats without injurious consequences. The author found no difficulty in running smoothly on an American-Scotch "soft" iron containing 4–5.5 per cent. of silicon, the slag containing 30–31 per cent. of silica, but there was sufficient manganese in the ore mixture to ensure a content of from 2–2.3 per cent. in the pig-iron.

The highest silicon iron ever made by the author contained 8.75 per cent. of silicon; it contained only a trace of manganese and the slag was normally an acid one.

The following is an analysis, made some years ago, of a Scotch ferro-silicon. The iron was silvery white in colour and had an irregular fracture:—Iron, 83.16; manganese, 3.86; silicon, 10.55; phosphorus, 0.04; sulphur, 0.03; carbon (graphite), 0.52; carbon (combined), 1.84. The percentage of total carbon (2.36) is very small in an iron containing so much silicon.

In the Ashland furnace, an iron has been made containing 12–13 per cent. of silicon.—A. S.

Iron, Boride of, Its Preparation and Properties.

H. Moissan. Bull. Soc. Chim. 1895, 956–959.

BORIDE of iron may be prepared by leading a slow current of chloride of boron vapour over pure reduced iron, contained in a porcelain tube at a dull red heat, when ferrous chloride is formed and distilled over, whilst the required boride is left; or by heating pure iron in a porcelain boat, brasqued with a sufficient quantity of boron, in a gentle stream of hydrogen, at 1100 or $1200^{\circ}\text{C}.$ After cooling in hydrogen, the residue is boride of iron which, if it contain about 9 per cent. of boron, will be very crystalline, and may be easily fractured along very marked planes of cleavage; and may be traversed by long needles which are often iridescent. The boride, thus formed by cementation, and containing 8 to 9 per cent. of boron, fuses at $1050^{\circ}\text{C}.$ But when the boron exceeds 10 per cent., fusion is far less easy, the fracture is conchoidal, and the crystallisation confused; whilst a 20 per cent. sample can be fused only with difficulty in a gas-carbon fire. In the electric furnace, a current of 300 ampères and 65 volts may be made to produce a large quantity of the compound within the space of 5 or 6 minutes, if fragments of iron be placed in a boron-brasqued crucible; but the temperature must not be excessive or crystalline boride of carbon will also be formed from the carbon of the crucible. On treating fragments of the crude boride, as it is formed by the above processes, with hydrochloric acid diluted with two or three volumes of water, the excess of iron is removed, and a crystalline residue is left, which should be washed successively with water, alcohol, and ether, and then dried; it has a composition corresponding to the formula BoFe . This boride is yellowish-grey in colour, and has a specific gravity of 7.15 at $18^{\circ}\text{C}.$ In dry air or in oxygen the crystals are unaltered, but in moist air they become covered with an ochreous layer.—W. G. M.

Japanese Alloys. Dingler's Polyt. J. 298, [3], 72.

THE following notes are based upon the statements of individual workers, who have revealed the composition of Japanese alloys, hitherto kept a secret.

"*Shakdo*" is copper alloyed with 1–10 per cent. of gold. The articles manufactured of this composition, after being polished, are boiled in a corrosive mixture consisting of copper sulphate, alum, and verdigris, and thus attain a beautiful bluish black colour. This colour is due to the evenly distributed gold, tests with pure copper yielding adverse results. The intensity of the shade depends essentially upon the gold content of the colouring, 1–2 per cent. of gold produces a rich bronze colour. "*Shakdo*" is employed in the manufacture of swords, scabbards, buckles, brooches, and decorative work. When boiled with the above-mentioned corrosive, the surface of the alloy is oxidised to a copper-red shade.

"*Gin-shi-bu-ichi*" (so called quarter-silver) consists of copper alloyed with 30–50 per cent. of silver. The jewellery prepared from this alloy has a rich grey colour which finds much favour in Japan.

"*Mokume*" is a compound of several different coloured alloys and simple metals which are arranged so as to produce an ornamental effect. Damascened goods are prepared as follows:—30–40 thin plates of gold, *shakdo*, silver, rosette-copper, and *gin-shi-bu-ichi* are soldered one over the other in varying order. Holes of different forms and sizes are bored in the plates, which are then hammered out and boiled in the corrosive mixture already mentioned, whereupon the different colours are developed.

"*Sin-chu*" (brass). The finest kind of Japanese brass consists of 10 parts of copper and 5 parts of zinc, a less valuable kind, of 10 parts of copper, and 2·7 parts of zinc.

"*Karakane*" (bell-metal). According to the size and used of the bells one of the four following alloys is used:—

1....	10 pts. copper,	4 pts. tin,	$\frac{1}{2}$ pt. iron,	$\frac{1}{2}$ pts. zinc.
2....	10 "	2 $\frac{1}{2}$ "	1 $\frac{1}{2}$ pts. lead,	$\frac{1}{2}$ pt. zinc.
3....	10 "	3 "	2 "	1 "
4....	10 "	2 "	2 "	$\frac{1}{2}$ pt. iron.

In preparing the alloy, the copper is melted, and the other metals added in the above order. The best bells are cast from the first alloy, large bells from the third. For all the alloys above described, suitable solders are employed, the following are their respective compositions:—

Karakane.....	20 pts. brass,	10 pts. copper,	15 pts. tin.
Sin-chu (a)....	10 "	1 $\frac{1}{2}$ "	6 " zinc.
Silver.....	3 "	1a and 10 pts. silver.	
Gin-shi-bu-ichi	5 "	1a " 10 "	1a and 3 pts. zinc.
Mokume.....	1 $\frac{1}{2}$ "	1a " 10 "	
Shakdo.....	3 pts. shakdo,	10 pts. zinc.	
Tin.....	10 pts. tin	5 " lead.	

Amongst the metal goods which arrive in Europe, are some with lustrous red surfaces which are generally considered to be lacquered or enamelled. This, however, is not the case, the appearance in question being due to a coating of red oxide of copper, produced by boiling the articles in the already mentioned corrosive liquid.—J. L. B.

The Silver Deposits of Zechan and Dundas, Tasmania. W. F. A. Thomae. J. Inst. Mining and Met. Dec. 1895.

The lodes exploited for lead and silver in this district may be classed either as fissure veins or irregular deposits, and contain the following valuable minerals:—Galena (with silver ranging from 10 to over 200 oz. per ton), argentiferous iron pyrites (sometimes yielding 146 oz. of silver per ton), cerussite, anglesite, pyromorphite, erocoisite, native silver with silver chloride, fahlerz, bournonite, jamesonite, and in one place a variety of leadhillite. Of objectionable minerals, sphalerite with from 2 to 5 oz. of Ag per ton usually accompanies galena in small proportions. Tin occurs in one or two localities, the maximum in any ore offered for sale having been 0·75 per cent.; arsenic, and antimony (in bournonite and jamesonite), rarely occur in any quantity. The concentrating mills are for the most part unsuitable, steam-jiggers at one mine losing at least 30–50 per cent. of the gross contents of the ore delivered to them. In all cases there is a greater loss of silver from the galena by machine concentration than by hand treatment, the loss, which, in the table of assays quoted, ranges from 0·21 to

0·56 oz. of silver per unit of lead, is attributed to the excessive crushing of a galena in which much of the silver is present in mere admixture as a silver ore, that may be carried off in the slimes. No fair comparison of concentrators can be effected unless the trials be made with the same ore. Only two attempts at local smelting have been made, one of which never had any prospect of success, whilst, in the other, a water-jacketed blast furnace, with a capacity of 60 tons per 24 hours, smelted over 3,000 tons of ore, and then stopped because the supply was exhausted.

—W. G. M.

The Cyanide Process, The Chemistry of.—Is the Double Zinc Potassium Cyanide a Solvent for Gold. J. S. C. Wells. Eng. and Min. J. 1895, 60, 584.

The author describes a series of experiments which he made to test the accuracy of a statement by Feldman (this Journal 1894, 952), that gold is soluble in a solution of zinc potassium cyanide. He draws the following conclusions from the results of his tests:—1. Zinc potassium cyanide is a solvent of gold, but of less power than potassium cyanide. 2. Zinc potassium cyanide is not decomposed by alkali into free potassium cyanide and potassium zincate. 3. Zinc potassium cyanide, in presence of potassium cyanide, can have no solvent action on gold, and is therefore valueless in the ordinary cyanide process. 4. The estimation by silver nitrate in presence of free potash, does not indicate the cyanide available as a solvent of gold, but the total amount of cyanogen in the solution.—A. S.

Gold and Silver Ores and other Compounds; The So-called "Selective Action" of very Dilute Solutions of Potassium Cyanide upon. J. Maclear. J. Inst. of Mining and Met., Dec. 1895.

The statement in the MacArthur-Forrest patents, as to the selective action of dilute solutions causing gold and silver to dissolve, in preference to the base metals, and the more definite interpretation thereof given in the judgment of the Court of Appeal (that "a strong solution attacks the base metals without attacking the gold, whereas a weak solution is feeble and *nil* on the base metals but attacks the gold"), led the author to institute a series of experiments on the subject. Gore's experiments showed that whilst many base metals (Al, Zn, Cu, Sn) were electro-positive as metals, others (Pb and Fe, as well as Hg) were electro-negative; and the rate of solubility varied in a similar way. But in gold ores the base metals occur in combination; yet even under these circumstances cyanide solutions of 0·5, 2, and 5 per cent. strength, acting upon freshly precipitated oxides of iron, zinc, copper, and lead, mixed with finely divided gold, dissolved, in 24 hours, more of the former than of the latter; and the proportion of gold passing into solution was small as compared with that of the oxides. With native oxides the rate of solution may be slower, but still may often be great as compared with the gold; but in the cyanide treatment of ores, the preliminary addition of alkalis often produces hydroxides, which would behave similarly to those experimented with. Carbonates are like oxides in respect of solubility. Sulphides are acted upon irregularly, in a manner and to an extent which depend upon physical and chemical conditions; but, broadly speaking, they too are far more easily attacked than gold. The base metals of oxidised ores, containing soluble sulphates, would dissolve even in water, and therefore also in cyanide solutions. But too little attention has been given to electro-chemical action. Skey pointed out that mercury, being electro-negative to gold in cyanide solutions, the use of cyanide in gold-milling caused the solution of any salts of mercury which had caused flouzing; whilst the mercuric cyanide produced dissolved gold rapidly, with deposition of mercury. Many of the natural sulphides, as well as manganese peroxide and magnetic iron ore, are electro-negative to gold in cyanide solutions, and are sufficiently good conductors to allow of galvanic couples being set up, which expedite the solution of the gold. Similarly couples may be formed by gold with the particles of iron worn from the shoes and dies of the stamps, iron being the negative element. Further, the mere passage of a current of elec-

tricity though a solution in which finely divided gold is suspended was found to hasten the rate of solubility, although the gold was not in metallic contact with either electrode.

The greater comparative proportion of gold to base metal in weaker solutions is due mainly to the fact that in all there is a large excess of cyanogen over that necessary to combine merely with the gold, and the larger the excess the more foreign substances may be expected in solution; whilst gaseous oxygen, being more soluble, and therefore present in greater quantity, in the more dilute solutions, these will attack the precious metal more readily. Thus, it is considered, the action cannot properly be described as "selective."—W. G. M.

Alloys of Copper and Zinc; their Mechanical Properties.
G. Charpy. Comptes rend. 1895, **121**, 494—496.

THE brass alloys are not influenced by the time of heating or cooling whilst undergoing thermal treatment; so that the condition of the metal depends solely upon the amount of mechanical work to which it has been submitted in the cold, and the maximum temperature of the last annealing. Hence the author has selected this series for exhaustive examination. Alloys containing from 50 to 100 per cent. of copper were cast, and then hammered or rolled until the deformation or extension at the moment of rupture, as observed during mechanical testing, was practically *nil*. Specimens thus hardened to the maximum point were annealed at various temperatures, increasing by 50° C. each time, up to the fusing point of the metal. At each stage tests were made by tension and compression, and these have led to the following conclusions:—1. The strength of cast metals, depends upon the casting temperature, being greatest as this approaches the fusing point; also upon the rate of cooling, a rapid solidification giving the best result. 2. The temperatures of annealing may be divided into four zones, varying in extent for different alloys; the first includes those at which no softening effect is observable in the annealed metal, and extends only up to 350° C. for copper, and to temperatures which are lower as the percentage of zinc increases. In the second zone, the softening effect is a function of temperature, almost absent when copper is being treated, this zone extends as the zinc is increased, until for the 40 per cent. alloy it reaches almost from the ordinary temperature nearly to the fusing point. Within the third zone, which ranges from 400° to 1,000° for copper, and diminishes as the zinc increases, the alteration of the mechanical properties by annealing is sensibly the same. In all these cases, annealing causes a reduction in strength and an increase of elongation before rupture. Finally, at temperatures near to the fusing point of the alloy, the metal sometimes becomes burnt, and suffers in both strength and extensibility; the extent of this zone depends upon the presence of impurities, especially of fusible metals, such as lead and tin. 3. The tests of perfectly annealed brass, show that the tensile strength rises as the zinc increases, until it reaches a maximum at about 43 per cent. of Zn, whilst the extension at the moment of rupture increases simultaneously, but reaches its maximum at 30 per cent. of Zn; in each case the diminution is rapid after the highest point is attained. The most useful alloys, therefore, are those in which the percentage of zinc ranges between 39 and 43. The actual tests are as follows:—

Composition of Metal.		Cold-worked.		Perfectly Annealed.	
Cu.	Zn.	Tensile Strength.	Extension.	Tensile Strength.	Extension.
		Kilos.	Per Cent.	Kilos.	Per Cent.
100	0	34	0	21	33
90	10	37	0	24	37
80	20	42	0	25	42
70	30	50	0	31	66
60	40	57	0	37	39
50	50	10	0	9	2

—W. G. M.

Steel, Extra hard, the Quenching of. F. Osmond.

Comptes rend. 1895, **121**, 684—685.

THE polished surfaces of steel bars, carburised by cementation, and highly hardened by quenching, are capable of being scratched by a sewing-needle, if their carbon percentage is lower than 0.7 or higher than 1.3; but between these proportions the effect of the scratch is not traceable. In the most highly carburised specimens however, the scratch is shown by the microscope to be intermittent, and the steel must therefore contain at least two constituents, which may provisionally be termed A and B, of which the former is not scratched by the needle, but will itself scratch glass, whilst the latter is scratched by apatite and possibly by fluorspar. The colour of A on a well-polished surface is greyish, that of B is white. In spite of the difference in mineralogical hardness, polishing in bas-relief by means of moistened and rouged parchment does not cause any sensible depression of the surface of B. Etching by tincture of iodine or by dilute nitric acid shows that the mass is divided into polyhedra that are but slightly coherent, and may or may not be separated by traces of a carbide which is probably Fe₃C. But A and B assume different colours, usually identical for the same constituent, in the same polyhedron. A is generally distributed in the form of lamellae, parallel-barbed in two directions, which are constant for each polyhedron, whilst B forms the groundwork. Prolonged etching renders the whole section black, hence both constituents must be carburised. A is the hard material which constitutes practically the whole of quenched steel containing 1 per cent. of carbon. The proportion of B increases with the proportion of carbon up to 1.6 per cent., beyond which the carbide Fe₃C (?) appears in increasing quantity. With a steel containing 1.57 per cent. of carbon, the maximum of constituent B is obtained when the steel is heated to at least 1,000° C. (there is no gain in exceeding 1100°), and is then quenched as rapidly as possible, in ice water or in very cold mercury. Otherwise some Fe₃C separates and diminishes the proportion of carbon in the remainder of the mass to a corresponding extent. Under the most favourable circumstances a mixture of equal parts of A and B may be obtained. Such a mixture is but slightly magnetic as compared with the same material quenched at 800° C. in water at the normal temperature. The intensity of the residual magnetism in such a bar, quenched at 1,000° C. in ice water, was found to be 345 immediately, and 221 two days after magnetisation, whilst that of a bar, quenched at 800° C. in water at 15° C., was 966 and 814 under similar circumstances. Since A is known to be magnetic, it may be suspected that B is non-magnetic. The same mixture of A and B cannot be filed, and breaks without bending, as much because A is hard and brittle as because of the want of cohesion between the polyhedra; but it breaks down freely when it is crushed. The properties of B appear to resemble those of steel containing 25 per cent. of nickel or 12 to 13 per cent. of manganese, presenting no critical point during slow cooling, and containing the iron in the form naturally stable above 850° C. (γ-iron).—W. G. M.

Gold, Analysis of, from Batoum District. G. Tchernik.

J. Russ. Chem. Soc. 27, 492—496.

ONE specimen of gold analysed contained 65 per cent. of gold and 35 per cent. of palladium. Another sample contained 88.4 per cent. of gold and 11.6 per cent. of rhodium.

—J. W.

Copper, Action of Hydrochloric Acid on. R. Engel.

Comptes rend. **121**, 528—530.

THE decomposition of hydrochloric acid by copper is so slow that it is often overlooked, but in saturated solution at 15° C. it is decomposed sufficiently rapidly for the evolution of hydrogen to be demonstrated; if a little platinum chloride be added, the reaction becomes tumultuous. Hydrochloric acid of less density than 1.083, which corresponds to HCl + 10H₂O, is without action on copper, and the action becomes extremely slow at greater strengths when the liquid is saturated with cuprous chloride. From this it would appear that the hydrochloric acid necessary to

maintain the cuprous chloride in solution is incapable of reacting on the copper, and that the slow action that does take place is due to variations in temperature; a fall in temperature producing a deposition of cuprous chloride, leaving the liquid, when a rise takes place again, incompletely saturated and capable of slight action upon the copper. When a current of hydrochloric acid gas is passed into water containing copper and cuprous chloride, a rapid action takes place notwithstanding the presence of the copper salt.—J. G. W.

Nickel and Cobalt Silicides. Vigouroux. *Comptes rend.* 1895, **121**, 686–688.

METALLIC nickel or cobalt heated strongly with 10 per cent. of silicon in hydrogen gas, gives crystallised ingots, exceedingly hard and difficult to break, which consist of the silicide mixed with an excess of metal, that may be removed by treatment with very dilute nitric acid. The resulting crystals contain silica, from the partial attack of the acid upon the silicide. A mixture in the proportion of one atom of silicon to one molecule of the metal gives a pulverulent mass of silica, metallic oxide, and silicide, when heated in a Doulton crucible in a Deville's furnace. Dilute nitric or hydrofluoric acid separates the impurities with difficulty. The best results are obtained on treating a 10 per cent. mixture in the electric furnace; as the heating is continued, the excess of metal distils off, leaving the silicide at last nearly pure, but the duration of the experiment must be governed by the bulk of metal operated upon, for if continued over long, nothing would remain in the crucible. The ingot obtained is greyish-white, and very hard and brittle. After cleaning the surface, the ingot is broken into fragments, and treated with very dilute nitric acid, to remove the trace of residual uncombined metal. The pure residue is a silicide with the formula SiNi_2 or SiCo_2 . These silicides are steel-grey, crystalline, and metallic in appearance; they are more fusible than either of the constituents, and resist the highest temperatures without decomposition. The density of nickel silicide is 7.2 at 17°, and that of the cobalt compound 7.1. The silicides burn in fluorine at the ordinary temperature, with the formation of white fumes of fluoride of silicon; in chlorine they burn at a red heat, but bromine and iodine have a less violent action. Oxygen (or air) attacks them also at a red heat, especially if they have previously been pulverised. Dry hydrofluoric acid gas, passed over the silicides contained in a platinum tube heated to redness, attacks them, yielding a combustible gas. Dry hydrochloric, hydrobromic, or hydriodic acid gas acts slowly at a red heat, giving metallic haloid compounds and gases which yield silica and hydrogen when led into water. Hydrofluoric acid solutions attack them readily, the other acids but slowly. Aqua regia completely decomposes the powdered crystals. Alkalis in solution are without action, but their carbonates, when fused, decompose them at a red heat, yielding alkaline silicates and an insoluble oxide of nickel. Mixtures of carbonate and nitrate of potash behave similarly, but at a lower temperature. Cold water is without action, but steam at a red heat decomposes the silicides.

—W. G. M.

Aluminium Vessels. Bulland. *Comptes rend.* **121**, 381–383.

THE French War Office has ordered the use of aluminium drinking and mess vessels for the army, which are made without solder, being beaten up from plate.

Similar vessels, made in the same way from the same plate, vary in weight by from 4 to 9 per cent. of the total. The author attributes this to the solvent action of the soda baths which are used to clean the surface of the manufactured vessel.

The vessels resist well in ordinary use, mechanical wear and tear, and the action of fire, foods, and cooking liquids which are not in contact with the metal for long periods.

Water left in these vessels for some months gives rise to flocculent deposits of alumina. These seem always due to particles of foreign substances in the metal, and appear especially in the neighbourhood of the rivets which fasten the handles, and which are made of alloys of aluminium. The loss of weight in this way during six months was less

than 9.1 per cent. Sheets of aluminium used in the author's former researches, and bottled up with Seine water for four years, became covered with a hard skin, dissolved off by 1 per cent. sulphuric acid, leaving a bright surface, and causing a loss of weight of about 3 per cent.

Salt water, of 35 grms. to the litre, acted like ordinary water, but to a much greater extent. The rivets become loose, and the handles come off. Except where the nodules of alumina are, a blackish, rough skin forms, which sand will not bring off, but which yields to 24 hours' soaking in 1 per cent. sulphuric acid. The loss of weight in four months through corrosion by the salt water was about 0.6 per cent.

—J. T. D.

Titanium, Preparation and Properties of. H. Moissan. *Bull. Soc. Chim.* 1895, 959–965.

THE conclusions drawn from this paper are that, when an electric arc of varying intensity is caused to heat a mixture of titanic acid and carbon, there are produced successively the blue oxide of titanium, fused titanium nitride (Ti_2N_3), and either fused titanium or a crystallised carbide TiC . Titanium is the most refractory substance yet obtained in the electric furnace, being more infusible than vanadium, and far more so than molybdenum or zirconium. It has only been prepared in the electric furnace at temperatures above that at which its nitride is decomposed, and by means of a dynamo absorbing 100 h.p. As compared with the powder obtained by the action of the alkali metals upon fluoritanates, the fused titanium has far less affinity for nitrogen: reduced to powder, however, it burns in nitrogen gas at a temperature of 800°C. The general properties of titanium resemble those of the metalloids, and particularly silicon.—W. G. M.

Cement for Metals, Experiments with. M. Rudeloff. *Mitt. aus d. Königl. techn. Versuchsanstalt zu Berlin*, **13**, (6), 290.

See under IX., page 114.

Aluminium and its Alloys, Analysis of. H. Moissan. *Comptes rend.* **121**, 1895, 851.

See under XXIII., page 136.

Nickel Estimation [Nickel-plating Solutions], New Volumetric Process for. Lecœuvre. *Bull. Soc. Chim.* **13**, 1895, 1011.

See under XXIII., page 135.

Lead, Estimation of, by Electrolysis. A. Kreichgauer. *Zeits. anorg. Chem.* **9**, 89.

See under XXIII., page 135.

Lead, Colorimetric Analysis of. M. Lucas. *Bull. Soc. Chim.* **15**, 1896, 39.

See under XXIII., page 134.

PATENTS.

Compressing, Squeezing, or Squirting Heated Metals, Improvements in or connected with Means or Apparatus for. G. A. Dick, London. Eng. Pat. 23,172, Nov. 29, 1894.

THIS patent relates to the construction of moulds used for casting copper alloys and "squirting" therefrom, whilst in a plastic condition, wires, rods, or bars. Instead of a mould with a thick wall, which is liable to fracture through irregular heating, the mould consists of an inner cylinder with an internal parallel bore, open at both ends. The outside of this cylinder is slightly conical, and fits into a tubular casing inversely tapered. Round this again are placed comparatively thin concentric casings with annular spaces between them. These spaces are tightly rammed with a non-conducting material, such as granite in small pieces, and, by preference, mixed with a little borax. Outside the whole, is the wrought-iron or steel casing. A mould is thus produced which can withstand pressure and retain the heat, and which also is not liable to fracture, since a new inner cylinder can be easily replaced. The outside casing is mounted on trunnions, so that it can be

swung vertically or horizontally. In the former position, the lower end is closed with a plug, and the copper or alloy poured in. When plastic, it is swung round horizontally, the false bottom is replaced by a die, and a ram or plunger, preceded by a heated block, enters at the other end, and forces the metal through the die.—A. W.

Blast-Furnaces, Cupolas, Steel-melting or other Furnaces supplied with Hot or Cold Air, An Improved Tuyère, Block, and Plate Coil for Use in. J. Patterson, Workington. Eng. Pat. 23,502, Dec. 4, 1894.

A COPPER coil with a brass covering is substituted for the usual iron or steel coil with cast-iron covering; or an iron or steel coil may be lined (e.g., electrolytically) with copper or other metal of high conductivity, and covered with cast iron in the ordinary way.—W. G. M.

Gold and Silver, the Extraction of [Cyanide Process], from Ores, Improvements in or relating to Processes for. J. Pfleger, Kaiserslautern. Eng. Pat. 23,557, Dec. 4, 1894.

A VESSEL is employed with a porous partition of unglazed earthenware down the centre, dividing it into two compartments. On one side of the partition is placed the cyanide solution containing the gold, &c., whilst the other side is filled up with a solution of caustic soda of a strength of from 1 to 5 parts to 100 parts of water. In the soda solution is placed a rod of an electro-positive metal, such as iron, zinc, copper, or aluminium, and in the cyanide solution an electro-negative substance unacted on by cyanide, such as carbon. A current is set up by joining these two substances with a metallic wire outside the vessel, whereby the gold is deposited from solution on the carbon, and may be collected and refined in any suitable manner.

—A. W.

Gold, a Method for Extracting, without the Use of Water, by Means of a Combined Air Blast and Mercury, and Apparatus for effecting same. W. H. Hyatt, London. Eng. Pat. 24,782, Dec. 20, 1894.

THE dry pulverised gold-bearing material is blown by strong currents of air on to or through liquid mercury placed in suitable tubes, &c. The ore is blown through these tubes and the gold is stated to amalgamate with the mercury.

—A. W.

Precious Metals, Improvements in or relating to Apparatus employed in the Recovery of, from their Solutions. H. L. Sulman, London. Eng. Pat. 2729, Feb. 7, 1895.

THE apparatus consists of a storage tank for the zinc fume, the bottom of which slopes to a point where there is provided a tubular outlet containing a double valve, so that a given quantity of fume may be let through at a time. This valve is attached to a rod, which is connected with a lever arrangement working in conjunction with a ball and siphon tank supplying the gold solution. The solution is constantly fed into this tank, which alternately fills and empties. Every time the solution siphons off, the float ball in falling works the lever connecting the valve in the fume tank. By this means the required quantity of fume falls into the tubular channel through which the gold solution is rushing from the siphon. This mixture passes into a cylindrical or conical vessel, where it is swirled round and automatically siphoned into the top of a vessel containing inclined baffle plates one under the other, which further agitate the solution. The gold being thus separated from solution, it is collected together with the remainder of the fume by passing the mixture upwards over a series of inclined plates of slate placed close together, upon which the solid particles deposit, and from which they slide down into the bottom of the vessel, whilst the waste liquor passes out of the top and through a filtering cloth.—A. W.

Precious Metals, Improvements in or relating to the Precipitation of, from their Solutions [Cyanide Process]. H. L. Sulman, London. Eng. Pat. 2730, Feb. 7, 1895.

IN the author's process of precipitating the precious metals by means of zinc fume, it is advantageous to submit the

fume to a preliminary cleaning to free it from zinc oxide. It is therefore digested with any reagent that will dissolve the oxide; and ammonia, ammonium chloride, and ammonium carbonate are claimed for the purpose. The use of these solutions may also be applied to the cleaning of zinc shavings and granules used in other processes.—A. W.

Ores containing Zinc or Blende and other Metals and Metalloids; Improved Method or Process, and Apparatus for obtaining Chlorine and Zinc in the Treatment of. H. R. Lewis, London, and C. Gelstharp, Manchester. Eng. Pat. 584, Jan. 9, 1895.

THE ore is crushed and roasted in furnaces of the type protected by Eng. Pat. 6567 of 1892 (this Journal, 1893, 12, 842), sulphur, sulphuric acid, and volatile metallic compounds being recovered. The zinc in the roasted ore is dissolved by water or dilute acid, and a certain proportion of a soluble chloride is added, which depends upon the percentage of zinc present. The liquid (after settling, if necessary) is concentrated by evaporation, the residue being treated according to Eng. Pat. 8467 of 1892 (this Journal, 1893, 12, 765). The solution is electrolysed, the chlorine and zinc being recovered. The electrolytic vat is preferably divided up into separate compartments by the alternate anode plates, which may be of carbon, and cathode plates, which may be of zinc. Both electrodes may be of suitable metallic gauze, covered with asbestos. Within the compartments thus formed are series of transverse glass plates, placed obliquely, in such a way that ascending bubbles of chlorine are deflected upwards and away from the cathodes. Above each of these chambers, which is otherwise closed air-tight, is a tube leading upwards to a horizontal main for the collection of the chlorine from all the compartments. Scrapers are provided to remove the rough deposited zinc, and cocks or valves are arranged below to discharge it into trucks placed beneath them. Reguline, instead of pulverulent deposits, may be obtained. In another type of depositing apparatus, a circular round bottomed vessel is employed, with an outside heating chamber; a perforated cathode forms a false bottom to the former, and the anode is suspended above it, separated or not by a porous diaphragm; the chlorine is led off above, and the zinc, detached by a rotary scraper, falls through the perforations in the cathode, and is drawn away through a cock as before. In each apparatus, pipes are arranged for the conveyance of the electrolyte to the vats.—W. G. M.

Lead; Improvements in the Extraction of, with Silver, Gold, or other Metals from Ores blended with Sulphide of Zinc or otherwise. H. R. Angel, London. Eng. Pat. 801, Jan. 12, 1895.

SULPHIDE ores are treated in a furnace, V-shaped in cross section, but tilting endwise, with a slag outlet at one end and a metal tap-hole at the other, and with a separate chamber containing a coke fire at one side. The furnace is of iron plates, lined with firebrick cemented by a mixture of 90 per cent. of volcanic dust or fireclay, and 10 per cent. of iron oxide mixed to a cream with sodium silicate solution. The ore is to be mixed with caustic soda or sodium sulphide, and to be heated by driving a mixture of steam and petroleum, or of gas and air, over the coke fire and through apertures in the partition wall. The charge is said to be reduced in a few minutes.—W. G. M.

Alloys of Iron with other Metals [Manganese, Aluminium, Nickel, Chromium, Tungsten, &c.], Manufacture of. C. D. Abel, London. From M. M. Roiten, Berlin. Eng. Pat. 1155, Jan. 17, 1895.

THE metal to be alloyed with the iron is obtained in a finely-divided state, either as a powder if brittle, or as drillings if malleable; it is then mixed with lime and with coal or coke in sufficient quantity to produce the required carburization, much as described in Eng. Pat. 23,286 of 1892. The mixture is moistened with water, moulded and compressed, the blocks being heated to drive off the hygroscopic, but not the combined water. The pieces thus prepared are then introduced into the iron in the ladle, in the furnace, or otherwise. The hydration water,

which is evolved as vapour, serves to mix the metals, whilst it is considered to expel gases from solution in the liquid metal. Other alkaline earths or alkaloids may be used instead of lime; and in place of the metal to be alloyed, its oxide may be employed, mixed with a sufficient excess of carbon. The process is especially applicable for use with manganese, aluminium, nickel, chromium, and tungsten.—W. G. M.

Metals and Metallic Alloys containing Carbon and Silicon: Process for the Production of. W. Kaufmann, Prague. Eng. Pat. 2278, Feb. 1, 1895.

CARBONUM IN a finely-divided state is added at a high temperature to the molten metals which are required to be combined with carbon and silicon. An electric furnace is employed by preference.—W. G. M.

Metals and Metallic Compounds: Improvements in their Recovery from Finely-divided Substances, such as Crushed Ores, Slime, Tailings, and the like. G. Robson, Dolgelly, and S. Crowder, London. Eng. Pat. 2538, Feb. 5, 1895.

IN carrying into effect Eng. Pat. 427 of 1894 (this Journal, 1895, 14, 580), soap and water of the consistency of white of egg, with hydrocarbon oil, may be substituted for the mixture of fatty and hydrocarbon oil previously specified. The dry finely-divided substances also may be prepared for treatment by first moistening them with a liquid hydrocarbon and a fatty oil, and then adding the necessary quantity of water.—W. G. M.

Casting Copper Ingots, A New or Improved Solution [to Prevent Adherence] for Use with Moulds for, or the like. J. Lunt, Warrington. Eng. Pat. 13,617, July 16, 1895.

THE bark of the oak or other suitable tree is calcined "together with a proportion of valonia," and the ashes so produced are, after being cleaned, powdered, and mixed with water, used as a wash for moulds in the preparation of copper castings. Spent oak-bark, and valonia which has been employed in the tanning process, are preferably employed, the proportions being about equal. The effect of the above treatment is to produce a wash which will prevent the copper adhering to the mould.—A. W.

Ores and other Auriferous Substances, Improved Process [Bromine and Chlorine] and Apparatus for Extracting Gold from. B. C. Hinman, New York, U.S.A. Eng. Pat. 16,920, Sept. 10, 1895.

THE object of this invention is to use an excess of bromine for gold extraction, by which means the dissolving is accelerated, and to regenerate the bromine. The pulverised ore mixed with water is treated in a revolving cylinder with from 3 lb. to 20 lb. of bromine per ton of ore, and the solution thus obtained, drained off. The ore is leached, preferably with chlorine water, which is then added in a closed tank to the bromine and bromide solution. More chlorine may be introduced into this mixture to decompose the bromides if necessary. The tank and its contents are heated in any convenient way, preferably by steam, and the bromine distils off through a pipe leading from the top of the tank to a condenser. The gold is recovered from the residual chloride solution in the usual manner.—A. W.

Amalgamation of Gold and the like Metals in Ores, An Improved Process for Effecting. E. L. Oppermann, E. Fischer, and C. T. J. Oppermann, all of London. Eng. Pat. 17,020, Sept. 12, 1895.

TO ensure the complete amalgamation of the gold, including the fine and float gold, the wet or dry crushed ore is brought into contact with mercury vapour at a suitable temperature. The vapour is conveyed by pipes from the retort in which the mercury is heated, and is blown on to the crushed ore, or even made to pass through a perforated plate over which the ore is passed. The vapour may be mixed with steam or other suitable gas, and any convenient means may be used to recover the gold from the amalgam which is said to be obtained.—A. W.

Gold and Silver, Process [Bromine and Chlorine] and Apparatus for the Extraction of, from their Ores, and from other Auriferous and Argentiferous Substances. H. A. de Neufville, Paris. Eng. Pat. 18,177, Sept. 28, 1895.

THE pulverised material or ore, mixed with water, is introduced into the apparatus, and the following reagents added in small quantities, which vary according to the nature of the material under treatment, viz., bromine or one of its compounds, sodium chloride or hydrochloric acid, potassium cyanide, a plate of copper connected with the anode to secure the solution of a little copper, mercury or its amalgam similarly connected for the same purpose, sulphuric acid to render the solution acid, and sulphates of iron and copper to assist the formation of complex salts. Electricity is used in conjunction with this mixture, thereby producing chlorine, bromine, and chloride of bromine, which dissolves out the gold. The sulphuric acid is used for facilitating the action by the production of hypochlorites and the liberation of chlorine by electrolysis, whilst the cyanide is employed to scour the surface of the mercury. The apparatus consists of a cylindrical tank with a central revolving vertical rod, which carries small blocks of retort carbon for agitating the solution. Inside this tank are placed a series of concentric plates, alternately connected with the positive and negative poles of a dynamo. Those forming the anode are made of retort carbon, and are perforated, whilst the cathode plates are amalgamated metal. A thin layer of mercury is also placed at the bottom of the tank, and is negatively connected. Suitable outlets are arranged for the gold amalgam obtained and for the ore residues from which the gold has been extracted, the whole process being conducted in one vessel.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

A Cell of High and Constant E.M.F. M. Marisot, L'Éclairage Électrique, 1895, 4, 297; Comptes rend. 1895, 121, 251.

THE cell is prepared in the following manner:—The positive pole is a plate of retort carbon, placed in the outer jar, containing a depolarising liquid, prepared by mixing 3 vols. of a saturated solution of bichromate of potassium with 1 vol. of sulphuric acid. Crystals of bichromate are added to keep the solution saturated. A porous pot immersed in the depolarising liquid contains a solution of sodium hydrate of sp. gr. 1.05. The negative pole, consisting of a plate of amalgamated zinc, is placed in a second porous pot within the first, and contains a solution of sodium hydrate of sp. gr. 1.25.

THE author states that the E.M.F. of this cell is 2.5 volts at the start, and keeps above 2.4 volts during 10 hours of uninterrupted work. The internal resistance is about 0.8 ohm, but this value varies with the nature and thickness of the porous pots. In a cell containing 600 c.c. of depolarising liquid, 130 c.c. of weak and 110 c.c. of concentrated sodium hydrate, a current of 0.432 ampère was maintained through a resistance of 5 ohms, and one of 0.220 ampère through 10 ohms.

UNDER these conditions the intensity is maintained as stated. The regular régime is established in something short of an hour, when the diaphragms are sufficiently impregnated.

THE increase of voltage over the ordinary bichromate cell arises from the substitution of the alkaline for the acid solution usually surrounding the zinc. The advantage obtained by this substitution alone is small, owing to the rapid increase of resistance. The sodium hydrate is converted into a neutral chromate, and an abundant deposit of zinc hydroxide is found on the zinc. This action is, however, lessened by the interposition of the weak alkaline solution. The use of potassium instead of sodium hydrate does not offer any advantage, neither does that of bichromate

of sodium instead of bichromate of potassium in the depolarising liquid. After 10 hours of continuous action the zinc becomes covered with a grey coating, which may be removed by dipping it into dilute acid, when the cell will be again in working order.—J. L. B.

PATENTS.

Carbides, and Illuminating Gas derived therefrom, Improvements in the Production of Metallic. G. B. Ellis, London. From T. L. Willson, New York, U.S.A. Eng. Pat. 16,342, Aug. 27, 1894.

See under II., page 103.

Galvanic Cells, Improvements in the Construction of. C. Vogt, Posen, Germany. Eng. Pat. 16,586, Sept. 1, 1894.

THE improved cell, which can be used either as a dry or as a wet element, is constructed as follows:—A zinc and a carbon electrode are placed with water in a suitable vessel, and metallic oxides (preferably the peroxides of lead or manganese) which have been saturated with chlorine either by mechanical or electrolytic means, are pressed into the surface of the carbon. A dark cell is employed in order to prevent the formation of hydrochloric acid by the combination of the hydrogen from the water with the chlorine; and as soon as the current is passed, the electrolysis gradually effects a separation between the oxygen and the metallic oxides by the substitution thereof of chlorine, whilst the water is decomposed into hydrogen and oxygen, and the oxygen, which combines with the zinc electrode, is continually replaced by the oxygen freed from the metallic oxides. It is claimed that by using more chlorine, or oxides richer in oxygen, that the voltage can be raised to 2.20 volts.—G. H. R.

Electrolysis, Method of and Apparatus for Effecting. C. Kellner, Vienna, Austria. Eng. Pat. 24,541, Dec. 17, 1894.

IN the apparatus described, a cylinder is employed composed of porcelain or stoneware, provided with numerous helical channels, through which the mercury flows in the form of a stream, the parts of the mercury stream in the several channels constituting strips. The channels are arranged so that the odd-numbered convolutions of the helix are on the inner surface of the cylinder, whilst the even-numbered ones are on the outside. The internal channels in the decomposing cell communicate with the external ones in the forming cell by means of openings in the walls of the cylinder. Within this is placed a cylindrical anode filled with the solid salt to be decomposed, and is so arranged that the salt cannot enter the mercury channels, but passes from below the anode into the electrolyte. The whole is placed in a covered iron vessel, which contains the water or other reagent with which the separated cation is to be combined. The mercury is supplied to the topmost channel by means of a pipe, and is connected at various points of its course with the iron-containing vessel, to which the lead from the negative pole of the dynamo is attached. If the combination of the cation with the reagent is to be utilised as a source of energy, another lead connects the mercury in the combining vessel with the negative pole of the dynamo.—G. H. R.

Secondary Batteries, Improvements in. C. A. Faure, Paris, and F. Kiog, London. Eng. Pat. 1731, Jan. 24, 1895.

THE improvement consists in constructing the plates for secondary batteries of a light metallic support, which is coated with active material, and, to prevent loss from the falling away of this, the plate is surrounded or coated by a thin layer of silicated asbestos fibre, cloth, or paper, and upon or around the plate so covered, a perforated envelope of celluloid, ebonite, or other acid-resisting, non-conducting material is placed.—G. H. R.

Cables, Improved Insulating Material for, and Process of Making Same. A. Gentzsch, E. R. von Scanavi, and N. R. von Scanavi, Vienna. Eng. Pat. 5967, May 6, 1895.

THE new insulating material consists of one or other of the minerals of the species hornblende, from which the water

of crystallisation has been driven off by heat. The mineral may be used alone, or mixed with other insulating material, such as rubber. In the latter case, good results are obtained by using 10 per cent. of the hornblende mineral and 90 per cent. of rubber. The materials are mixed hot, when the rubber penetrates the mineral, which is in a porous condition, owing to the expulsion of the water of crystallisation.—V. C.

Insulators for Electrical Purposes, Improvements in and relating to. A. J. P. Whitaker and F. G. Treharne, Llanishen, Cardiff. Eng. Pat. 11,528, June 13, 1895.

THE improved insulators, which are chiefly for telegraph and telephone wires, consist of a metal shell coated with a non-conducting enamel, in combination with a spindle for carrying the insulator. The spindle is secured by insulating cement.

The non-conducting enamel is composed of "silica, aluminium, barium, oxide of tin, and borax."

The insulating cement is composed of sulphur, bitumen, sulphate of lime, or of barium, silica, and oxide of lead or resin.

The improved insulators are adapted for use in any climate, and are practically unbreakable.—V. C.

Vegetable Parchment, Improvements in Treating, to make it applicable as an Electric Insulating Material, and for other Purposes. J. A. London and H. P. Bailey, Newcastle-on-Tyne. Eng. Pat. 12,711, July 2, 1895.

See under XIX., page 132.

Electrodes, Improvements in and appertaining to. H. Leitner and E. Reicher, Nieder-Schönhausen, Germany. Eng. Pat. 18,038, Sept. 26, 1895.

THE improved outer electrode is composed of lead peroxide and carbon prepared in tubular form in such a manner that the outside consists of a firm mass of carbon, whilst the peroxide of lead is on the inside, and is made conducting by an admixture of carbon dust. The peroxide of lead is forced into the carbon plate under pressure, and penetrates its pores to the depth of several millimetres. The electrode thus prepared is surrounded by a coating of insulating material, such as celluloid or ambrion (Eng. Pat. 14,334, 1895), which also forms a bottom to it, thus converting it into a cell capable of containing the sulphuric acid. The inner electrode consists of a staff of vulcanite supporting a lead tube on which chemically pure zinc is precipitated.—G. H. R.

Double-Fluid Galvanic Batteries, Improvements in. E. S. Boynton, Brooklyn, U.S.A. Eng. Pat. 20,215, Oct. 26, 1895.

THE battery consists of two or more cells of the Daniell type, which are placed in a reservoir containing a solution of copper sulphate. The cells are set up with the zincs in the zinc sulphate solution in the porous pots, whilst the copper plates are in the outer jars, which are perforated down one side to admit of the circulation of the copper sulphate solution.—G. H. R.

Galvanic Batteries, Improvements in. E. S. Boynton, Brooklyn, U.S.A. Eng. Pat. 20,216, Oct. 26, 1895.

IN the improved battery the electrolyte is common to all the elements, which are arranged so that one electrode of each element is separated by insulating material from the corresponding electrode of the adjacent element, so that the full voltage due to the number of the elements is attained. Each pair of zinc and carbon plates forming an element is surrounded by an open-bottomed casing of insulating material. The plates are suspended from the cover of the casing or cell, and the carbon does not extend to the bottom. When these cells are immersed in the receptacle, they rest on a perforated false bottom, which allows of the free circulation of the electrolyte to all the cells.—G. H. R.

Secondary Batteries, Improvements in. J. J. Rooney, Brooklyn, U.S.A. Eng. Pat. 20,431, Oct. 29, 1895.

THE improved plates are formed of insulating material perforated in vertical parallel rows, the grid having exten-

sions in the line of alternate rows to form foot-rests. The perforations are filled with active material, and the rows of plugs are alternately positive and negative, each row being connected to a conductor.

The material employed for the grid is preferably compressed paper, like press-board, which is perforated and treated with caustic soda and hydrochloric acid so as to reduce it to vegetable fibre, and remove all size and glue.

—G. H. R.

(B).—ELECTRO-METALLURGY.

Galvanising of Iron Electrolytically. O. Vogel, Diogler's Polyt. J. 1895, 298, 191—192. Paper read at the Oct. Meeting (1895) of the Eisenhütte Düsseldorf.

PRACTICALLY the three processes employed for the electro-deposition of zinc on iron are those of Cowper-Coles, worked by Messrs. Watson, Laidlaw, and Co. in Glasgow, and consisting of cleansing the iron in hot potash, pickling in sulphuric acid, washing, and then coating it with the aid of a dynamo yielding 2,500 amperes at a pressure of 5 volts; Richter's process, worked at Witkowitz (*Stahl u. Eisen*, 906); and Alexander's, which combines the methods of Schaag and Falk, and is worked by Seelhorst and Werner in Rothenfeld, Hanover, for the deposition of zinc containing aluminium or magnesium. The advantages of the galvanic as compared with the fusion method of galvanising are summed up in stating that it gives a more uniform and a thinner coating, which is nevertheless perfectly protective, whilst it eliminates the loss due to the formation of hard zinc and dross, is applicable to complex forms, and does not require continuous work. On the other hand, it demands a larger number of, and more intelligent, workmen, whilst it requires more time, and is therefore unsuitable for large-scale operations. For the treatment of 10,000 kilos. of sheet daily, a space of 200 sq. m. area would be necessary, and the plant, excluding a 50- to 60-h.p. engine, would cost about 27,000 M. In the discussion, Eckardt, speaking of the Richter process, described it as ill adapted for work on a large scale, and doubted whether the galvanised surface could ever be faultless, on account of the difficulty in rendering it quite clean. Seelhorst (of Seelhorst and Werner) uses the sand-blast with advantage for cleansing, and finds that the cost of their process works out at 5 pf. per sq. m. of plate, as against 50—60 pf. by the fusion method. Schmidt considered that the galvanic process could not well be applied to the treatment of telegraph wire, because the resulting product would not stand the immersion test (immersion in copper sulphate solution eight times repeated).—W. G. M.

Iron, Boride of, its Preparation and Properties. H. Moissan. Bull. Soc. Chim. 1895, 956.

See under X., page 115.

Lead, Estimation of, by Electrolysis. A. Kreichgauer. Zeits. anorg. Chem. 9, 89.

See under XXIII., page 135.

Titanium, Preparation and Properties of. H. Moissan. Bull. Soc. Chim. 1895, 959.

See under X., page 118.

PATENT.

Tin, Electrolytic Treatment of, and its Separation from Alloys and Mechanical Mixtures, Improvements in. C. F. Claus, junr., Swansea, and H. S. Sutton, Neath, Wales. Eng. Pat. 297, Jan. 4, 1895.

THE improved process for recovering tin from alloys or coated materials such as "scrap tin" consists in making them the anode in an alkaline sulphide bath, preferably composed of 1 part sulpho-stannate of sodium, and 2 parts of water, yielding a solution of sp. gr. 1.070, which is heated to approximately 90° C. The cathode is preferably formed of tin, and with a current density of 10 amperes per square foot of anode surface, the tin is deposited in a metallic state upon the cathode, and may be recovered therefrom in any suitable manner. In the event of the deposited tin containing either antimony or arsenic or both,

it may be used as an anode in a bath of sufficiently diluted hydrochloric acid, to which hyposulphite of soda (thiosulphate) is added as required. The bath is provided with a tin cathode as before, and by the passage of the current the arsenic and antimony are precipitated as sulphides, whilst the tin is deposited on the cathode.—G. H. R.

Gold and Silver, Process and Apparatus for the Extraction of, from their Ores, and from other Auriferous and Argentiferous Substances. H. A. de Neufville, Paris. Eng. Pat. 18,177, Sept. 28, 1895.

See under X., page 120.

XII.—FATS, OILS, AND SOAP MANUFACTURE.

Lubricating Oil Testing, Recent Experiences in. Holde. Mitt. aus d. königl. techn. Versuchsanstalt zu Berlin, 13, (6), 253.

See under XXIII., page 138.

Rape Oil and other Vegetable Oils, The Congealing Points of. D. Holde and A. Ruhemann. Mitt. aus d. Königl. techn. Versuchsanstalt zu Berlin, 13 (6), 287—290.

The congealing points of the various kinds of rape oil range between—

°C.	°C.	
—2	and —10	for colza oil (Benedikt).
—1	" —10	" Brassica campestris (Bornemann).
—6.3	"	(Girard).
—4	"	" colza oil (Hübl).
—4	" —6	" Brassica campestris (Schädler).
—8	" —10	" rapa (summer) "
—4	" —7.5	" " (winter) "
—1	" —4	" napus (summer) "
—1	" —3	" " (winter) "

Black mustard oil congeals at —17.5°, according to Chateau, or —1° to 0°, according to Girard. For white mustard oil Bornemann gives —16° and Schädler —8° to —16°.

From the tabulated results of tests made at Charlottenburg it would appear that nearly all rape oils will congeal at about 0° after standing for 8 hours. The lower temperatures recorded by other observers, probably refer to oils that have been simply exposed to cold without being stirred, this latter operation assisting solidification.

Olive oils, by reason of their varying content of stearin, congeal at different temperatures; an oil from Bari, for example, being found completely set after 5 hours' exposure at 0°, whereas a Rizza oil still remained fluid, though very turbid, after standing for 4½ hours at —8° C. Arachis oil, on the other hand, assumed a salvy consistency in 4 hours at 0°, and set like tallow in three-quarters of an hour at —5° C.—C. S.

Oils for Greasing Wool. A. Merstone. Chem. Rev. Fett u. Harz Ind. 1895, [29], 1—2.

FOR this purpose, neutral oils, mixtures of soap with neutral fats and fatty acids, and emulsions of oil with water are employed, the chief essentials being easy removal by washing and freedom from oxidisable and mineral oils, on account of the liability to spontaneous combustion of the wool induced by the former, as well as of the streakiness occasioned by both in the dyed wool. At one time olive oil alone was used, but was superseded by oleic acid, and later by the "extract oil" from recovered grease, which now frequently contains from 20 to 30 per cent. of mineral oil. The emulsions of "soluble" oils allow the oil to be more regularly distributed on the fibre, but spinners are apt to abuse this capacity for mixing with water and to dilute them to excess, with unfavourable results. Some "soluble" oils sold as pure olive oil contain 88 per cent. of water and 12 per cent. of rape oil, or mixed mineral and seed oils. The composition of some others is given below:—

"Olive" Oil.—Olive oil, 30 per cent.; rape oil (treated with oil of rosemary), 70 per cent.

"*Olein*."—Fatty acids, 36; mineral oil, 64 per cent.

"*Extract*" Oil.—1. Fatty acids, 91; mineral oil, 5; dirt and water, 1 per cent.

11. Fatty acids, 65; mineral oil, 24; neutral fat, 9; dirt and water, 2 per cent.

111. Fatty acids, 30; mineral oil, 50; resin, 7.5; neutral fat, 12; water and dirt, 9.5 per cent.

"*Soluble*" Oils.—Fatty acids or neutral oils holding ammonia soaps in solution, with or without resin.—C. S.

Cholesterols of Cryptogams. E. Gérard. *Comptes rend.* 121, 723–726.

By extracting brewers' yeast, the mould, *Mucor Mucedo*, and the lichen, *Lobaria pulmonacea*, with alcohol, evaporating the extract and again extracting with ether, the author has in each case obtained a fatty substance which, when freed from fat, yielded a body which agreed in properties with a cholesterol of the ergosterin group. The cholesterol contained in the cryptogams are therefore distinct from animal cholesterol and from phytosterol, the cholesterol of the higher plants.

The author gives the following additional reactions which serve to differentiate animal cholesterol from cholesterol of the ergosterin group:—1. Animal cholesterol treated with concentrated sulphuric acid gives a yellowish coloration, the addition of water producing a white precipitate. Ergosterin, on the contrary, gives a red coloration, and with water yields a green precipitate. 2. The addition of sulphuric acid of 1.76 density to a solution of animal cholesterol in carbon tetrachloride gives a yellow coloration, which changes to milk-white in the presence of water. When left to stand the tetrachloride which separates out is colourless. Ergosterin and the analogous cholesterols, treated in the same manner, yield a blood-red coloration, and the tetrachloride which separates is coloured green.—J. G. W.

Wool-Fat, Contributions to the Analysis of. W. Herbig. *Dingler's Polyt. J.* 297, [6], 138 and 150.

See under XXIII., page 138.

Soaps, Analysis of. E. Spaeth. *Zeits. angew. Chem.* 1896, 5.

See under XXIII., page 139.

PATENTS.

Oils or Fatty Substances, Improved Method of Recovering from Clays, Sands, Ores, Mine Slimes, or other Finely-divided Substances. S. Crowder, London. Eng. Pat. 23,228, Nov. 30, 1894.

The mixture of the finely-divided substances and water is introduced into a suitable vessel, so as to produce an upward current. As the oil rises to the surface it is allowed to flow over the edge into receptacles at the side of the tank, or is skimmed off by means of revolving brushes or paddles. The separation of the oil is facilitated by blowing a current of air through the mixture.—C. A. M.

Treatment or Oxidation of Fixed Oils, Fats, and the like, Improvements in, and the Application thereof as a Menstruum for Paint, Varnish, Oil-Cloth, and the like. S. Banner, Liverpool. Eng. Pat. 24,103, Dec. 11, 1894.

On blowing oil with air or oxygen in the usual manner, a point is soon reached where the varnish becomes insoluble in turpentine, &c., being therefore useless for the manufacture of paint. To avoid this, and also to enable the oxidation to be carried still further, the inventor adds to the oil, either before or during the operation, sufficient volatile solvent such as a paraffin or terpene, to keep it liquid, the temperature being so regulated as to prevent the volatilisation of the said solvent. The ordinary driers may be employed as usual.—F. H. L.

Drying-Oils, Treatment of. E. Andreoli, Brixton. Eng. Pat. 25,324, Dec. 31, 1894. (Date claimed under Inter. Conv. July 20, 1894.)

OZONISED air, prepared as described in Eng. Pats. 21,794, 1892, and 21,707, 1893 (this Journal, 1893, 452, and 1894,

162), is made to pass through or over the oil, which has been previously purified by treatment with 0.02 per cent. of tannin. The oxidation may be hastened by the addition of 0.25 per cent. of any hydrocarbon boiling above 100 °C. or other substance, such as tallow, "possessing great affinity for oxygen." The oil may also be made to pass over a series of glass plates stacked between the pointed grids of the ozonisers described *loc. cit.* and in Eng. Pats. 17,426, 1891, and 9631, 1892, being afterwards collected by scraping or otherwise.—F. H. L.

Waste Oil, Improvements in Apparatus for the Recovery and Purification of. V. Camiz and A. Bettoni, Venice. Eng. Pat. 11,948, June 19, 1895.

This apparatus consists of three parts working automatically—a recuperator for the recovery of oil which has been used for lubricating machinery, a separator, and a filter. These parts may either be arranged to work together, or may be set up separately.—C. A. M.

Oil from Vegetable Seed, Improvements in the Process of Extracting. H. T. C. Kraus, Brooklyn, New York. Eng. Pat. 20,107, Oct. 25, 1895.

The crushed seeds are first soaked with running water in a trough, and at the same time (*i.e.*, under water) subjected to the action of an agitator. The lighter hull is carried into a trough, while the kernels pass through a discharge-pipe into the tub of an agitator. Here they are mixed with more water, or with oil, acids, or alkalis, and reduced to a paste-like condition, which renders them "more susceptible or sensible for the evaporation." Thence they are conveyed in trays, by means of a carrier, into a boiler, to be subjected to the action of steam heat, dry or saturated, but preferably the former. The evaporated liquid is condensed by a worm, and falls into a tank, the fatty matter being on the surface. To clear and refine this, it is placed in pans in a jacketed boiler, and subjected to the indirect heat of superheated steam. The evaporated liquid passes into a chamber fitted with a series of perforated plates or wire gauze, and surrounded by a heating chamber. The more volatile matter passes on through a condenser into a tank, while the heavy oils remain in a recess at the bottom of the chamber, whence it can be removed by means of a tap. If necessary, the volatile matter left in the chamber with the heavy oils can be driven forward by the admission of superheated steam of low temperature.—C. A. M.

Oil Extracted by Solvent from Linseed or Similar Substances, Improvements in Purifying. The Cleveland Linseed Oil Company, Ohio, America. Eng. Pat. 23,166, Dec. 3, 1895.

The naphtha or other solvent is removed from the oil by the introduction of steam at a temperature of about or below 140 °F. By this means the coagulation of albuminoid matters in the oil is said to be largely avoided, which is one of the principal objections to the process of steaming as ordinarily practised. To this coagulation it is to be attributed, it is said, the unfitness of solvent-extracted oil for certain industrial uses, such as painting. Low-tension steam is obtained by delivering it from an ordinary boiler below the surface of the oil in the separator, the vapour pressure in the latter having been suitably reduced. The pipe employed to convey the steam below the oil has a bore of sufficient size to deliver enough steam without unduly raising the vapour pressure. The temperature of the steam will be low in correspondence with the reduced tension.

Practically, the operation is best carried out in two stages, the temperature being raised and a greater volume of steam introduced when the solvent has been largely removed.—C. A. M.

Waste Oil or other Fluids, a New or Improved Apparatus for Filtering. T. Atkins and T. A. Harris, London. Eng. Pat. 14,434, Dec. 7, 1895.

See under I., page 102.

A Lubricating Compound, An Improved Manufacture of.
A. J. Boulton, Middlesex. From T. J. Lovett, Chicago.
Eng. Pat. 19,890, Dec. 14, 1895.

THE lubricating compound is formed by intimately mixing together granular mica, lubricating oil, and lime, raising the temperature of the mixture to a degree such that under climatic changes the plastic condition will not vary, and then adding resin oil.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

PATENTS.

Lead Pigments or Lead Compounds for Use as Pigmentary Materials, Improvements in Manufacture of. W. B. Priest, Gresford, Wales. Eng. Pat. 17,115, Sept. 8, 1894.

LEAD sulphate and slaked lime, in about molecular proportions, are suspended in water and heated by steam with constant agitation until the liquid is neutral to test paper. The resulting calcium sulphate may be removed by elutriation or by washing, and the lead hydrate mixed with more lead sulphate for use as a pigment: or the hydrate may be dried with the calcium sulphate and the two be used together. Carbonic acid gas may also be injected into the liquid when the reaction is complete, in order to form white lead, the calcium sulphate being either removed or allowed to remain. The whole process can be conducted in the cold if desired.—F. H. L.

Drying-Oils, Treatment of. E. Andreoli, Brixton. Eng. Pat. 25,321, Dec. 31, 1894. (Date claimed under Inter. Convent. July 20, 1894.)

See under XII., page 123.

(B).—RESINS, VARNISHES.

PATENT.

Treatment or Oxidation of Fixed Oils, Fats, and the like, Improvements in, and the Application thereof as a Menstruum for Paint, Varnish, Oil-Cloth, and the like. S. Banner, Liverpool. Eng. Pat. 24,103, Dec. 11, 1894.

See under XII., page 123.

(C).—INDIA-RUBBER, &c.

The New Rubber Plant (Kikxia Africana, Benth.).

"Kew Bulletin," No. 106, through Imperial Institute Journal (Research Dept.), February 1896, 56.

In his report on the Botanic Station at Lagos for the quarter ending 31st December 1894, the curator stated that the rubber industry of the colony was rapidly extending, and that the rubber supply of West Africa was not confined to species of *Landolphia* and *Ficus*, but that a large tree, probably belonging to the *Apocynaceae*, and occurring abundantly in the interior lands, and called by the natives *Ire*, *Irch*, or *Erch*, also yielded rubber.

Mr. Olubi, F.R.G.S., describes it as one of the most beautiful trees in the forest, growing to a height of 60 to 70 ft. It was first discovered in Acra about 1883, and many fortunes have been since made from the rubber it has produced. In the rainy season, when the trees are full of milk, a tree well tapped is capable of yielding 10 to 15 lb. of rubber.

The new rubber tree appears to be *Kikxia Africana*, Benth., belonging to the *Apocynaceae*. Its seeds were used in commerce as an adulterant of *Strophanthus* seeds. A sample of these seeds had been sent by Messrs. Bowden, of Liverpool, to Kew in 1888, under the name of *India-rubber seeds*; they came from Winnebah, Gold Coast, West Africa. The tree is evidently very widely distributed in the country, extending from Sierra Leone to the Gold Coast, and beyond the mouths of the Niger to the Bight of Biafra. How far its growth extends inland is at present unknown.

Mr. F. C. R. Leigh, acting curator of the Botanic Station at Lagos, states that, in tapping the *Ire* trees, a vertical cut is first made in the bark from the bottom to the top of the tree, $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in breadth, and deep enough to reach the inner bark. On each side of this main-groove, two series of oblique grooves are cut, 2 ft. apart, each running into the main-groove, by which the milk exuding from the grooves is conducted to the base of the tree, where it is collected.

The methods adopted for coagulating the milk are at present of two kinds, viz.: the "cold process" and the "hot process"; the first-named chiefly practised by the Fanti men introduced from the Gold Coast. A cavity excavated in the trunk of a fallen tree, of sufficient capacity for holding the material collected during several days, is filled with the milk, which is first strained. It is then covered with palm leaves and left for 12 to 14 days or longer, according to the season, until most of the water has either evaporated or been absorbed by the wood. The rubber thus obtained, after being kneaded and pressed together, has a dark-brownish colour, the interior being slightly lighter in colour. Such rubber is known locally as "silk rubber." The local price is from 10d. to 1s. 2d. per lb.

The hot process, which deals with the milk daily as collected, is the one generally adopted by the natives of Lagos. The strained liquid is heated in a vessel, when the rubber begins to coagulate almost directly. After boiling, the product thus obtained is somewhat sticky, and of a blackish colour; its local price is from 9d. to 1s. per lb., the quality of the rubber being deteriorated by the crude character of the heating operation, which could easily be improved. An experiment in this direction was tried at the Botanic Station, and a product obtained similar to that furnished by the cold process. A sample of this, received at Kew, was reported to be of very fine quality, and rubber, if supplied in the same clean and dry condition, would realise 2s. 3d. to 2s. 4d. per lb.

Owing to the climbing habit of the species of *Landolphia* which have hitherto yielded African rubber, it has not been practicable to cultivate them in regular plantations, as they required the support of other plants, and when once they had been tapped, many years would have to elapse before they would be fit to yield another crop. With the *Kikxia* these practical difficulties disappear.

As showing the remarkable development which has taken place in the rubber industry at Lagos during the last six months, the Acting-Governor has furnished Kew with the following particulars:—

Return of Rubber exported from Lagos during the Half-Year ended June 30th, 1895.

	Weight.	Value.
	Lb.	£ s. d.
January	21,131	1,213 10 3
February	15,888	777 0 11
March	26,306	1,419 7 8
April	33,763	2,078 16 6
May	216,916	11,700 0 7
June	268,619	12,577 2 6
Total	588,633	29,765 18 5

PATENTS.

Nitrocellulose or Pyroxylic Compounds, Improvements in and connected with the Manufacture of. F. Greening, Stoke Newington. Eng. Pat. 22,019, Nov. 11, 1894.

THIS invention relates to the manufacture of nitrocellulose or pyroxylin compounds, and of a solvent therefor, for use as substitutes for ivory, india-rubber, vulcanite, &c.

Fibrous substances are immersed in a bath of sulphate of alumina and a bleaching agent, at 212° F. The fibrous substance is taken out, dried, and placed in a bath of a mixture of concentrated sulphuric and nitric acids. The saturated mass is then submitted to pressure to expel any excess of acid, and allowed to remain two or three hours, when it will be in a soluble condition.

It is then washed in a bath of sulphate of alumina and then with water, until all trace of the acid is expelled. It is afterwards dried, and is ready to be converted into a plastic or liquid substance by means of a suitable solvent.

The solvent is obtained from the distillation of wood-tar ("picamar"). This "picamar" is sometimes mixed with methylated alcohol and chromic acid salt and distilled, the distillate thus obtained being also suitable as a solvent for pyroxylin.—S. P. E.

A Substitute for India-Rubber, Gutta-Percha, and Substances of a Like Nature, and Process for Manufacturing the same. E. Hornung, Vienna. Eng. Pat. 20,243, Oct. 26, 1895.

This consists of glue or a glue substitute precipitated from its aqueous solution by means of tannin, &c., mixed with five or more per cent. of rubber, &c., and dried, with or without the addition of pulverised cork or other solid body, and softened, if necessary, with fats or glycerin.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin [Quantitative Estimation]. L. Fajans. Zeits. f. angew. Chem. 1895, 16, 471.

See under XXIII., page 139.

Chrome Leather, The Alizarin Colours applied to. H. Burgess. Leather Trades Circular and Rev. 1896, 396.

See under VI., page 112.

PATENT.

Tanning, An Improvement in. M. Lewin, Falkenberg, Germany. Eng. Pat. 20,123, Oct. 25, 1895.

The employment of concentrated liquors in the so-called quick-tanning process has the disadvantage that it causes the grain to contract and become drawn, producing unsightly leather. By the present invention the grain is protected by a preliminary treatment, consisting in squeezing off the skins whilst in the soft state, in which they are after they have been placed in a weak liquor and swelled, and impregnating them on the grain side with grease or oil. Such prepared skins will withstand the strongest liquors, even when warm, without damage to the grain.—A. G. B.

XV.—MANURES, Etc.

Calcium Cyanate, A New Nitrogenous Manure. C. Faure. Comptes rend. 1895, 121, 463.

CALCIUM cyanate may be expected to supersede sodium nitrate as a nitrogenous manure, being even richer in nitrogen than is the nitrate. The compound is made in an electric blast-furnace. A mixture of lime and coal is first directly heated in this furnace to 1,500° C., and then superheated electrically to 2,500° C. in the presence of a large excess of pure nitrogen. Finally, air is admitted, whereby the product is oxidised, and the atmospheric nitrogen, heated by the exothermic reaction, obtained sufficiently pure for introduction into the electrically heated sphere of action.

The author has no doubt concerning the assimilability by plants of the nitrogen of this compound.—A. G. B.

PATENTS.

Ammonia from Sewage Effluent and other Weak Ammoniacal Liquors, Improvements in the Recovery of. T. Twynam, Egham, and F. E. Matthews, Englefield Green, Surrey. Eng. Pat. 2625, Feb. 6, 1895.

See under VII., page 114.

Drying Superphosphates and other Granular Materials, Improvements in and relating to Apparatus for. C. Zimmermann, Harburg, O. Ruperti, A. Borgnis, C. von Merck, and E. Merck, Hamburg, Germany. Eng. Pat. 4129, Mar. 1, 1895.

See under I., page 101.

Manure and Preservatives and Disinfectants for Manure, Improvements in the Manufacture of. L. Tralls, Turn, near Teplitz, Bohemia, and E. Burmeister, Hamburg, Germany. Eng. Pat. 21,627, Nov. 11, 1895.

ASHES of fuels of all kinds are treated with dilute sulphuric acid (5°–10° B.), about 50 per cent. of acid serving to combine with the bases of household ashes from brown coal. The product is rapidly dried in air, but its desiccation may be hastened by heat; when dry, it forms a powder which remains dry in air, and is, therefore, easily strewn or otherwise distributed. These "sulphate ashes" are applied as manure, or as preservatives of manure. Thus, when mixed with stable dung or liquid manures, they fix the ammonia and prevent fermentation of nitrogenous materials. As a disinfectant and deodoriser, the sulphate ashes can be used in sinks, drains, sewers, and closets.

—A. G. B.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar-Cane Juice, Non-Sugar Constituents of. Maxwell. Bull. Ass. Chim. 1895, 13, 371.

ALCOHOL precipitates considerable quantities of a gum in evaporated cane-juice that has been boiled to coagulate the albuminoids. The author considers it to be a cellulose gum, which is easily, and sometimes with difficulty, hydrolysable by acids into hexoses and pentoses, glucose alone being obtained in a crystalline condition. 1.2 to 1.3 per cent. of the dry substance of the juice consists of nitrogenous bodies; 0.3 to 0.4 per cent. are albuminoids, partially coagulable; the remaining 0.9 per cent. are amides and amino acids.

CrySTALLISED asparagin and aspartic acid were obtained from the young shoots of the cane.—J. L. B.

Sugar, Recovery of, from Impure Products such as Molasses, Plant Juices, &c. G. Kassner. Dingl. Polyt. J. 1895, 298, 65.

THE author describes in detail the different phases in his process for the recovery of sugar, of which the following is a summary:—

1. Vigorous agitation of oxide of lead and water during the flowing in of the impure sugar solution; under certain conditions this operation is reversed, the oxide of lead and water being caused to flow into the agitated sugar solution.
2. Gentle warming to promote the formation of lead saccharate. If this takes place rapidly as it frequently does in concentrated solutions, a spontaneous evolution of heat is observed.
3. Allowing the semi-solid mass to stand until crystallisation is complete.
4. Separation of the liquid portion of the mixture by mechanical means. A concentrated salt solution is obtained which is worked up for the recovery of potash, and a saccharate which is repeatedly washed with water, the washings serving to dilute the molasses.
5. Saturation of the saccharate with carbon dioxide.
6. Separation of the sugar solution from the mud.
7. Removal of the lead from the sugar solution, with subsequent filtration if necessary.
8. Evaporation of the sugar solution.
9. Regeneration of lead oxide, and carbon dioxide from the washed saturation mud.—J. L. B.

Beetroot Sugar, Possibility of Presence of Lead in. Altschul, Pharm. Central, H.N.F. 1895, 16, 707.

IN view of Kassner's process for the recovery of sugar from molasses, &c., by lead oxide (this Journal, 1895, 978; also preceding abstract) the author discusses the possibility of beetroot sugar containing lead. According to Kassner

the principal amount of the lead is separated by treatment with carbon dioxide, but a small quantity passes over into the sugar solution, depending on the content of invert sugar and other secondary products. This should be removed by the addition of sulphurous acid or calcium sulphite. Proof will have to be given that *firstly*, traces of lead saccharate can be detected in commercial sugar by the usual qualitative methods, and *secondly*, that the separation of the lead from the sugar solution succeeds on a manufacturing scale.—J. L. B.

Saccharose, Characteristic Reaction for. G. Papasogli, J. de Pharm. et de Chim. [6], 2, 129.

See under XXIII., page 137.

Glycerose, New Method for Preparation of. Fonges Diacon. Bull. Soc. Chim. 1895, 13, (16—17) 862.

See under XXIV., page 141.

PATENTS.

Heating, Evaporating, Distilling, and Condensing, Improvements in Apparatus for. F. H. Eydman, Weg Delft, Holland. Eng. Pat. 2723, Feb. 7, 1895.

See under I., page 100.

Cyanides, Process for Manufacturing out of Molasses and Lyes resulting from Beetroot Molasses. H. Reichardt and J. Bueb, Dessau, Germany. Eng. Pat. 7171, April 8, 1895.

See under VII., page 114.

Dextrose, Process for Manufacturing Pure. A. L. Tedesco, Paris. Eng. Pat. 21,311, Nov. 11, 1895.

COMPRESSED air is forced into solutions prepared in the usual way for saccharification or crystallisation, by means of jets or perforated pipes. The jets penetrate the liquid in as many directions as possible, so that the dynamic impulsion which characterises the invention may be fully exercised. The pressure of air varies according to the quantity and quality of the solution, and of the acids, diastase, &c. employed. Partially converted material after being slightly acidulated, may be treated in a similar manner.—J. L. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Enzymes of some Yeasts. E. Fischer and P. Lindner. Ber. 1895, 28, 2034—2039.

In the first part of this paper there is an account of the author's experiments on the behaviour of melibiose towards top and bottom fermentation yeasts (this Journal, 1895, 1056). *Behaviour of Monilia Candida towards Cane Sugar and Maltose.* C. E. Hansen has made the observation that *Monilia Candida* ferments cane sugar, but contains no invertase. In their first experiments the authors were able to confirm this statement. Subsequently, however, they found that if the dried yeast be allowed to act on a cane-sugar solution for 40 hours at 33°, and in the presence of anaesthetics, 40 to 60 per cent. of invert sugar is obtained. It thus appears that the dried *monilia* contains an enzyme insoluble in water which can invert cane sugar. If kept for a long period in the presence of toluene it becomes inactive. It was observed that when the fresh yeast was triturated with powdered glass, and allowed to act on a solution of cane sugar for 16 hours at 33°, 7 per cent. of the sugar was inverted, an amount not augmented by continuing the action for 24 hours. From these observations the authors conclude that in the action of *monilia* on cane sugar, inversion precedes fermentation. The inverting enzyme appears to be a body insoluble in water, and is probably a constituent of the living protoplasm. Maltose is fermented by the fresh and dried yeast, and by an aqueous extract of the latter.

It is known that *Saccharomyces Apiculatus* does not ferment cane sugar, and the authors have failed to find any inverting enzyme either in the fresh or dried yeast.

—J. L. B.

Mixed High-fermentation Yeast, Researches on the Composition of. H. van Laer. Bull. de l'Ac. soc. Belge des Chimistes, 9 (7), 216—222.

THE yeast forming the subject of the investigation was one of mixed race that had been constantly employed, with regular results, for three years in one brewery. For the analysis of its constituent races, Lindner's small drop culture method was employed, the colonies being then cultivated on plates and subsequently in flasks. The system of classification adopted was to consider as *predominant yeasts* those forming the largest number of compact aggregations. Such were found to be—

1. *Sacch. cerevisia A.*—A yeast which, in wort cultures, consists of large round cells, slightly oval in form and united into clusters, but becoming decidedly oval on cultivation in sterilised Froberg beer. The gelatinised wort plate colonies resemble white eupolas, but the giant colonies are disc shaped with raised edges. In attenuation this yeast belongs to the Froberg-Logos class, quickly fermenting dextrose, levulose, maltose, and the carbohydrates degraded by Froberg yeast, and also attacking saccharose when inverted by its sucrase.

2. *Torula A.*—In wort cultures the cells are very small and ellipsoidal, collecting in flakes which imprison other yeasts when present. The plate (gelatinised wort) colonies are columnar, and the giant colonies form smooth whitish discs. This yeast attacks dextrose and levulose, and first inverts and then degrades saccharose, but is inert towards diastatic starch-transformation products and only ferments beer wort to a slight extent, although reproducing itself abundantly therein. It imparts an agreeable flavour and odour to the liquid it ferments, but its chief characteristic is its power of clarification by enveloping and carrying down the other yeasts, a faculty clearly exemplified by the parallel experiments made on this point.

The minority yeasts consisted of two forms of *Sacch. Pastorianus*, designated A and B, the first-named being of Froberg-Logos type, but less energetic than *S. cerevisia A.*, which it resembles in its action on sugars. In wort it forms large, solitary, elliptical cells, becoming pastorianic when developed in Froberg beer.

The second *pastorianus* type was present in the initial yeast in quantity too minute to be detected, but occurs largely in the sediment deposited by the beer. It assumes a variety of odd shapes, especially during secondary fermentation. In plate cultures the cells are spherical and tangential to the surface of the gelatin; the giant colonies finally hollow out the gelatin by liquefaction.

Although it would at first sight appear likely that from its low fermentative power the *Torula A.* would be crowded out by the other and stronger yeasts, yet this is not the case, analysis of the mixed yeast at the end of three and six months revealing the following constitution of 20 cultures:—

Yeasts.	After Three Months.	After Six Months.
<i>S. cerevisia A.</i>	9	8
<i>Torula A.</i>	7	10
<i>S. Pastorianus A.</i>	3	2
Undetermined	1	2

This persistence of *Torula A.* is due to its high co-efficient of reproduction, which under the circumstances of the present investigation is represented by 0.272, *S. cerevisia A.*, having a value of 0.068, *S. Pastor. A.*, 0.064, and *S. Pastor. B.*, 0.067. These values are for weight of yeast produced during fermentation and depend on the conditions under which that action occurs, but if established on a numerical basis *Torula A.*, by reason of the small dimensions of its cells, would be still farther ahead of the others. These results are considered as exemplifying one of the factors influencing stability of constitution in mixed yeasts.—C. S.

Saccharomyces Pombe, The Dextrin-fermenting Yeast.
Windisch. *Woch. für Brauerei*, 12, 1895, 655—656.

THE attenuative power of this fission yeast, which was described by Lindner (*Woch. für Brau.* 10, 1298), has been investigated by Dr. Rothenbach, who compared it with yeast race II., a yeast of high attenuative power of the Froberg type. In a 14 per cent. malt-wort free from diastase, race II. fermented 10 per cent., while *Pombe* yeast fermented 12 per cent. A 24 per cent. wort was fermented down to 3.5 per cent. by race II., and to 2.2 per cent. by *Pombe* yeast. As race II. ferments the sugars completely, *Pombe* yeast must attack the dextrin. *Pombe* yeast shows particular resistance to infection by fission fungi, a fact which is explained by the comparatively large amount of acid it forms during fermentation. From this it is concluded that the more acid a yeast forms, the more inimical it is to fission fungi. *Pombe* yeast possesses a higher attenuative power than Froberg yeast or Logos yeast.—J. G. W.

Pure Yeasts, The Reducing Power of. Nastukoff.
Comptes rend. 121, 535—536.

THE author has studied the reducing power of various pure cultures of wine and beer yeasts on magnesium sulphate, using, as a means of measuring the action, the colour produced by the resulting sulphide with bismuth subnitrate. The reducing action varies but very slightly for the same yeast under similar conditions, while different races of yeast have very different reducing powers (e.g., the wine yeast of Champagne has four times the reducing action of the beer yeast of Brussels). The reducing action in no way agrees with the quantity of alcohol produced or carbonic acid gas liberated.—J. G. W.

Yeast, Novel and Singular Formation of Asci in the case of a. H. Schöning, Meddelelser, Carlsberg, Laboratoriet, 1895, 4, Part I., 30—35.

IN 1893 the author found a new species of yeast on Italian raisins. When cultivated in beer wort it produced slight fermentation, and reproduction took place by fission instead of by gemmation. Propagation by means of ascospores was also observed. The formation of asci is effected in the following very characteristic manner:—After three to six days the cells become shorter and rounder; one cell divides into two contiguous cells, which reunite in the form of an hour-glass and gradually become elliptical. A refractile protoplasm with a constant slow motion is observed; it contains large and small granules and large vacuoles. The shape of the asci are variable, but the elliptical and hour-glass forms predominate. This yeast slowly ferments maltose and dextrose, but not cane sugar.

A culture of Beyerinck's *Schizosaccharomyces octosporus* has been examined, and the author finds that asci are formed in the manner above described, and that a similar irregularity in the number of ascospores is noticeable. Since the morphological characters of the two yeasts are alike, the author concludes that they are identical.—J. L. B.

Pectase, its Occurrence and Preparation. G. Bertrand and A. Mallèvre. *Comptes rend.* 121, 726—728.

FROM numerous experiments made by the authors, pectase may be regarded as of universal occurrence among green plants, though in varying amount. It varies considerably in amount in various organs of the same plant, being most abundant in the leaves, from which it probably extends to the other organs. The authors have prepared this ferment for the first time from the leaves of lucerne and clover by a method similar to that employed in the preparation of diastase.—J. G. W.

Amylase (Diastase), some Experimental Investigations, and their Bearing on Practice considered. J. Effront.
Monit. Scient. 1895, 541—559 and 711—725.

THE following conclusions are arrived at:—

1. The amount of active diastase contained in a malt infusion depends—apart from other considerations—on the temperature of extraction. An infusion possessing the maximum activity is obtained at 40° C. At other temperatures, whether higher or lower, and no matter how long

extraction is continued, the resulting infusions are decidedly less diastatic. Extracts prepared at 15°—35° C. and 45°—55° C. respectively, have about the same strength, equal to 70—80, as compared with an infusion made at 40° C. (= 100). At 60—65° C., diastase is more restricted, and reduced to 40—60 per cent. of the maximum.

2. The time required for complete extraction depends on the temperature and on the state of sub-division of the malt. At 15° C. the diastase available at that temperature is extracted from finely powdered malt in 6—12 hours. As regards crushed or bruised malt, and using 4 parts of water for extraction, 40—50 hours of contact are required, which may be reduced to 15—17 hours by frequently stirring the mash. At 45° C. extraction is complete in 10 hours—when often stirred, in 3 hours. At 60° C. these times are reduced to 7 and 1½—3 hours respectively.

3. The saccharifying power of diastase is greatest at 55°—60° C. Its activity, however, diminishes as saccharification proceeds, in proportion to the percentage of maltose formed. At 50° C. the rate of saccharification, and, concurrently, destruction of diastase is diminished, whilst at 30° C. hydrolysis proceeds, although slowly, without loss of active material. An excess of starch (in solution) in no way retards the destruction of saccharifying diastase at a temperature of 55°—60° C. On the contrary, the diastase is weakened more rapidly than when heated alone. The conversion products (maltose, &c.), however, appear to exert a slight but unimportant protective influence.

4. Barley and malt contain certain substances which, although themselves inactive, stimulate the saccharifying of diastase. The saccharifying power of malt is, therefore, not proportionate to the amount of diastase present.

5. This accelerating influence is, however, very pronounced, only during the early stages of saccharification, and rapidly diminishes as the degree of conversion increases. In the analysis of malt, no distinction is made between active and exciting material, although under the conditions obtaining in practical brewing, &c. they behave very differently.

6. The saccharifying and liquefying functions of malt are dissimilarly affected by physical and chemical agents. Barley-extract, phosphates, and certain other substances, stimulate saccharification, but do not influence liquefaction. 0.4 per cent. of lactic acid added to malt-extract increases its saccharifying power, but decidedly hinders liquefaction. A temperature of 65°—70° C., decidedly harmful to saccharification, has no effect on the liquefying power of diastase. In the valuation of malt, both functions of diastase should be taken into account.

7. The saccharifying power should be determined in the wort prepared by mashing the malt at 60° C. The resisting power of the diastase to heat thus becomes known. It is this point which is of special importance in the case of malt intended for brewing.

8. Diastase suffers less change in fermenting worts than in such as are not fermenting.

9. The residual diastase contained in wort (distillers') after 38 hours of fermentation, is a guide as to the nature of the final result to be expected.

Methods for the determination of diastase in malt and fermenting worts are described, and some hints given as to the interpretation of results.—H. T. P.

Organic Acids, Influence of, on Alcoholic Fermentation.
F. Lafar. *Thiel's Landwirthschaftlich. Jahrbuch*, 1895, 445—474.

THE author has investigated the influence of the addition of various organic acids to unfermented must—either in its normal condition, or neutralised with calcium carbonate, or made slightly alkaline—on its fermentation by various races of wine yeasts. The various acids have differing effects upon the same race of yeast, whilst the same acid has a varying influence on different yeast races. With acetic acid the influence on the fermentation by means of different yeasts, as shown by the time-curves of carbon dioxide production, is very different, but the time-curves of alcohol production do not agree with the carbon dioxide ones, thus pointing to the conclusion that the influence is not only upon the progress of the fermentation, but also upon its chemical form.

The addition of acetic acid, as compared with that of other acids, gives by far the least yield of glycerin and also the least crop of yeast, whilst the alcohol production in no way takes the last place, from which the author concludes that acetic acid affects the vegetative life of the yeast cell without equally influencing its fermentative power.

The addition of 0.27 per cent. of acetic acid has no appreciable effect on fermentation, which was still possible with the whole of 15 races of yeast experimented with when the amount was increased to 0.78 per cent. With 0.88 per cent., fermentation was stopped in one case, and in 12 out of the 15 when the amount equalled 1 per cent.

—J. G. W.

Malting and Brewing, Amount and Nature of Acids produced in. E. Prior. Bayer. Brauer J. 1895.

In the process of brewing, so long as the temperature is low enough to permit of bacterial development, organic acids are formed, which partly combine with the lime and magnesia of the water and react on the phosphates, forming primary phosphates.

There is an increase of acidity during the boiling of the goods and hopped wort, due to the interaction of the acid phosphates and the organic acid compounds of lime and magnesia, as well as to concentration.

At certain temperatures the acidity of the wort may decrease, partly through the neutralisation of the free organic acids by the phosphates of lime and magnesia, and partly from the volatilisation of the acids.

A certain amount of acidity is imparted to the wort by the hops, but no increase of acid is noted while the wort is in the cooler.—C. S.

Alcoholic Fermentation, Role of Organic Acids in.

F. Lafar. Landwirthsch. Jahrb. 1895.

Wine Yeasts and Acetic Acid.—In carrying out the experiments described in this paper, the author made use of sterile grape must, either normal or neutralised by precipitated chalk, additions of various organic acids being made to different portions of the neutralised medium. The wine yeasts employed in the first series were of the Schazhoberg and Geisenheim races, and were found to differ considerably from each other in presence of acetic acid, the latter being the more active of the two. In both instances the presence of this acid lowered the reproductive power of the cells and lessened the production of glycerin, without having much effect on the quantitative formation of alcohol. Further experiments, however, showed that whilst Geisenheim yeast will stand over 0.74 per cent. of acetic acid in normal must, and above 1 per cent. in neutralised must, fermentation is retarded and the production of alcohol diminished when the acetic acid exceeds 0.27 per cent. Further investigation revealed the fact that of fifteen yeasts examined, all were able to stand 0.78 per cent., and all but one, 0.88 per cent. of acetic acid, but only three could resist 1 per cent. By comparing the amount of alcohol produced with the number of yeast cells gathered, it is found that the presence of acid increases the anaerobic functions of the yeast cell.—C. S.

Alcoholic Fermentation [Wine], Determination of the Heat liberated in. A. Bouffard. Comptes rend. 121, 357—360.

The high temperature produced by fermentation and the refrigeration in consequence necessary, are serious obstacles to vinification in warm countries. The determination of the quantity of heat liberated in this process is therefore important.

Employing Favre and Silbermann's thermal data, the quantity of heat set free by the fermentation of 180 grms. of sugar, is calculated as 71 calories. But taking Pasteur's figures for the proportion of sugar which suffers decomposition into glycerol, succinic acid, and carbon dioxide, and Berthelot's recently corrected heats of combustion, the calculated number becomes 32.07 cal.

As a mean of four calorimetric determinations made on must, the author obtains 23.5 cal., a number which, while approximating to the lower calculated value, is still materially less. The author concludes that, as this direct

determination shows that the quantity of heat liberated lies between 24 and 32 cal., it is unnecessary to reckon on 71 in the construction of refrigerators, &c.—E. W. W.

Gum contained in Wine. G. Nivière and A. Hubert. Comptes rend. 121, 360—362.

PASTEUR and Béchamp, and many previous investigators, have stated that the gum contained in wine is of the same kind as gum arabic. The authors find, however, that there are the following well-defined differences between the properties of the two bodies:—(1.) The gum of wine is more easily oxidised by nitric acid. (2.) On boiling with dilute sulphuric acid, gum arabic forms arabinose, the gum of wine, galactose. (3.) Reducing agents transform gum arabic into arabinite, but the gum of wine into dulcitol. The authors divide the gums contained in wine into two classes:—

(1.) The natural gum, which exists in the grape, and is found in ordinary wine. This consists for the most part of pectin, and is similar in properties to the pectin discovered by Fremy, which, like it on oxidation, gives mucic acid (not the pectin of Scheibler; this does not form mucic acid). This gum of wine may be regarded as formed from n molecules of galactose, with elimination of water, just as dextrin is made up of n molecules of glucose. Dextrin and this gum have, moreover, many properties in common, *viz.*, solubility in water, precipitation by alcohol and by the salts of the alkaline earths and metallic salts in alcoholic solution. Both have the same solvent power on phosphate of lime. Their action on polarised light is different, and the gum of wine is precipitated by chloride of iron in presence of chalk and very dilute alcohol, whilst dextrin does not give this reaction.

(2.) The gum formed by reduction of sugars in consequence of bad fermentation. Maumené calls this variety viscose. It is precipitated by lead acetate, and is present with mannite, which clearly indicates its origin from sugars, for the wine gum would form dulcitol. Desfosses finds that viscose on oxidation forms oxalic acid without mucic acid. The authors regard its constitution as made up of n molecules of levulose with loss of water.

In order to distinguish wine made from raisins, or at least to obtain another indication, the following method is given:—A polarimetric measurement of the wine is first made; the gums of the first class are then precipitated by ferric chloride, and a second measurement then follows. Certain badly fermented French and Algerian wines would, however, give precisely the same reactions.

The amount of natural gum in a wine, may be estimated by converting it into mucate of iron, calcining and weighing the oxide of iron formed.—E. W. W.

Beer-Worts, Coloration of, by Iron, during Hop-Boiling. Kukla. Wochenschr. f. Brauerei, 1895, 12, 1061—1062.

The author has carried out experiments which show that the additional coloration produced by boiling a wort with and without hops, depends respectively upon the hops themselves, and upon the concentration of the wort. The colouring produced in the wort by boiling *per se* is proportionately greater than that brought about by the influence of hops, at least, so far as the better sorts are concerned.

Worts were boiled with hops in the presence of oxide of iron, which was added in the form of chloride in quantities varying from 0.0013 to 0.0264 gm. per 100 grms. of malt. The coloration, in proportion to the iron present, was less than when the worts were boiled with hops; small amounts of iron produced cloudy worts, whilst larger quantities acted as a clarifier. The results of the examination of the spent hops indicated that the blackening of the hop heads varied according to the amount of iron that had been added. The blackening is caused by tannate of iron, which adheres to the heads, and is distributed to only a small extent in the wort. The estimation of albuminoids showed that the coloration was dependent on the amount of these that remained in solution.

A direct colouring was not caused by oxide of iron during the process of hop-boiling. The wort also loses colour in proportion to the quantity of oxide of iron present, a

circumstance evidently due to the separation of more albuminoids from the solution. The precipitated tannate of iron being insoluble in water exerts no colouring effect on the beer.

Windisch cites a case in which a brewery employed a hop extractor. The water used for brewing was rich in iron and the additional colouring was very pronounced. During fermentation, however, it disappeared, whilst the yeast was coloured bluish-black.—J. L. B.

Duration of the Mash, Influence of, upon the Extract and the Composition of the Wort. L. van Dam. Woch. für Brauerei, 12, 1895, 711.

The yield of extract depends more on the mashing temperature than on the time of standing on the goods, owing, the author states, to the existence of two kinds of starch in malt, one readily soluble at 62–64° C., and the other soluble only after previous gelatinisation at 70° C. The nearer then the mashing temperature is to 70° the greater will be the extract.

The author divides the nitrogenous constituents of wort into albumins, peptones, and amides, the first of which are useless to the fermentation, but may, under the influence of bacteria, favour diseases of the beer. Their degradation into peptones and amides by means of peptase, the most favourable temperature for which is 40° to 45° C., is therefore advisable. The author gives the results of two mashes, one made and kept at 40°–45° C. for 2 hours and then heated up to 62°, and the other heated immediately up to 70°, from which it appears that the first mash yielded a greater quantity of nitrogenous constituents but a larger proportion of peptones and amides than the second one.

According to the author, lactic acid effects a greater solubility of albumin and also increases fermentation. The development of the lactic acid bacteria is increased by standing of the mash at a temperature of 40°.—J. G. W.

Carbon Dioxide, Collection and Utilisation of, in Breweries. H. Kerr-Thomas. Jouru. Fed. Inst. Brewing, 1896, 2, 6–16.

The following is a description of the plant employed by the author for the collection of carbon dioxide from the fermentation vats, and the subsequent purification and compression of this gas.

The gas, which is collected, as soon as the beer becomes saturated, from the fermenting vessel by means of a parachute, passes through the suction main to the compressor. The latter is of the three-stage type, and has three cylinders, each of which raises the pressure by an equal amount to the point required for the liquefaction of the gas. The purification takes place after the first compression, when the gas is at a pressure of 20 lb. above that of the atmosphere. The purifying scrubbers consist of a series of cast-iron vessels, and contain water through which the gas is made to bubble. The water is frequently changed. By this treatment, the gas is freed from yeast particles and mechanical impurities; it is then led to a second series constructed of lead, and containing sulphuric acid, which brings about the elimination of odorous principles. After this, the gas is conducted through a solution of potassium permanganate and sodium carbonate in order to remove any traces of acid, and, after being dried, it passes to the second and third cylinders of the compressor. Here it is subjected to a pressure of about 700 lb. per sq. in., and is passed through a copper coil submerged in a tank of water, whence it issues as a liquid of sp. gr. 0.8, and is collected in the ordinary steel flasks.—J. L. B.

English Beer, A Viscous Bacillus in. L. Vandam. Bull. de l'Assoc. Belge. 1895, 9, 245–257.

In the course of an examination of a yeast from Burton producing ropiness in beer, the author has isolated a ferment resembling in some particulars the *Bacillus viscosus* I. and II. of van Laer, but differing in several important respects from these organisms as described by Fellowes (this Journal, 1894, 1080), its powers increasing, rather than otherwise, by successive cultures in solid media.

B. Viscosus III., as this ferment is styled by the author, occurs as short rods, varying in length between 1.3 and 2.0

μ , and about 0.7 μ in thickness, mostly as isolated cells containing a spore; less frequently in short chains, except in wort cultures, when the chains are larger, more numerous, and embedded in a viscous mass. In hopped wort cultures at 28° C. ropiness sets in after 48 hours and continues until the whole is of the consistency of white of egg, but the energy of the organism decreases with age, although its reproductive powers are unimpaired. The ferment does not cause evolution of CO₂ or any other gas, nor does it develop on gelatinised meat extract, but on the other hand, it grows freely in gelatinised wort, thus exhibiting marked contrasts to *B. viscosus* I. and II. In yeast-water it attacks glucose, maltose, and saccharose quantitatively, in the order named, but in presence of peptone the relative positions of glucose and saccharose are reversed, the effect of the ferment being at the same time greatly diminished; however, the resulting viscosity is not affected by the quantity of the nitrogenous matter.

The most favourable temperature for this bacillus is between 28° and 30° C., and it is essentially aerobic in habit, refusing to grow at all in the absence of air.

For the production of ropiness by *B. viscosus* III. it appears necessary that infection should occur before, or at any rate, not later than, the time the wort is pitched, since attempts made at inoculating fully fermented beer failed, one reason for this being that dextrin is less readily assimilable by the bacillus than maltose. The employment of infected yeast is inadvisable although the bacillus may be present merely in slight quantity, because the reproductive power of the organism is such that in the course of a few generations it will have multiplied to an extent capable of making the beer decidedly ropy. This effect depends for its intensity on the amount of the bacillus present and not on the quality or preparation of the wort, the addition of, for example, invert sugar, exerting, so far as has been observed, no influence on ropy fermentation.

In view of the fact that lactose is eliminated by *B. viscosus* III. the author suggests that this property may perhaps be employed for the detection of the organism, as also for I. and II., although the effect of yeasts, &c. on the assimilation of this sugar has yet to be studied.

—C. S.

Cellulose, Fermentation of. V. Omelianski. Comptes rend. 121, 653–655.

According to the author *Bacillus amylobacter* is only a collective species, comprising a great number of distinct butyric ferments. From the mud of the river Neva, working in the following manner, the author has isolated a bacillus, 6–7 μ long, 0.2–0.3 wide, which has a very vigorous action on cellulose:—The mud was sown in a solution of potassium phosphate and magnesium and ammonium sulphates, containing Swedish filter-paper and chalk and a small quantity of gum arabic. The bacillus collects on the filter paper and is obtained in a pure state by heating the culture up to 90° C. several times for five minutes, and making anaerobic cultures on cooked potato.

—J. G. W.

Pentosans or Pentoses in Beer, Occurrence of. P. Mohr. Woch. f. Brauerei, 12, 1895, 739.

See under XXII., page 140.

Wine, Estimation of Tannin in. E. Maneau. Bull. de Soc. Chim. 13, [24], 1098.

See under XXIII., page 140.

Fine Spirit, Quantitative Estimation of Small Amounts of Fusel Oil in, by Rose's Method. M. Glasenapp. Zeits. f. angew. Chem. 1895, 657.

See under XXIII., page 140.

Absinthe, Detection of Adulteration in. G. Nivière and A. Hubert. Monit. Scient. 1895, 553.

See under XXIII., page 137.

PATENTS.

A Material Suitable for Use in Brewing and for other Purposes. An Improved Method of Manufacturing from Starch or Starchy Substances. R. C. Garton, Battersea, and C. H. Meyer, Shepton Mallet. Eng. Pat. 24,511, Dec. 17, 1894.

ONE HUNDRED parts of dry powdered starch or starchy material is introduced into a suitable machine and intimately mixed with $\frac{1}{4}$ to 4 parts by weight of acid (preferably sulphuric) of sp. gr. 1.81, diluted to sp. gr. 1.001 to 1.060. The moistened material which is still in a powdered condition is transferred to a converter, and subjected to a steam pressure equivalent to a temperature of 270° to 300° F., which is maintained until the starch is saccharified, and a sample shows little dextrin when treated with alcohol. A heavy gravity syrup is obtained, which, on being neutralised and filtered, has, without any evaporation, the same degree of concentration as is usual after the first evaporation in the ordinary process of manufacture. A syrup of greater concentration may be prepared by employing dry or superheated steam.—J. L. B.

Malting Wheat, Improved Method of. R. W. Clarke, Reading. Eng. Pat. 20,798, Nov. 4, 1895.

THIS improvement consists in cleansing the grain, steeping it for 24 hours in water made slightly alkaline with lime, running this off and adding more fresh water until the grain has absorbed 30 to 35 per cent. The grain is drained, allowed to remain in the cistern for 12 hours, spread out on the floor of the kiln, and germinated until the rootlet has attained the length of the grain. The temperature of the air beneath the kiln-floor is maintained at 90° – 95° F., and must not exceed 100° F. The inventor states that a wheat malted in the above described manner is more suitable than the ordinary malt for use in combination with unmalted wheat in the manufacture of bread, &c.—J. L. B.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY AND WATER PURIFICATION, DISINFECTANTS.

(A).—CHEMISTRY OF FOODS.

Bread, The Distribution of Nitrogenous and Mineral Matters in. Balland. Comptes rend. 121, 786–788.

THE crust of bread does not contain more nitrogenous and mineral matters than the crumb, provided they are both brought to the same degree of dehydration. The baking of bread is effected without loss of matter, for though the constituent elements of the flour are modified by a loss of fatty matters and an increase in sugars, their respective weights do not vary in an appreciable manner, and it may be laid down that desiccated bread does not contain more nutritive matter than the dry flour employed to make it. The determination of the water in a flour will thus enable us to calculate the quantity of bread, of a given degree of hydration, it will produce, and the simultaneous determination of the water in the bread and in the flour will enable us to make certain that the yield of bread has not been improperly increased by a too great addition of water.

—J. G. W.

Rice, The Composition of, Imported into France. M. Balland. Comptes rend. 121, [17], 561–564.

THE author shows by a most complete series of analytical results the composition and dietetic properties of various varieties of rice (raw, husked, and in process of preparation) that are found in the French markets. The percentage composition of husked rice varies as follows:—Water, 10.20–16.00; nitrogenous matter, 5.50–8.82; fat, 0.15–0.75; amylaceous matter, 75.60–81.35; cellulose, 0.18–0.42; ash (phosphatic) 0.11–0.58. The rice of Carolina and Cochín China contains the largest proportion of nitrogenous constituents.—E. J. R.

Extract of Meat, Composition of. J. König and A. Bömer. Zeits. Anal. Chem. 34, 1895, 548–562.

A CHEMICAL examination of extract of meat led to the following conclusions:—

1. Precipitation with 80 per cent. alcohol, as originally recommended by Liebig, can give no idea of the kind of nitrogenous substances present, or of the quality of the extract of meat.

2. In order to form an opinion of the extract it is necessary to salt out the aqueous solution with ammonium or zinc sulphate (compare following abstract). The solid salt is added to the solution, which is constantly stirred until it is thoroughly saturated and the precipitate is afterwards washed with a saturated solution of the salt. The precipitate produced by ammonium sulphate is best weighed in the usual manner and the quantity of albumoses then calculated by estimating and subtracting the ammonium sulphate in the weighed residue. The nitrogen in the zinc sulphate precipitate can be directly determined by Kjeldahl's method.

3. The filtrate from the salting-out process is tested for peptone by the biuret reaction, if necessary, after decolorising with animal charcoal. If this reaction gives negative results peptones are either not present at all or only in such quantities as may be neglected.

4. It is desirable to estimate the ammonia in extract of meat by distilling the aqueous solution with calcined magnesia.

5. If the extract of meat has been proved to be free from peptones, then the precipitate produced by phosphotungstic acid, i.e., the nitrogen of the same after subtracting the nitrogen occurring as (gelatin + albumose + ammonia) may be considered as due to meat bases. It is to be noticed that the filtrate from the phosphotungstic acid precipitate should stand for a sufficiently long time (5–7 days) in order to separate out all the bases.

6. The difference between the total nitrogen minus the nitrogen in the form of (gelatin + albumoses + meat bases + ammonia) gives a measure of the quantity of other nitrogenous compounds occurring in the extract of meat which cannot be precipitated by phosphotungstic acid.

—J. S.

Albumoses, Zinc Sulphate, a Precipitant for. A. Bömer. Zeits. Anal. Chem. 34, 1895, 562–567. (Compare preceding abstract.)

THE author proposes to use zinc sulphate instead of ammonium sulphate as a precipitant for albumoses. The advantage claimed for zinc sulphate is that the nitrogen can be directly estimated in the precipitate by Kjeldahl's method. Another advantage that accrues from the use of zinc sulphate is that the peptones, meat bases, &c. can be directly determined in the filtrate from the albumoses after acidifying with an equal volume of dilute sulphuric acid (1:4). Test experiments, so far as they have gone, show that the use of the new precipitant is highly satisfactory.—J. S.

Flour. S. Cerkez. Zeits. f. angew. Chem. 1895, 663.

See under XXIII., page 140.

Gelatin, Estimation of, in Meat Extracts and Commercial Peptones. A. Stutzer. Zeits. Anal. Chem. 34, 1895, 568.

See under XXIII., page 140.

PATENTS.

Raising the Temperature of Organic Substances and Alimentary Products generally, and particularly for Thawing Frozen Meat, Method of and Apparatus for. A. M. Clark, London. From La Compagnie de Carnes Congeladas, Buenos Ayres, South America. Eng. Pat. 5588, March 16, 1895.

THE present system of thawing a large bulk of frozen meat occupies so long a time that the exterior portions are liable

* 4–5 c.c. of the liquid are treated with caustic soda solution, and to the mixture is added, drop by drop, a dilute (about 10 per cent.) solution of copper sulphate. The presence of peptones is manifested by the formation, in the cold, of a reddish-violet coloration.

to become unfit for sale, while the interior is still frozen. The object of this invention is to remedy this inconvenience by establishing an internal circulation of the heat within the mass, by alternate compression and rarefaction of heated air, which process also causes the destruction of organisms and prevents the escape of valuable juices. The apparatus consists of a closed chamber provided with end covers suitably held together. The meat is hung by hooks attached to roller carriages running on the suspension rail. The chamber is connected with pipes for the introduction and withdrawal of high-pressure air, controlled by stop-valves and connected with vacuum pumps or with compressors. The desired temperature within the chamber is attained by means of a series of hot-water pipes.—L. de K.

Milk and other Liquids, Apparatus for Sterilising. H. H. Lake, London. From P. J. Buus, Aalborg, Denmark. Eng. Pat. 11,908, June 5, 1895.

The apparatus consists of a horizontal chamber surrounded by a steam jacket, in which a shaft furnished with helical wings revolves. These give a centrifugal motion to the milk and eventually force it through the outlet to the upper part of the cylinder. The steam enters the jacket near the exit tube, so that the milk is most heated on leaving the chamber.

The air-space in the middle of the chamber is kept at atmospheric pressure by being connected with the outer air by a tube.—L. de K.

An Improved Food for Animals, and Process for Manufacturing the Same. F. V. Friderichsen, Copenhagen, Denmark. Eng. Pat. 13,176, July 8, 1895.

Blood is treated so as to render it suitable as a forage by mixing 700 parts of blood with 400 parts of molasses, and the mass is then absorbed in a mixture of, for example, 500 parts of bran and 500 parts of palm-meal. The compound is subsequently kneaded, pressed, dried, and finally made into cakes or coarse powder.—L. de K.

Sterilising or Pasteurising Milk and other Liquids, Improvements in or relating to Apparatus for. A. J. Boulton, London. From H. Davidson, Gottenburg, Sweden. Eng. Pat. 18,767, Oct. 7, 1895.

The inventor claims improvements in that the apparatus consists of three vessels, one inside the other, so arranged and fitted with sockets and tubes that the milk may pass down a central tube fitted with a strainer and upwards into the middle vessel, whilst the heating medium flows down another central tube and into the outer and inner vessels. The latter contain a large cylinder of air, which by reason of its low specific heat, requires less fluid to reach and maintain the requisite temperature. The inner and middle vessels may be easily removed from the outer ones.—L. de K.

Fats for Use as a Comestible, Improvements in Preparing. David Gray, jun., Inverness. Eng. Pat. 21,103, Nov. 7, 1895.

This specification describes the production of peptonised fat, which, while having special digestive properties, will serve as a substitute for butter. Refined sweet beef fat, rendered at a temperature not exceeding 130° F., is introduced into enamelled jacket boilers, in which has been standing for 96 hours, a mixture of three parts of glycerin (to act as a solvent), five parts of water, and eight parts of digestive mucus from the upper stomach of sheep or pigs. The proportions used are 112 lb. of fat to 4 lb. of this mixture. The contents of the boilers are heated for two hours, at 100° F., and mechanically stirred. After this, the peptonised fat is filtered and left in enamelled vats for 30 minutes at 100° F. Then for every 112 lb. of fat, 12 lb. of edible cotton-seed oil and $\frac{1}{2}$ lb. of salt are added. The whole mass is stirred for 15 minutes and is then ready for packing. The inventor states that this product, which he terms "Oleotene," is devoid of fatty flavour or taste.—C. A. M.

Fish Liver, An Improved Process for the Preservation and Preparation for Transit of. C. M. V. Dahle, Stamsund, Norway. Eng. Pat. 22,887, Nov. 25, 1895.

The aim is to preserve fish liver without using an antiseptic such as boracic or salicylic acid, as it has been proved that these substances are unwholesome.

The liver is first dressed with sterilised water to remove all clots, fibres, &c., and it is then dried in air at about 30°–40° C. After soaking in a sterilised 10 per cent. solution of common salt, the liver is wiped and thoroughly boiled in oil under atmospheric pressure. This treatment causes, however, the partial destruction of the tissues and the product must, therefore, be crushed before being packed.

—L. de K.

(B.)—SANITARY CHEMISTRY.

Acetylene, The Poisonous Properties of. N. Gréchant. Comptes rend. 121, [17], 561–565.

A series of experiments on dogs shows that acetylene is poisonous when breathed in an atmosphere containing from 40 to 79 per cent. The effect of a mixture of coal gas, oxygen, and air is comparatively far more violent and is mainly due to the presence of carbon monoxide.

M. Berthelot remarked that in his own experiments the mixture he had used of pure acetylene and air had little effect on birds. M. Gréchant's results, indicated no doubt the difficulty with which acetylene forms a compound with the hæmoglobin of the blood. M. Moissan stated that pure acetylene had an agreeable ethereal odour and caused no inconvenience when inhaled in small quantities.—E. J. R.

Acetylene, The Toxicity of. L. Brociner. Comptes rend. 121, 773–774.

The blood dissolves four-fifths of its volume of acetylene, with the formation, however, of a very unstable, if any, compound with the hæmoglobin, differing greatly in this respect from carbon monoxide. Acetylene exerts a very feeble toxic action, which is not more marked than that of other hydrocarbons, such as ethylene and propylene. Animals can exist for several hours in air containing considerable quantities of acetylene, provided care be taken to remove the products of respiration.—J. G. W.

Organic Matter, Estimation of, in Water by Potassium Permanganate. V. Skupevsky. J. Russ. Chem. Soc. 27, 500.

See under XXIII., page 140.

PATENTS.

Purification of Sewage and Impure Waters, Improvements in, and in Apparatus for Use in or in connection with. F. P. Candy, Eccles, Lancaster. Eng. Pat. 166, Jan. 2, 1895.

The improvements consist in—

(1.) Causing the precipitate to aggregate previous to subsidence, by passing the sewage through a bed of pebbles on its way to the settling tank, or by passing the sewage upwardly through a chamber at such a speed that the suspended particles agglomerate, or by an improved arrangement and construction of the settling-tanks themselves.

(2.) Impregnating sewage with air or other gas by causing it to flow down a pipe, carrying bubbles of air or gas along with it; also utilising the admission of water to, and its discharge from, a closed chamber in order to pump air into a filter-bed.

(3.) Construcing upward-flow filter-beds in such a way that the dirty or fouled filtering material can be removed from the bottom and allow the cleaner upper portion to sink down and take its place, without putting the filter entirely out of use.

(4.) Improvements in the construction of precipitation-tanks, relating chiefly to the form of the bottoms of circular tanks and the means for admitting sewage and removing sludge.

(5.) An arrangement for drawing off sludge from a tank, without the orifice of the outlet-pipe becoming choked.

—L. A.

Tanks for the Precipitation of Sewage and Foul Waters, Improvements in and relating to. G. H. Skelsey, Liverpool. Eng. Pat. 2449, Feb. 4, 1895.

A precipitation tank is constructed with a series of transverse walls in such a way that the sewage flows alternately under one wall and over the next. Each division of the tank between two over-shot walls is shaped in section like an inverted bottle, and the undershot wall extends down the middle as far as the shoulder. The sludge settles into the bottle neck, whence it is drawn off from time to time.

—L. A.

Ammonia from Sewage Effluent and other Weak Ammoniacal Liquors, Improvements in the Recovery of. T. Twyman, Egham, and P. E. Matthews, Englefield Green, Surrey. Eng. Pat. 2625, Feb. 6, 1895.

See under VII., page 114.

Softening and Purifying Water, Improvements in Apparatus for. H. T. Wright, Westminster. Eng. Pat. 3366, Feb. 15, 1895.

This invention relates to apparatus by means of which water under pressure may be softened and purified without the employment of any pumping or pressure,—employing means other than may be necessary for the ordinary town or other supply. The water to be treated, enters a receiver having two outlets, a larger one, furnished with a back pressure valve, leading directly to a tower, in which the water is to be treated, and a smaller one leading first to a chamber in which the solution of the reagent employed is made. This solution is then pumped into the tube leading the main body of water to be treated to the lower part of the tower. This tower is provided internally with a vertical series of inclined surfaces, each alternate surface leaving a space between its upper part and the sides of the tower or vessel, and terminating at its lower end in a short, central pipe, and each other alternate inclined surface joining the sides at their upper part, and leaving a central opening and a space between themselves and the first-named inclined surfaces, so that the water and the treating solution pass slowly upwards through the apparatus, alternately upwards and outwards, and downwards and inwards, whilst the deposited matter falls through the central short tubes and openings to the bottom. The water may pass through more than one such tower, and then be led to a filter.

—R. S.

Purifying the Water of Hat-Felting or Sizing Tanks, Improvements in Means for. G. Wells, C. Swartz, and W. B. Hubbell, all of South Norwalk, Connecticut, U.S.A. Eng. Pat. 19,369, Oct. 15, 1895.

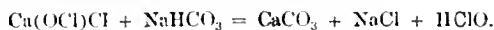
In order to remove hairs, particles of fur, &c. from the tanks, a pipe leads from below the level of the water to the bottom, where it is bent, and again rises. Its outlet is above the surface, and leads into a strainer, through which the water is delivered back into the tank, and constant circulation and straining thus take place. The water, of course, finds its own level in the pipe, and is forced upwards to the strainer by means of high-pressure steam introduced through a nozzle in the lower part of the pipe.—R. B. B.

(C).—DISINFECTANTS.

PATENTS.

Antiseptic, Disinfectant, and Deodorant, Improved Compound forming an. S. A. Vasey, Loughton, Essex. Eng. Pat. 788, Jan. 12, 1895.

BICARBONATE of soda is impregnated with oil of eucalyptus in the proportion of 1 pint of the oil to 1 cwt. of the bicarbonate, or other suitable proportions. 57 parts of the product are then mixed with 43 parts of bleaching powder, though these proportions also may be varied. The object is the production of a powder which, on being treated with water, yields free hypochlorous acid, thus:—



The eucalyptus oil is to preserve the powder when in a dry state. Instead of the bicarbonate, normal sodium carbonate may be used mixed with an equivalent proportion of a crystallised acid, such as tartaric, or an acid salt.—L. A.

Improvements in Sterilising and Purifying Liquids. P. Boisserand, Paris. Eng. Pat. 4514, Mar. 2, 1895.

THE patentee claims the use of the permanganates of lime, potash, or the like, in conjunction with the higher oxides of manganese (Weldon mud), for sterilising and purifying river or drainage water.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

PATENTS.

Nitrocellulose or Pyroxyline Compounds, Improvements in and Connected with the Manufacture of. F. Greening, Stoke Newington. Eng. Pat. 22,019, Nov. 14, 1894.

See under XIII., C., page 124.

Paper or Pulp, A New Product obtained from, applicable for Use as a Filtering Material, and in the Manufacture of Celluloid, Collodion, and Explosives, and for other Purposes. A. Grandjean, Paris. Eng. Pat. 22,556, Nov. 21, 1894.

This new product is produced by disintegrating paper pulp, which product the inventor terms "snow paper" or "snow pulp."

It is specially suitable for filtering purposes, or for the manufacture of cellulose, &c.—S. P. E.

Machine-Paper, with Coloured Longitudinal Stripes, Process for the Manufacturing of. A. Cohn, Prussia. Eng. Pat. 1978, Jan. 15, 1895.

This process consists of allowing several differently coloured stuffs to run upon the wet end of the machine, the differently coloured stuffs being kept separate by means of very thin plates, suitably fixed, and resting upon the wire.

This method may also be adopted for paper having longitudinal stripes upon a common ground. The coloured stuffs are run on to the ground stuff when the latter has sufficient moisture left to felt with them, and thus form a completely felted paper, having longitudinal stripes over a common ground.—S. P. E.

Wrapping Paper, Improvements in. J. C. Kaye, Wakefield. Eng. Pat. 1768, Jan. 25, 1895.

PARCHMENT paper and wrapping paper are pasted together, passed through rollers, and cut into sheets of any required size. By this means a sheet is produced, having the qualities of each paper on its respective outer surfaces, with the combined strength of both papers, for the purpose of wrapping oleaginous or moist articles.—S. P. E.

Vegetable Parchment, Improvements in Treating to make it Applicable as an Electric Insulating Material, and for other Purposes. J. A. London and H. P. Bailey, Newcastle-on-Tyne. Eng. Pat. 12,711, July 2, 1895.

A BLOTTER paper is first made from ordinary materials and run on reels in the ordinary manner. This paper is passed through a trough of sulphuric acid, kept as cold as possible. Immediately on passing from this trough it is washed with water, and re-wound on another reel. This washing and rewinding is repeated four times to make the paper more skin-like, and water and grease-proof. Weak soda may be used for washing, neutralising any free acid. The sheet is then passed through a bath of glycerin to make it pliable and to prevent curling. After drying, it is cut to the required size and sheeted in the usual way. Such parchment may be used for insulating electric conductors, for the manufacture of waterproof clothing, and many other purposes where rubber is now employed.

—S. P. E.

Supporting and Moving a Web of Paper or other Flexible Material for Coating, Drying, or other Purposes, Improved Means for. G. J. Burns, United States. Eng. Pat. 16,498, Sept. 3, 1895.

This invention relates to the coating of paper with mineral colours, and drying the same without allowing it to touch any solid support until dry.

The paper is taken from a reel, and passed between ordinary distributing brushes, the first pair of which dip into the colouring matter, coating each side of the paper simultaneously. The paper is kept at the required tension by a blast of air striking equally across the whole width of the paper, forming the paper into a loop, while another blast is forced against the under side, the two serving the purpose of a roller, without affecting or in any way marking the surface. The air also helps to dry the coloured surface, and may be heated for this purpose.—S. P. E.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Alcoholates. H. Lescœur. Comptes rend. 1895, 121, 691—692.

To set at rest the question of the proportion of alcohol of crystallisation in the solid products of the action of sodium and of sodium hydroxide respectively upon alcohol, the author has studied the manner in which these substances dissociate. He quotes the vapour tensions observed on concentrating solutions *in vacuo* at 60° C., and obtains indications of the existence of $\text{NaO} \cdot \text{C}_2\text{H}_5 \cdot 2\text{C}_2\text{H}_5(\text{OH})$ in the former, and $\text{NaOH} \cdot \text{C}_2\text{H}_5(\text{OH})$ in the latter case.

By boiling sodium hydroxide in alcohol, and then cooling, small scales are produced, which alter rapidly in moist air, dissolve in water with a rapid circular motion, fuse easily, evolve alcohol on heating, and appear to have the formula $\text{NaOH} \cdot 3\text{C}_2\text{H}_5(\text{OH})$. These last are the true alkaline alcoholates, and should be distinguished from the ethylates, such as that first described, which is an alcoholate of sodium ethylate, and yields sodium ethylate in dry air.

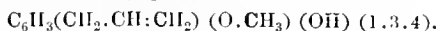
—W. G. M.

Methyl Nitrate, Preparation of. Delépine. Bull. Soc. Chim. 13, (1895), 1044—1045.

According to the method proposed, 100 c.c. of concentrated sulphuric acid and 150 c.c. of pure nitric acid (35°) are mixed and cooled to about 12° C. A second mixture is then prepared by carefully adding 50 c.c. of sulphuric acid to 150 c.c. of 98—99 per cent. methyl alcohol, with constant agitation, and keeping the mixture cool so that the final temperature is below 12°—14° C. The solution so obtained is then gradually added to the nitro-sulphuric acid, the temperature being kept below 15° C. When the two solutions have been thoroughly mixed, 100 c.c. of sulphuric acid is quickly added and the whole is stirred rapidly, when the temperature rises to about 20° C., and after a few minutes the ether floats up. After separating, it is washed with dilute alkali, dried, and rectified, when almost the whole passes over at 66° C. The yield from 150 c.c. of alcohol is 86 c.c. of crude ether, whilst a litre of alcohol divided into four charges gave 560 c.c., and it does not appear to be advisable to work with larger quantities.—T. A. L.

Methyleugenol, Synthesis of. Constitution of Eugenol. C. Moureu. Comptes rend. 121, 721—723.

By fixing the radical allyl on to the dimethyl ether of pyrocatechol, veratrol, the author has at once synthesised the methyl ether of eugenol, methyleugenol, and proved eugenol to be an allyl guaiacol of the constitution—



This he has effected by acting on veratrol with allyl iodide in the presence of zinc dust, whereby hydriodic acid is eliminated. This, however, as soon as liberated, demethylates part of the veratrol, producing iodides of methyl,

guaiacol, and pyrocatechol, from which substances the methyleugenol is purified by distillation, which removes the methyl iodide, and then by rendering alkaline with soda and distilling with a current of steam, which carries over the methyleugenol containing only any excess of veratrol, from which it is purified by fractional distillation. The body so obtained agrees in all its properties with methyleugenol formed from natural eugenol. The author intends to apply this method to the synthesis of other natural products possessing a non-saturated lateral chain, such as safrol, anethol, and estragol.—J. G. W.

Phenol, Action of, upon Mercurous Iodide. M. François. Comptes rend. 121, 768—770.

At its boiling point phenol acts upon mercurous iodide, decomposing it into mercury and mercuric iodide, the latter of which enters into solution. This action ceases, however when the amount of mercuric iodide dissolved by the phenol equals 2.75 grms. per 100 grms. of liquid. This evidently corresponds to a state of equilibrium, for the reverse action takes place when a boiling solution of mercuric iodide in phenol, of greater strength than the above, is brought into contact with metallic mercury. The mercury is converted into mercurous iodide, the action, however, ceasing when the content of the solution in mercuric iodide falls to the above amount.—J. G. W.

Denatured Alcohol, Production and Analysis of. Petit. Monit. Scient. 1895, 702—708.

THE regulations affecting the production (in France) of denatured spirit, require that not only the finished article, but all the materials used (alcohol, methylated spirit, &c.) shall conform in composition to particular standards; and certain methods of analysis are officially recognised. These the author has examined, and criticises in detail. He concludes that—

1. The standards for alcohol and wood spirit are, as such, meaningless, because the analytical processes adopted are insufficient to define them.

2. The denaturing processes fail to prevent fraud.

3. The methods of analysis are in some cases absolutely worthless, whilst others have been hastily adopted and very imperfectly studied.

These strictures apply especially to the methods for the determination of acetone, saponifiable ethers, and total impurities.—H. T. P.

XXII.—EXPLOSIVES, MATCHES, Etc.

Matches with Explosive Pastes. T. Schloesing. Comptes rend. 121, 331—336.

Nor only have the Académie de Médecine, the Conseil d'hygiène de la Seine, and all authorities on hygiene, condemned the use of white phosphorus in the manufacture of matches, but the workmen in the factories of Pantin and d'Aubervilliers have also demanded its suppression. In the hope of finding some substitute for this substance, the French Minister of Finance appealed to all match makers and inventors, and appointed a commission to judge of the products submitted to competition.

Some of the matches submitted to the commission fulfilled the condition of Swedish safety matches, though in a less degree, but all were made of explosive pastes composed essentially of potassium chlorate and combustible bodies, such as red phosphorus, certain sulphides, hyposulphites, &c. In fact, their composition was similar to that in common use 50 years ago, except for the advantageous introduction of red phosphorus. Though their storage and transport presents no special danger, and the paste may be prepared in large quantity if due precautions are taken, these matches—unlike the ordinary ones containing white phosphorus, which require an atmosphere containing oxygen to enable them to burn—have in themselves all the elements necessary to combustion. This is a serious disadvantage, considering

that the slightest amount of friction, such as that caused even by the rubbing of one head against another, is usually sufficient to cause ignition.

This difficulty, however, does not seem insurmountable. The author has attempted to obtain by experiment some scientific knowledge of the composition of a suitable paste. In the first place, mixtures of each of the substances which act as supporters of combustion with each of the combustible bodies in common use, were made. Glue and sand or broken glass were added, and matches were then made from the pastes. Potassium chlorate and red phosphorus proved to be the best materials, though their mixture when dry is a dangerous explosive even when combined with glue and a large proportion of an inactive substance. With sulphur, the sulphides of antimony or tin, or hyposulphite of lead, potassium chlorate forms pastes which may be ignited on a rough surface, such as slate, but not upon cloth, and these mixtures on burning tend to fuse, and not to detonate like those containing red phosphorus. With sugar, gum, or gelatin ignition is effected with greater difficulty. The other oxygenous substances—the nitrates, "oxidised minium" (a mixture of nitrate and peroxide of lead, obtained by heating red lead with nitric acid and drying), peroxide of lead, manganese dioxide, bichromates, and neutral chromates—do not give pastes which can be ignited on a match by friction, even on a surface containing red phosphorus.

From these experiments it is evident that potassium chlorate and red phosphorus must be regarded as indispensable ingredients. The effect of the addition of another combustible material to this mixture was next tried. Glue and powdered glass were employed as before. It was found that the combustion of a mixture of chlorate and phosphorus is very much moderated by the presence of a fusible body such as sulphur, the sulphides of antimony, or hyposulphite of lead. In fact, without destroying the sensibility due to the phosphorus, pastes which burn less violently and do not eject sparks, may be obtained by this means. The state of division of the materials has a great influence on their manner of combustion. If the phosphorus be in coarse powder the mixture fuses on burning, but if in a very fine state of division it detonates and emits sparks. In most cases a mixture of chlorate, phosphorus, and another combustible still ignites too violently, but this may be moderated by the addition of inert substances such as zinc oxide, insoluble chromates, or the oxides of manganese or iron.

The best idea of the composition of a suitable paste may be obtained by regarding it as a mixture of four kinds of material:—

- (1.) A supporter of combustion—potassium chlorate.
- (2.) Two mineral combustibles, of which one is invariably red phosphorus.
- (3.) Inert substances such as silica or powdered glass.
- (4.) A colloid in solution; e.g., gum or glue.

From laboratory experiments the author finds that a paste which will ignite on cloth must contain 12 to 15 per cent. of red phosphorus, and the potassium chlorate should not exceed 35 per cent., or the combustion becomes too violent. These numbers, however, would probably require modification in commercial practice.

The problem of finding the proper combustible to use with the phosphorus, the most suitable inert material, and their best proportions, concerns the manufacturer principally, and might easily be ascertained by experiment on the principles laid down.

The composition of the fumes produced on burning was next investigated. For this purpose 100 matches were burnt in a closed vessel, the fumes allowed to settle, rinsed out with water, and the liquid analysed. Six kinds of matches were used, with the results shown in table in next column.

The phosphorus is present in the fumes as phosphoric acid, the lead as white oxide, the antimony equally as oxide or antimonie acid. These figures show the necessity of avoiding accidental ignition and practically condemn the use of antimony or lead. But phosphorus cannot be avoided, though the presence of phosphoric acid in the fumes largely deprives red phosphorus of its superiority to white. Thus, the substitution of explosive pastes for yellow phosphorus becomes one of great difficulty.

	100 Matches contained	The Fumes contained	Per Cent. present in Fumes.
	Mgms.	Mgms.	
1. { Phosphorus.....	105.6	26.4	23
{ Antimony persulphide.....	132.0	..	..
{ = Antimony.....	79.0	28.0	35
2. { Phosphorus.....	93.4	33.3	37
{ Antimony persulphide.....	117.0	..	..
{ = Antimony.....	79.0	24.0	35
3. { Phosphorus.....	93.4	36.4	39
{ Antimony persulphide.....	78.0	..	..
{ = Antimony.....	47.0	31.0	39
4. { Lead hyposulphite.....	78.0	..	..
{ = Lead.....	50.5	15.7	31
{ Phosphorus.....	39.5	15.5	39
5. { Lead hyposulphite.....	49.0	..	..
{ = Lead.....	64.2	18.8	29
{ Phosphorus.....	25.7	24.5	92
6. { Lead hyposulphite.....	38.0	..	..
{ = Lead.....	251.0	52.3	20
{ Phosphorus.....	25.0	24.6	98
7. { Lead hyposulphite.....	204.0	..	..
{ = Lead.....	132.0	32.0	24

—E. W. W.

PATENTS.

Nitrocellulose, and Compounds thereof, Improvements in Manufacture of. A. Luck, Bexley, and A. H. Durnford, Dartford, Kent. Eng. Pat. 4769, March 6, 1895.

In order to obviate the necessity for gelatinising gun-cotton, the inventors prepare it in one process in a dense, powdery form, so that it can be finished, like ordinary black powder, by rolling or granulating. The original cellulose is dissolved in dilute sulphuric acid, aqueous zinc chloride, zinc chloride and hydrochloric acid, or a mixture of caustic alkali, carbon bisulphide, and water. The solution is agitated, and, by dilution or heating, the cellulose is reprecipitated in gelatinous granules. These are washed and dried with constant agitation, then run through a hopper into the mixed acids, and nitrated as usual.—F. H. L.

Gunpowder, An Improved. E. Dickson, Oak Lake, Manitoba, Canada. Eng. Pat. 19,667, Oct. 19, 1895.

This powder consists of barium nitrate, 40 per cent.; wheat flour, $6\frac{1}{2}$; potassium ferrocyanide, $6\frac{1}{2}$; picric acid, 32; potassium chlorate, $6\frac{1}{2}$; liquid ammonia, 8; and lamp-black, 1 per cent. The ingredients are mixed, granulated, and treated with petroleum in a revolving drum, the spirit having been previously refined by washing with nitric and sulphuric acids and ammonia in succession.—F. H. L.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC CHEMISTRY.—QUALITATIVE.

Arsenic in Presence of Organic Matter, Detection of. Izhevsky and Nikitine. Jour. Russ. Chem. Soc. 27, 254.

The authors find that when organic matter containing arsenic is oxidised by strong sulphuric acid and potassium permanganate, as in Kjeldahl's method of nitrogen estimation, the arsenic is in general not volatilised. The clear residual liquid may be transferred at once to a Marsh apparatus and tested as usual.—J. W.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Lead, Colorimetric Analysis of. M. Lucas. Bull. Soc. Chim. 15, 1896, 39—42.

The method, which may be applied to the determination of minute quantities of lead in copper, brass, waters, &c., in proportions varying between 1 and 20 mgrms. per litre, is based upon the coloration of the slightly alkaline solution caused by the addition of ammonium sulphide. The tendency of the lead sulphide to segregate, which militates against the success of the process, is greatest in those solutions which contain most lead, alkali, or soluble salt,

and is noticeable in dilute solutions in the changed colour of the liquid, even after a quarter of an hour. The colour of the solution also varies under varying conditions; in the presence of alkalis it is brownish, whilst with neutral salts it becomes greyer, and even more grey when carbonates or bicarbonates are present; and the colour density increases with the proportion of these substances. Hence the addition of salts or alkalis is to be avoided, except in very dilute solutions; and in all cases the conditions obtaining in the two liquids to be compared must be as nearly as possible identical.

In the analysis of bronze, by way of example, 1 gm. of the metal is dissolved in nitric acid, filtered to separate tin and antimony, and evaporated to 7 or 8 c.c. after the addition of 1 c.c. of sulphuric acid. After dilution, the liquid is electrolysed for 12 hours, in Riche's apparatus, with the aid of a current of 2 volts and 0.3 ampères; when the precipitation of copper is complete, the liquid is siphoned off and the deposits washed without breaking the electric circuit. The peroxide of lead on the anode is dried and weighed, to ascertain approximately the percentage of lead, which is found by multiplying the weight obtained by 0.865. Meanwhile, solutions of lead nitrate (1 gm. per litre), caustic soda (300 grms. per litre), and sodium nitrate (610 grms. per litre) are prepared, the last two being in equimolecular proportions. The deposit of lead peroxide is dissolved in 1 c.c. of nitric acid containing nitrous acid formed electrolytically from nitric acid; the crucible is washed with boiling water, and the solution and washings are neutralised by standard soda solution, added from a burette, and made up to as many times 50 c.c. in bulk as there were milligrammes of lead found by weighment, 5 drops of ammonium sulphide are then added, and the solution is well mixed. The standard for comparison is mixed with a volume of the sodium nitrate solution equal to that of the caustic soda added to the sample under examination, and the liquid is then made up to the same bulk as the sample, and mixed with 5 drops of ammonium sulphide and shaken. The colours are compared with equal volumes of liquid and in similar glasses. In very dilute solutions, the liquid should be divided into two parts, an approximate determination being made with one portion first, the second portion being then compared with several solutions containing slightly different proportions of lead, varying on either side of the number first found. The sulphide should be added to the second half and the standards simultaneously. Concordant results are obtained.—W. G. M.

Lead, Estimation of, by Electrolysis. A. Kreichgauer.
Zeits. Anorg. Chem. 9, 89.

With a current of 0.1 ampère and 9 to 13 per cent. by volume of nitric acid, a compact precipitate of lead, the author says, is obtained, provided that the vessel in which the electrolysis is carried out is placed on an asbestos card and heated from 50° to 60° over a micro-burner.

For the examination of galena, 0.5 gm. of the sample, broken into small pieces, is spread over the bottom of a large beaker glass (400—500 c.c.). Sufficient concentrated hydrochloric acid is added to cover the galena, and the whole warmed on the water-bath or asbestos card. When the reaction ceases, more acid is added until all the sulphide is converted into chloride. In the event of the ore not containing slaty matter, the end of the reaction can be determined by the disappearance of black particles. On the cessation of the evolution of hydrogen sulphide, the contents of the flask are raised to a higher temperature until the lead chloride is completely dissolved. A solution consisting of 1 part of pure potassium hydroxide and 3 parts of water is then added until the lead is again dissolved. If antimony be present, 1—2 gm. of tartaric acid is added, and the mixture warmed for some minutes from 70° to 100°. A current of carbon dioxide is next led into the cooled alkaline solution for 1½ to 2 hours. (A large excess of alkali is neutralised with hydrochloric acid before the introduction of carbon dioxide.) The precipitate is allowed to settle for a few minutes, filtered, and washed with hot water until free from chlorides. The solution of the precipitate with nitric acid (1 part nitric acid of sp. gr. 1.4 and 7 parts water) is carried out on the filter under cover of a watch-

glass, the filter being afterwards washed with acid of the same strength. The solution of lead nitrate contained in a platinum basin is electrolysed over night at the ordinary temperature, or at 50°—60° during the day.—J. L. B.

Arsenic, Gravimetric Estimation of. C. Friedheim and P. Michaelis. Zeit. Anal. Chem. 34, 1895, 505—515.

In this paper the authors discuss the methods and the errors involved in the gravimetric estimation of arsenic.

Part I. deals with the precipitation and estimation of arsenic by means of magnesia mixture, and a large number of test experiments show that the method is satisfactory. The authors, however, recommend the use of the Gooch crucible and the magnesio pyroarsenate must not be ignited for more than ¼—½ hour in a current of oxygen over a sixplex Bunsen burner (Sechsbrenner), otherwise some of the arsenic will be lost. Attempts to obviate the necessity of drying the precipitate of magnesium ammonium arsenate prior to transferring it to a Rose's crucible for ignition, gave unsatisfactory results on account of the hydrolytic action of the water on evaporation.

In *Part II.* the authors critically examine the methods for the estimation of arsenic as trisulphide. The precipitate invariably contains an excess of sulphur, all of which cannot be removed by extraction with carbon bisulphide. Further experiments show that in the freshly precipitated trisulphide the excess of sulphur does not exist as such but as hydrosulphide. On drying, only a portion of the hydrosulphide is decomposed into arsenic trisulphide and hydrogen sulphide, and, it is only that fraction of the hydrogen sulphide which is oxidised to sulphur by the action of the air that can be extracted by carbon bisulphide. Hence the authors criticise adversely the method recommended by Classen and Ludwig. Mohr's method was also found to be unsatisfactory on account of the formation of a skin on the surface of the liquid during evaporation.

The conversion of arsenic trisulphide or pentasulphide into arsenic acid, and the estimation of this as magnesium pyroarsenate has frequently been recommended. If arsenic sulphide be oxidised in the usual way with nitric acid, a considerable quantity of sulphuric acid is formed in the solution, and the authors find that the magnesium ammonium arsenate precipitated from such a solution, invariably contains sulphuric acid or rather basic magnesium sulphate. This, however, depends to a large extent on the concentration of the solution, and the basic magnesium sulphate may be almost entirely removed by a second precipitation.

Bäckström's method, which depends on the conversion of the arsenic sulphide into arsenic acid by oxidising with nitric acid and then directly weighing the arsenic acid is also unsatisfactory, as it is extremely difficult to maintain the temperature so that the last traces of the sulphuric acid will be driven off, whilst the arsenic acid remains undecomposed.—J. S.

Nickel Estimation [Nickel-Plating Solutions], New Volumetric Process for. E. Lecœur. Bull. Soc. Chim. 13, 1895, 1011—1013.

The process is devised specially for determining the strength of nickel-plating solutions, and depends upon the precipitation and re-solution of nickel by means of potassium cyanide in feebly ammoniacal solutions. A 10 per cent. cyanide solution (corresponding to about 22 or 23 mgms. Ni per c.c.) is used, and is standardised against nickel-ammonium sulphate. The nickel solution should be fairly concentrated, and if it contains no organic acid, sufficient ammonium tartrate should be added before rendering it alkaline to prevent the precipitation of iron and other similar metals by the ammonia. Working at the normal temperature, sufficient ammonia solution (5 per cent. NH₃) is added to render the liquid faintly alkaline; the cyanide is then run in, little by little, with constant shaking, until the further addition of one drop in excess converts the turbid liquid into a clear but yellowish solution. When the liquid contains less than 0.1 gm. of nickel per litre, it should be concentrated by evaporation. 100 c.c. of a 1 per cent. solution of nickel is a suitable quantity to employ. Organic acids in the nickel solution up to the point of saturation in the cold, have no influence upon the determi-

nation, but if they exceed this amount they hinder the precipitation of nickel, unless the solution be slightly warmed. In the presence of sufficient organic acids, 5, or even 10, per cent. of iron should exert no prejudicial influence. Ammoniacal salts and a small proportion of free ammonia (less than 25 grms. per litre) may be present; but a larger proportion of ammonia hinders the precipitation of the nickel. Copper, zinc, and cobalt are interfering metals; and, indeed, the two latter may themselves be determined by this process, which may also inversely be applied to the determination of cyanides.—W. G. M.

Aluminium and its Alloys, Analysis of. H. Moissan.
Comptes. rend. 121, 1895, 851—856.

SEVERAL methods are given for the determination of the various impurities in commercial aluminium as the processes hitherto employed are stated to give untrustworthy results. A preliminary investigation is necessary to test for copper by dissolving about 2 grms. of the aluminium in dilute hydrochloric acid and passing sulphuretted hydrogen through the gently warmed solution when after filtering, copper is detected in the residue. Considering first of all those cases in which copper is absent, a qualitative examination shows the presence of silicon, iron, carbon, nitrogen, titanium, and sulphur.

Silicon.—About 3 grms. of the metal are treated with 10 per cent. hydrochloric acid. A greyish residue remains undissolved containing silicon, iron, aluminium, and carbon. This is fused with a small quantity of sodium carbonate in a platinum crucible and after dissolving in dilute hydrochloric acid the two solutions are mixed and evaporated to dryness on the water-bath and the residue is finally heated to 125° C. when it forms a white pulverulent mass and no longer fumes with ammonia. It is then taken up with warm water containing a very small quantity of hydrochloric acid and after boiling a few minutes, the silica which remains undissolved is filtered off, dried and weighed.

Iron and Aluminium.—The above solution in hydrochloric acid, after separation of the silica, is made up to 500 c.c., and 25 c.c. corresponding to 0.15 grms. of aluminium are neutralised in the cold with ammonia, and the two oxides are precipitated by freshly prepared ammonium sulphide. The mixture is digested for an hour and the precipitate filtered off, washed until free from chloride, dried, calcined, and weighed. The washing is performed by decantation with boiling water and the calcination must be carried out carefully and at a sufficiently high temperature since the alumina obstinately retains traces of water.

Iron.—250 c.c. of the hydrochloric acid filtrate, after separating the silica, are evaporated to 100 c.c., and caustic potash, free from silica, is added, the whole mixture being kept nearly boiling for about 10 minutes. After washing five or six times by decantation with boiling water, the solution is filtered, the precipitate taken up with hydrochloric acid, and the treatment with caustic potash is repeated. A second washing and filtering are then carried out, and the iron is finally precipitated with ammonia. The precipitate is filtered off, washed, calcined, and weighed as sesquioxide of iron. From this and the weight of the two oxides together the percentage of iron and aluminium can be calculated.

Sodium.—The method for the determination of sodium depends upon the fact that aluminium nitrate is decomposed by heat, giving alumina, at a lower temperature than is the case with sodium nitrate. About 5 grms. of aluminium are dissolved in warm nitric acid diluted with an equal volume of water, and the solution, after evaporation on the water-bath, is evaporated to dryness on a sand-bath. The residue is then heated to a point below the fusing point of sodium nitrate until the evolution of nitrous acid vapours ceases. The residue is taken up with boiling water and filtered from the alumina. The collected washings, containing a trace of nitric acid, are evaporated, again taken up with water to get rid of any traces of alumina, and finally evaporated to dryness. This residue is then treated with hydrochloric acid, and, after evaporation, is heated to 300° C. The resulting sodium chloride is determined as silver chloride, and from this is calculated the corresponding weight of sodium.

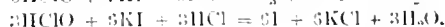
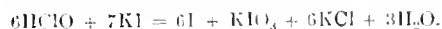
Carbon.—About 2 grms. of the metal are ground up with 10—15 grms. of mercuric chloride and a little water, and, after evaporation, the mixture is heated in a porcelain boat in a current of oxygen. The carbon dioxide evolved is weighed in potash bulbs.

In the case of alloys containing up to 6 per cent. of copper, 0.5 gm. of the metal is dissolved in nitric acid free from chlorine, diluted to 50 c.c., and a current of 0.1 ampère is passed through the solution, kept at 60° C., for 6 hours, or for 24 hours in the cold. The copper which deposits after washing and drying is weighed in the metallic state. The remaining constituents of the alloy, aluminium, silicon, and iron, are determined in the solution freed from copper, by means of sulphuretted hydrogen.

A certain sample of aluminium gave the following results on analysis:—Al = 98.82, Fe = 0.27, Si = 0.15, Cu = 0.35, Na = 0.10, C = 0.41, N = traces, Ti = traces, S = none. For comparison, the analysis of an earlier sample, obtained from another source, is given:—Al = 96.12, Fe = 1.08, Si = 1.94, C = 0.30. If an aluminium could be obtained free from sodium and containing smaller quantities of carbon, its preservation would be a simpler matter. Besides the analysis, the physical properties, elongation, limit of elasticity, and breaking strain of aluminium must also be taken into account.—T. A. L.

Hypochlorous Acid, Action of, on Potassium Iodide.
M. E. Klimenko and B. Klimenko. J. Russ. Chem. Soc. 27, 249—253.

When hypochlorous acid acts on excess of potassium iodide in aqueous solution, one atom of iodine is liberated by each molecule of hypochlorous acid. If hydrochloric acid is present in the solution, twice that amount of iodine is set free. The authors express the actions by means of the following equations:—



—J. W.

Boric Acid, the Methyl Alcohol Process of Separation Simplified. H. Jay and Dupasquier. Monit. Scient. 1895, 709—710.

THE substance under examination, finely powdered and free from organic matter, is acidified with hydrochloric or sulphuric acid and introduced with 25—30 c.c. of methyl alcohol into a small flask provided with a stopper and two tubes. One tube dips below the surface of the liquid and is connected above to an inverted condenser; the other passes to the bottom of a second flask, which is charged with 1—3 c.c. of normal potash, and also connected by an exit tube to the condenser. Both flasks are heated by means of a water-bath. The alcoholic vapour distils directly into the receiver, where the boric acid carried over is fixed by the potash, then passes to the condenser, and from thence back to the retort, &c., &c., in a continuous manner. About 1½ hours are required to volatilise 0.3 gm. of boric acid.

The liquid from the receiver is heated to expel methyl alcohol, slightly acidified with hydrochloric acid, boiled to expel traces of carbonic acid, and *exactly* neutralised with N potash (free from CO₂), using litmus paper as indicator.

Two drops of an aqueous solution (1 per cent.) of "blue C.L.B." are now added and titration continued until the colour "turns." The additional volume of alkali required corresponds to the boric acid present. In presence of fluorides the results come out a trifle high, but still sufficiently accurate. To ensure success, titration must be conducted always under as nearly as possible identical conditions of temperature and volume, and CO₂ and methyl alcohol must be completely absent.—H. T. P.

Mercurous Iodide, Action of Alcohol on. M. François.
Comptes rend. 121, 1895, 888.

See under XXIV., page 141.

ORGANIC CHEMISTRY.—QUALITATIVE.

Hydrogen Peroxide, New Test for. A. Bach. Chem. Zeit. 19, 1895, 37.

The reagents are a solution containing 0.3 grm. potassium bichromate and 0.25 grm. anilin per litre, and a 5 per cent. solution of oxalic acid. In applying the test, 5 c.c. of the solution under examination are mixed with 5 c.c. of the first-named solution and one drop of the second; the presence of hydrogen peroxide is revealed by the occurrence of a violet coloration, the reaction being sufficiently sensitive to detect one part of H_2O_2 in 1,000,000. Neither the oxygenated compounds of nitrogen, nor the foreign bodies occurring in vegetable saps, exert any influence on this reagent.—C. S.

Primary and Secondary Fatty Nitro-Compounds, Reaction for. M. Kononoff. J. Russ. Chem. Soc. 27, 453—455.

Ferric chloride gives a bright red colour with primary and secondary fatty nitro-compounds in benzene solution, especially when shaken up with a single drop of alcoholic potash solution. In this way 5 c.c. of a solution of α -phenyl-nitropropane containing one part in 14,000 of benzene gave a distinct coloration after one hour.—J. W.

Saccharose, Characteristic Reaction for. G. Papasogli. J. de Pharm. et de Chim. [6], 2, 429.

A FEW drops of a 5 per cent. solution of cobalt nitrate added to an aqueous solution of saccharose and followed by a slight excess of 50 per cent. sodium hydroxide, produces a beautiful and fairly persistent deep violet-amethyst colour. Glucose, on the other hand, gives a blue coloration, quickly turning to a pale dirty green; but in mixtures of the two sugars, this reaction is insufficient to mask that due to saccharose, even when the latter is only present in the proportion of 1 to 9. The saccharose reaction being unaffected by the presence of alcohol, caramel, or glycerin, it may be employed for wines decolorised by animal charcoal or sub-acetate of lead.

The transient blue coloration due to lactose does not prevent the development of the characteristic violet of saccharose, and the method is thus suitable for testing for the latter in condensed milk. The same applies to mixtures of saccharose and honey. The colour produced by this latter is blue, changing almost instantly to pale green. Gum arabic, however, gives a permanent blue, masking the saccharose reaction, wherefore this substance when present must be precipitated by sub-acetate of lead before the test is applied; and dextrin—also giving a blue coloration—requires to be thrown down by baryta and ammoniacal lead acetate.—C. S.

Absinthe, Detection of Adulteration in. G. Nivière and A. Hubert. Moit. Scient. 1895, 566.

THREE varieties of absinthe are produced commercially, containing respectively 72, 60, and 50 per cent. of alcohol. Of these the weaker kinds, especially that at 50%, are more particularly subject to adulteration. In the manufacture of inferior absinthe, the plant (*artemisia pontica*) to which the characteristic colour of the genuine article is due, is in great part replaced by *veronica* and *nettle* (ortie), the colour of the product, which is somewhat too yellow, being corrected by the addition of blue, or a mixture of blue and yellow dyes. The property of yielding a turbid mixture with water, possessed by genuine absinthe, is imitated by addition of gum benzoïn, guaiacum, rosin, &c. The following methods serve to detect such additions:—

Colouring Matters.—20 c.c. of absinthe are evaporated on a water-bath, and the residue repeatedly treated with small volumes of chloroform until the extracts pass off colourless. The residue is heated to expel chloroform, and dissolved in water. The resulting solution should be colourless, or nearly so. A decided olive-green tint indicates the presence of artificial colouring matters. Light blue (bleu lumière), if present, may be extracted from this solution (previously saturated with salt) by amy! alcohol.

Matters precipitated by Water.—100 c.c. of sample are diluted with 300 c.c. of water and distilled until the volatile

oils, &c. are completely expelled. The residue is evaporated to a syrup and extracted by chloroform. The weight of extract obtained by evaporation of the chloroform solution should not exceed 0.5 grm. per litre. If greater, the sample may be tested for resins by Halphen's process.

—H. T. P.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Cellulose, Quantitative Estimation of. G. Lange. Zeits. angew. Chem. 1895, 561.

A RESTATEMENT of the method published by the author in 1889 (Zeits. Physiol. Chem. 14, 283), and based upon the observation of Hoppe-Seyler (*ibid.* 1384) that "cellulose is not attacked by heating with the strongest alkalis at 200°."

The following are the conditions now recommended for the process:—The heating (Schmelzen) is carried out in an unglazed porcelain crucible; 5 to 10 grms. of the substance are mixed in the crucible with three parts of sodium hydrate and an equal weight of water. The crucible is gradually heated in an oil-bath to 170°—180°, and kept at that temperature for about one hour. After cooling, the contents are treated with water, and the alkaline solution is acidified. It is then again rendered alkaline, the alkali dissolving "non-cellulose" compounds precipitated together with the cellulose. After purification with water, alcohol, and ether, the cellulose is dried and weighed. It is then burned and the ash constituents determined. The difference of weight represents the cellulose. The process is stated to give concordant results, and in substantial agreement with those of other "standard" methods, *e.g.*, the Wende method and those of Holdelheiss and Hoffmeister.

The author proposes to define as cellulose "those constituents of plant structure which resist the action of alkaline hydrates at 180°—200°"—C. F. C.

Mineral Lubricating Oils, Uniform Methods of Testing. D. Hobie. Chem. Rev. Fett u. Harz Ind. 1896, 1—5, 17—22.

THE chief points in respect of which the testing of mineral lubricating oils is, in so far as practical considerations are in question, necessary, are: viscosity, resistance to cold, volatility, specific gravity, presence of suspended matter, free acids, extraneous oils, dissolved resin, soap, asphalt, paraffin, &c.; and in the case of cylinder oils, action on cast iron under the influence of high pressure (6 to 12 atmos.) steam.

For the determination of viscosity the Engler instrument has proved itself efficient under normal circumstances, but the peculiar influence exerted on the thick heavy oils by exposure to heat (see Mitt. k. k. Versuchs. 1895, Ergänzungsheft 1) necessitates occasional modification of the ordinary method. The simplest is to allow a margin of ± 7 to 8 per cent. in the viscosity at 20° C. of such oils as contain solid particles in suspension, or else to make parallel tests after exposing the oil for 10 minutes to 100° C. and -15° C. respectively. The method of shortening the time of the experiment and of testing cylinder oils at high temperatures has been already discussed (see next abstract but one, p. 138).

The "cold test" may either be directed to ascertaining the degree of congelation an oil will assume at a certain temperature, or the temperature at which solidification commences. In the latter case a preliminary series of tests at different temperatures, with a time exposure of 1 hour, will have to be made with the oil in test glasses, and repeated to obtain the correct result. In the other instance the U-tube method described by Martens (Mitt. aus d. k. k. Versuchsanstalt. 1890, 53; this Journal, 1893, 772), with a constant pressure of a 50-mm. column of water for 1 minute, should be adopted.

The fractional distillation of the heavy oils for the purpose of determining their content of volatile constituents being attended with difficulty, it is usual to employ the flashing-point test to obtain an insight into this matter; but comparative estimation of volatility is desirable, and it may be that the object will be attained by proceeding on

the basis of the author's method of evaporating the oil under favourable conditions at various temperatures from 100° C. upwards.

For testing the flashing point, the Pensky close cup, and for specific gravity the Muencke areometer, are useful. A more exact method for specific gravity, by the pycnometer, and the process for determining the coefficient of expansion, are described in the Mitt. aus d. k. k. Versuchsanstalt, 1893, 54 (this Journal, 1893, 919).

The chemical examination and friction testing will be dealt with in a subsequent paper.—C. S.

Petroleum Industry. Importance of Uniform Methods of Testing. L. Gans. Chem. Rev. Fett u. Harz Ind. 1895, [28], 2—3.

Referring to Zoloziecki's proposition (this Journal, 1895, 1038), the author communicates the methods of testing burning and lubricating oils pursued at the Trieste Mineral Oil Refinery. For the first named, Engler's distillation test is used, the results being plotted as curves. Objection is taken to the various modifications of glass stills, on account of the height of the dephlegmators, which is mostly greater than is conducive to efficiency. The density is determined by Kappeller's thermo-areometer at a normal temperature of 15° C. and the formula $d = d' + \frac{2}{3} (t - t')$, in which $t = 15^\circ \text{C.}$, is employed for correction. Colour and flashing point are tested by the Stammer and Abel-Pensky instruments respectively. The ash determination is only resorted to when the burning tests—carried out with 400 c.c. of oil and a Dymar burner with a 23-mm. wick, the height of the flame at the out-let being regulated to 2.5 cm., and the variations noted by the aid of the kathetometer—reveal the presence of salts (chiefly lime and magnesia compounds) calculated to retard the ascent of the oil in the wick.

The lubricating-oil tests are mainly confined to viscosity, flashing point, reaction, and "cold test"; the latter performed in a very primitive manner. Engler's viscosimeter and Treumann's flash-tester are used.

The "sulphuric acid" and "resin" tests are seldom employed. The author considers that no satisfactory method exists for determining the amount of paraffin in these oils, and for mixed lubricants refers to the works of Benedikt and Kunkler for assistance to the operator in deciding the course to be adopted in special cases.—C. S.

Lubricating Oil Testing, Recent Experiences in. Holde. Mitt. aus d. Konigl. techn. Versuchsanstalt, zu Berlin, 13, (6), 253—287.

The Congelation of Dark Mineral Oils.—A number of experiments carried out at the Charlottenburg Institution confirm previous observations made on the increased liability to congelation exhibited in some oils after being heated to various temperatures between 30° and 100° C., a circumstance attributed to the re-separation in a very finely divided condition, on cooling, of the solid particles of asphaltic, pitchy, or paraffin-like matter originally in suspension in the oil; perhaps also to molecular modifications of these bodies at the higher temperatures. In some instances a contrary effect was produced, which is thought to be probably due to the more gradual re-precipitation of added paraffin. The increased liability to solidify is in some cases obviated by filtering off the solid matter in suspension, and a similar influence appears to be exerted by mechanical stirring. To ensure concordance in the results of testing the resistance to cold of these oils by the U-tube method, and at the same time adhere as closely as possible to the conditions to which the oil is exposed in practical use, it is recommended that samples should be taken from different depths in the storage cask, and that one of them should be first heated for a quarter of an hour to 48°—53° C. This procedure will show whether the oil really conforms to the standard of "cold test" it is claimed to attain.

The effect of the presence of water on the congealing point of the oil is the reverse of what might be supposed, retarding solidification to an appreciable extent. Variations in the molecular structure of the oil, or of the molecular tension between water and oil, may be regarded as the cause

of this peculiarity. These results differ from those detailed by Albrecht (Glaser's Annalen, 1893) as having been obtained in tests instituted in some of the oil refineries, so that it is desirable the subject should be further examined.

Improvements in the Construction and Manipulation of the Pensky Flashing-Point Tester for High Boiling Oils.—To remedy a defect, sometimes noticeable in this instrument, viz., the extinction of the test flame before the occurrence of a flash, the addition of a small fixed gas or oil flame near the test flame is recommended. With reference to the proposed employment of an automatic stirrer, it is considered that the complication of mechanism required would be out of proportion to the convenience afforded to the operator.

Simplification of Viscometric Tests with the Engler Instrument.—In order to shorten the time occupied in testing slow-running oils, the operation may be performed with 50 or 100 c.c. of oil instead of 200 c.c., the results, when multiplied by 5 or 2.35 respectively, being concordant with those obtained in the ordinary way.

Viscometric Tests at High Temperatures.—The ordinary form of Engler's tester gives rise to certain inconveniences, when used at high temperatures, in respect of the difficulty of quickly bringing the oil up to and maintaining it steady at the required degree; the escape of oil vapour from the bath; and the liability of fusing the solder generally employed. The former may be overcome by covering the oil-bath with a lid, affixing a dephlegmator, and leaving only a small vent, the size of which will allow the pressure, and therefore temperature, of the steam-bath to be regulated. In this manner, 180° C. (oil temperature) may be reached by the use of aniline, and 200° C. by means of naphthalin. The other defect indicated may be surmounted by using hard solder.

Concerning the viscosity of the cylinder oils, those tested at Charlottenburg appear as a rule to exhibit a less rapid decrease in viscosity as the temperature rises, and although they may vary very much at 50°, they all pretty well approximate at 180° C. to $1\frac{1}{2}$ — $1\frac{1}{3}$ times the viscosity of water. The average flashing-point of the Russian oils was about 220° C., their specific gravity ranging between 0.906 and 0.929 at 20° C., the American oils flashing in the mean at 265° C. and being of 0.883—0.893 sp. gr.

Rape oil, tested for the sake of comparison, on account of its employment to lessen the volatility and increase viscosity at high temperatures, proved itself at 180° inferior in this latter particular to the generality of mineral cylinder oils.—C. S.

Wool-Fat, Contributions to the Analysis of. W. Herbig. Dingler's polyt. J. 297, [6], 135—141 and [7], 160—161.

AFTER summarising various methods employed for the determination of the unsaponifiable matter in fats, and pointing out what he considers to be defects in them, the author proposes the following process:—From 1 to 2.5 grams of the wool-fat are boiled with semi-normal alcoholic potash, as in the ordinary method of determining the saponification equivalent, the excess of alkali neutralised with acid, the whole washed into a beaker with boiling alcohol, the alcohol evaporated, and the fatty acids precipitated with calcium chloride at 70°—75° C. The precipitate is filtered off, washed with dilute alcohol (1 : 20), and dried on the filter *in vacuo*. When dry, it is extracted for 6 hours in a Soxhlet with freshly distilled acetone, in which solvent the author found that the calcium salts of the fatty acids were practically insoluble. After this, the acetone is evaporated, the extract washed into a platinum basin with ether, and the ether evaporated. The residue, which consists of the unsaponifiable matter and that portion of the wax which is not saponified by the ordinary method of saponification, is then dried at 105° C., and weighed.

The results obtained in this way varied from 48.31 to 48.5 per cent. in a sample of South American wool-fat. In New Zealand fat they were 46.17 to 46.44 per cent., and in a Russian sample 37.07 to 37.29 per cent. In each case five determinations were made.

The chief points to be observed are the absolute purity of the acetone (boiling-point 55.5°—56.5°), and the tempera-

ture at which the calcium salts of the fatty acids are precipitated.

In estimating the free and combined alcohols, the author saponifies under pressure (Cf. Lewkowitch, this Journal, 192, 134; and Herbig, this Journal, 1894, 1068), which effects complete saponification of wool fat, precipitates the fatty acids as calcium salts, and extracts them with acetone as described above. The results obtained were:—New Zealand wool fat, 43·66 to 43·94; Buenos Ayres fat, 43·15 to 43·65; Russian 38·72 to 39·10 per cent.

A certain relation was found to exist between the saponification number and the amount of unsaponifiable matter, and by calculating from the difference of the sum of the molecular weights of the unsaponifiable bodies in the ordinary saponification, and those left after the pressure saponification, figures were obtained which agreed well with the differences found by the gravimetric determinations. The Russian fat, however, was abnormal in this respect. With regard to the composition of wool-fat, the author came to the conclusion that, on the assumption that cholesterol constituted the principal part of the free alcohols, the amount of the cholesterol ester of cerotic acid present in American and New Zealand fat was 9·56 and 5·03 per cent. respectively. Other acids of high molecular weight, like cerotic acid, if present at all, were so only in very small quantities. The greater part of the fatty acids present were in the form of readily saponifiable esters. There were small amounts of lower fatty acids down to stearic and palmitic acids. The percentages of free alcohols in the unsaponifiable matter were 37·89 and 38·85 in the case of the American fat, and 41·93 and 41·27 in that of the New Zealand fat.

In order to effect a separation of the fatty acids, their ethyl esters were fractionally distilled *in vacuo*, the fractions saponified, and the fatty acids recovered and purified by crystallisation.—C. A. M.

Soaps, Analysis of. E. Spacht. Zeits. angew. Chem. 1896, 5.

FOR the determination of all foreign matter, the author recommends extraction with alcohol in a Soxhlet apparatus, the soap being contained in a vessel devised for the investigation of butters, and previously described (*ibid.*, 1893, 513). The method economises time, and leaves the insoluble residue in a condition easily available for further separation into its constituents.

Smaller variations of the methods ordinarily practised are proposed for the estimation of the soap constituents proper, the most noteworthy point being the employment of dilute alcohol (50 per cent.) as solvent in the first instance.

The author emphasises the necessity of finally dehydrating the separated fat acids for weighing, in an atmosphere of an indifferent gas.—C. F. C.

Tannin [Quantitative Estimation]. L. Fajans. Zeits. f. angew. Chem. 1895, 16, 471—472.

THE author has investigated the conversion of tannin into oxalic acid by oxidation with nitric acid under various conditions, the object being to ascertain whether a quantitative method of estimating tannin could be devised by studying the different phases of the oxidation analytically. Although he has not yet succeeded in determining the exact conditions needful for the acquisition of quantitative results, his observations point to the possibility of establishing a quantitative method.

In studying the behaviour of tannin towards other oxidising agents, the following observations were made:—On heating tannin in an aqueous solution treated with a small quantity of potassium chlorate, and adding hydrochloric acid gradually to the mixture, decoloration takes place, oxalic acid being formed. Gallie acid, when treated in a similar manner, yields isotrichloro-glyceric acid; nitric acid, however, yields oxalic acid. When a mixture of tannin and potassium ferrieyanide in aqueous solution is heated on a water-bath, and rendered alkaline by the slow addition of potash, oxalic acid is produced. A similar result is obtained on treating tannin with sodium peroxide.—D. B.

Glucose and Invert Sugar, Estimation of, in Solutions containing Lead. Zamaron. Bull. Ass. Chim. 1895, 13, 346.

BEFORE determining the reducing power of sugar solutions containing lead, it is necessary to remove the excess of lead. The author finds ammonium oxalate suitable for this purpose, the excess of lead salt being at once precipitated as insoluble oxalate. Special experiments show that small quantities of ammonia do not affect the accuracy of the results.—J. L. B.

Alcohols and Volatile Acids, Estimation of. E. Duclaux. Ann. de l'Inst. Pasteur, 1895.

THE method is based on the fact that the superficial tension of mixtures of alcohol and water decreases with the alcoholic strength, the result being that the number of drops furnished by a constant volume of liquid passing through the same orifice increases with the proportion of alcohol present. A modification of the author's drop counter, standardised to allow 5 c.c. of water to escape in 100 drops, at 15° C., was employed, the construction being such that the drops were of constant weight. Among the precautions necessary to ensure regularity are keeping the orifice of the delivery tube perfectly free from fatty bodies, and the removal of everything but alcohol from the solution—the latter effected by distillation from a neutral or alkaline liquid to keep back the aldehydes often formed during fermentation.

As a rule, the alcohols occur singly in fermented liquids, the association of two or more, except in very slight proportion, being rare. In this simplest case, the number of drops furnished by the counter, when read in conjunction with the density of the liquid, indicates the percentage of the particular alcohol present, and tables to enable this to be seen at once are given. For example—

	Density.		Number of Drops.
	1 per Cent. of Alcohol.	10 per Cent. of Alcohol.	
Methyl alcohol.....	998	987	104·0 127
Ethyl ".....	998	987	107·0 144
Propyl ".....	998	987	112·0 172
Butyl ".....	998	987	135·0 286
Amyl ".....	998	987	171·5 291

A table of corrections for temperature to a standard of 15° C. is also provided, as well as examples verifying the accuracy of the method. It is furthermore pointed out, that in distilling ordinary alcohol in the usual manner, down to one-third of the original volume of the liquid, appreciable quantities of the alcohol remain in the still-head and adherent to the walls of the condenser; pure butyl alcohol distils more quickly than ordinary alcohol of equal strength; amyl alcohol in aqueous solution also distils more rapidly than ordinary alcohol, but the distillation should be carried very far to ensure that all has come over into the receiver.

When a mixture of two alcohols is in question, their proportion has to be ascertained. If one of them is present in only comparatively small amount, the number of drops obtained will not entirely agree with the density of any of the pure alcohols, but will approximate thereto. Where the two alcohols are present in comparable proportions, some manipulation is necessary, the liquid being diluted with water or distilled until of a certain density or corresponding to a whole degree on the alcoholometer. It is then necessary to prepare a table of the drops furnished by varying proportions of mixed alcohols of the given density. The number of drops will, of course, depend on the instrument used for counting.

It is found that very small quantities of amyl alcohol suffice to considerably increase the number of drops, although without effect on the alcoholometric degree.

In the case (very rare) of mixtures containing three alcohols, the method is not suitable.—C. S.

Fine Spirit, Quantitative Estimation of Small Amounts of Fusel Oil in, by Rose's Method. M. Glasenapp. Zeits. f. angew. Chem. 1895, 657—663.

In a previous communication (this Journal 1894 982), the author has described the precautions which he has found necessary to observe in order to obtain accurate results when employing this method. He now recommends that the reaction tubes be immersed in a water-bath which is kept at a constant temperature, and he has had tubes made which will sink in the bath when they are being used with the proper quantity of liquid, and at the same time remain upright, in order that the amount of chloroform may be read off without disturbing them.

An important point is the cleansing of the tubes; a mixture of equal volumes of ordinary and fuming sulphuric acid is recommended.—A. L. S.

Wine, Estimation of Tannin in. E. Manceau. Bull. de Soc. Chim. 13, 1098—1101.

Four methods for estimating tannin in wine have been employed:—

- (1.) By a standard solution of gelatin.
- (2.) By a solution of ferric chloride.
- (3.) By a solution of acetate of zinc.
- (4.) Girard's method by means of gut strings.

The first three methods always give lower results than the fourth. The figures yielded by the former are moreover dependent on the dilution, on the temperature, and on the proportion of alcohol, acids, and salts. Girard's method is the only accurate one, but unfortunately it is slow, and is valueless for estimating tannin in champagnes which contain on an average 20 mgrms. of tannin per litre. For these wines the author has employed a combination of gut strings and permanganate of potash. About 100 c.c. of wine are placed in a flask with about 1 grm. of gut, in a week the whole of the tannin will have been removed from the wine. A solution of permanganate of potassium is prepared so that 1 c.c. corresponds to 0.2 grm. tannin, and a solution of indigo-sulphuric acid containing 1 grm. indigo per litre.

Two white glass cylinders are taken and into each is poured 1500 c.c. of water and 10 c.c. of indigo solution. To one is added 25 c.c. of the wine which has been freed from tannin by gut, and to the other the same quantity of the untreated wine. Permanganate solution is then added to one until a clear yellow colour is produced and then to the second until the same tint is produced in that. The difference in the number of c.c. of permanganate used will indicate the amount of tannin in the wine. The gut employed is that sold for violins, not oiled, and washed with alcohol, acidulated water, and distilled water.—A. L. S.

Pentosans or Pentoses, Occurrence of, in Beer. P. Mohr. Woch. für Brauerei. 12, 1895, 769—770.

EMPLOYING Tollen's and Flint's method of conversion into furfural and then into its hydrazone, the author finds that Lager beers contain from 4.22—4.51 per cent. of pentoses; Pilsener, 5.93; and Berlin white beer 5.01, calculated on the dry extract. (See also Morris, this Journal, 1895, 14, 690).—J. G. W.

Flour. S. Cerkez. Zeits. f. angew. Chem. 1895, 663—665.

THE author proposes to classify flour according to the amount of fat it contains; the less valuable flours containing the most fat, which is also proportional to the amount of ash. The latter has been used for the same purpose, but the author considers this as being unfair to those millers who use stones for grinding.

In order to estimate the fat expeditiously he adds 5 grms. of flour to 25 c.c. of ether and shakes well, the flour is allowed to subside and 5 c.c. of the supernatant liquid is taken with a pipette and allowed to evaporate in a dish, and the fat which remains is weighed. This number multiplied by 100 gives the percentage of fat.—A. L. S.

Gelatin, Estimation of, in Meat Extracts and Commercial Peptones. A. Stulzer. Zeits. Anal. Chem. 34, 1895, 568—570.

COMPARE this Journal, 1895, 897. The author gives a few additional details and recommends the use of sand instead

of asbestos which was previously employed. The nitrogen in the form of coagulable albumin of section II. of his former paper requires to be subtracted from the amount of albumose nitrogen as the former substance is insoluble in alcohol.—J. S.

Organic Matter, Estimation of, in Water by Potassium Permanganate. V. Skupevsky. J. Russ. Chem. Soc. 27, 500—503.

THE author finds that a natural water always reduces more potassium permanganate when oxidised first in alkaline and then in acid solution, than when oxidised in acid solution from the beginning. He shows that this behaviour is not due to the presence of acid or alkalis such, for these alone or together have no reducing action on the permanganate under the conditions employed. To estimate the total reducing power of the organic matter in water he recommends the following process:—

100 cc. of the water to be examined is placed in an Erlenmeyer flask and to it are added 2 c.c. of a soda solution (2 parts NaHO in 1 part H₂O) and excess (40—50 c.c.) of a standard solution of potassium permanganate (0.33 grm. KMnO₄ per litre). The mixture is boiled for 20 minutes, and then 6 c.c. of sulphuric acid (1 vol. to 3 vols. water) are added, the boiling being continued for 15—20 minutes longer. When the solution has cooled to 50° it is treated with excess of standard oxalic acid (1.26 grm. per litre), and the excess titrated with standard permanganate. The solution is again boiled for 20 minutes with more permanganate, and the quantity remaining estimated as before. If the two estimations agree, the oxidation is complete; if not, the process is repeated.

Should the water investigated be very rich in organic matter, a smaller measured quantity is taken and the volume made up to 100 c.c. with distilled water.—J. W.

Gum contained in Wine. G. Nivière and A. Hubert. Comptes rend. 121, 350.

See under XVII., page 128.

PATENT.

Butter and other Fats, Process and Apparatus for Testing. Emil Jahr, Berlin. Eng. Pat. 20,051, Oct. 24, 1895.

THIS process depends on the property of butter to form an emulsion with water or aqueous solutions, at a temperature of over 31° C., while other fats do not form emulsions under similar conditions. The butter-fat separates from the water after an interval depending on the temperature of the fluids; mixtures of pure butter with other fats separate out at a speed inversely proportional to the percentage of butter present. The test is rendered more distinctive by the addition of bleaching or colouring material, the different fats being bleached or coloured differently according to the length of time they remain mixed up with the water. The apparatus consists of a spoon-shaped instrument in which a given quantity of the fat is measured off, a vessel in which it is melted, a test glass in which the melted fat is mixed with double the quantity of warm water (preferably at 45° C.), and an air- or water-bath (heated preferably to 45° C.), in which the test glass is placed. In the special form of air-bath illustrated by the inventor, the temperature is kept constant by means of adjustable asbestos plates placed between the flame of a spirit lamp and the bath.

—C. A. M.

XXIV.—SCIENTIFIC AND TECHNICAL NOTES.

An Alkali Centenary. Chem. and Druggist, Feb. 22, 1896, 291.

THIS is the centenary year of the establishment of the Leblanc alkali trade on the Tyne. The first works were started at Walker, in 1796, by a partnership consisting of Lords Dundas and Dundonald, and Messrs. Anbone, John Surtees, John Losh, and Wm. Losh. The last-named, who had lived for some time in Paris, and had probably met

Nicholas Leblanc there, was the managing spirit of the concern. The salt duty of 36*l.* per ton was avoided by concentrating together the brine and sulphuric acid, and thereby obtaining sulphate of soda. John Losh, being a good business man, understood the value of advertising, as may be seen from the following announcement, published by the firm, shortly after its formation, in the Newcastle Chronicle:—

Alkaline Salts,

Such as crystals of mineral alkali or of soda, dried crystals of ditto, barilla salts, crystals of vegetable alkali or of potash, are now prepared in large quantities at the works established near Newcastle-upon-Tyne, from whence yarn bleachers, bleachers, soap makers, plate, flint, and crown glass manufacturers may be supplied with the article which suits their respective purposes.

Not until the repeal of the heavy salt duties, however, could the manufacture attain large dimensions. In 1799, the production of soda crystals on the Tyne was about 10 tons; in 1825, over 400 tons; in 1830, over 3,000 tons; in 1840, 13,000 tons; in 1862, 51,000 tons; in 1873, 97,000 tons; and in 1882, it was estimated at 104,000 tons. That year marked the maximum, and the output has since declined considerably, the quantity of salt decomposed having fallen from 188,000 tons in 1882 to 90,983 tons in 1893. The four alkali works on the Tyne in 1830 had risen to 24 in 1873; and these have now very rapidly decreased until five only are in operation on the river now. When the Leblanc alkali trade had attained its greatest growth, there arose in another district the newer form of manufacture—that by the ammonia process—at first on a small scale, but growing with rapidity, so that whilst in 1892, out of 824,000 tons of salt decomposed in the two processes, 519,000 tons were used in the Leblanc industry, in 1894 the total salt decomposed was 795,000 tons, of which the Leblanc process took 134,000 tons. The efforts that have been made to meet the competition have been heroic and prolonged; the adoption of the Weldon “manganese-recovery process” greatly reduced the use of that article; the hand-furnaces were largely replaced by mechanical furnaces; the manufacture of alkali as the chief product of the works was made subsidiary to that of bleaching-powder; caustic-soda manufacture was begun, and in increasing quantity has continued; the salt deposits of South Durham have taken the place of the Cheshire supply; and, greatest change of all, the recovery of sulphur from tank waste has given a new product, pure and valuable, from what was waste in one of its worst forms. Early in this century soda crystals were sold at 60*l.* per ton; they are to-day 2*l.* 2*s.* 6*d.* In 1838, bleaching-powder was sold at about 28*l.* per ton; the medium price to-day is 7*l.* In the cost, too, there have been vast reductions, for, without looking back to the days of high duties, the cost of salt to the chemical-maker on Tyneside is about one-half of that calculated as the cost in 1862.

Carbonado [a Variety of Black Diamond], A Specimen of, from Brazil. H. Moissan. *Comptes rend.* 121, 449–450.

This substance is much used for boring machinery, and when of good quality it is worth about 2*l.* 12*s.* per carat. The present specimen of “Carbonado” was found on July 15th, 1895, in a diamond-bearing district of the province of Bahia. It weighs 630 grms., or about 3,073 carats, and is the largest piece which has been found, 1,700 carats being the weight of the largest recorded find. It is of a good black colour, and its surface is in places smooth, in others pimply. These parts, under a lens, look as though gas had escaped from them whilst in a pasty condition; they are similar to the surface of the microscopic grains of carbon which the author has obtained by the compression, through sudden cooling, of melted silver or iron. The carbon is porous, having lost 19 grms., or 94 carats, in weight during two months since it was exhumed.—J. T. D.

Glucinum, Carbide of. P. Lebeau. *Comptes rend.* 1895, 121, 496–499.

PURE crystallised carbide of glucinum, prepared in the electric furnace, decomposes water in the cold with

evolution of methane, and in all its other properties so nearly resembles the carbide of aluminium (C_3Al_4), that the author attributes to it the formula C_3Gl_4 . In this case the atomic weight of glucinum would be about 14, and glucina must be a sesquioxide, with the formula Gl_2O_3 .—W. G. M.

Glucinum, Carbide of. L. Henry. *Comptes rend.* 1895, 121, 600–601.

The author disputes Lebeau's contention that glucinum is trivalent, and refers to the work of Combes, who showed that the glucinum derivative of acetyl-acetone had the formula $(C_3H_7O_2)_2Gl$, as compared with $(C_3H_7O_2)_3Al$, which was the corresponding aluminium compound; the glucinum carbide also was CGl_2 . The atomic weight and valency of glucinum should therefore be left undisturbed.

—W. G. M.

Manganese Silicide Vigouroux. *Comptes rend.* 121, 771–773.

MANGANESE silicide, of the composition $SiMn_2$, is formed at the temperature of the electric furnace by the direct action of silicon on manganese, or of silicon on manganese oxide, and also by heating in a current of hydrogen a mixture of silica, manganese dioxide, and charcoal. It is a metallic body, very hard and very brittle, unalterable in the air, and easily attacked by dilute acids.—J. G. W.

Nitrogen, Absorption of, by Lithium, in the Cold. H. Deslandres. *Comptes rend.* 121, 1895, 885–887.

THE author has observed that lithium which has been heated in a vacuum at a temperature below the softening point of glass will absorb nitrogen slowly in the cold, as evidenced by the total disappearance of the characteristic bands in the nitrogen spectrum. The bright surface of freshly-cut lithium, like sodium, rapidly tarnishes in the air, becoming covered with a blackish layer, preventing the absorption of nitrogen, whilst the brighter the surface the more rapid the absorption. It is noteworthy that lithium is at present the only substance known which will absorb nitrogen in the cold.—T. A. L.

Glycerose, New Method for Preparation of. Fonges-Diacon. *Bull. Soc. Chim.* 1895, 13, (16–17), 862–863.

THE author prepares this aldehyde by heating anhydrous glycerin and mercuric chloride in a retort on an oil-bath. At 160° a vigorous reaction takes place, calomel is precipitated in abundance, and a liquid distils over having strongly reducing properties. When the distillation has been continued for seven to eight hours, a yellow syrupy liquid, smelling strongly of acrolein, has passed over, which represents about half the weight of the glycerin employed. This liquid, freed from acrolein, is neutralised with sodium carbonate, and treated with benzene to remove oily chlorides. A clear yellow aqueous liquid results which is inactive to polarised light, gives metallic mirrors, and reduces Fehling's solution strongly in the cold. It forms a crystalline osazone, insoluble in cold water, slightly soluble in hot water, and readily soluble in ether, benzene, alcohol, and ethylic acetate. It melts at 131°, which is the number recorded by Fischer for phenylglycerosazone.—J. L. B.

Mercurous Iodide, Action of Alcohol on. M. François. *Comptes rend.* 121, 1895, 888–891.

THE author's conclusions are that boiling alcohol decomposes mercurous iodide, but the decomposition ceases when 100 grms. of the liquid contain in round numbers 0.22 gm. of mercuric iodide in solution. This reaction is reversible, and the inverse reaction stops at the same point. It follows from the facts, that 1 kilo. of alcohol boiling at 95° C. decomposes about 3.15 grms. of mercurous iodide; further, that the alcohol employed in washing mercurous iodide enriches the latter in mercury, and itself contains mercuric iodide; and also that the quantitative separation of mercurous and mercuric iodides by means of alcohol is incomplete.—T. A. L.

A Vanadium-Platinum-bearing Coal. Eng. and Mining J. Jan. 25, 1896, 81.

WE learn from a reliable correspondent that a firm of merchants in London are in possession of some deposits of coal containing vanadium.

The most remarkable point about the coal is that besides vanadium it contains considerable quantities of the platinum group of metals. Altogether some 10 tons of the coal have been shipped to London, and the whole sampled and analysed. Through the coal there are several very thin bands of earthy matter consisting of sand, limestone, &c., apparently an alluvial deposit, and these bands contain varying amounts of vanadium and platinum metals. A ton of this coal has been burnt and the remaining ash was 15 per cent. of the total weight. This ash gave the following analysis:—Metallic vanadium, 2.9 per cent.; platinum metals (chiefly platinum), 0.23 per cent.; oxygen combined with metals, 5.10 per cent.; sand, carbonate of lime, and other earthy matters, 91.77 per cent.; total, 100.

The metallic contents of one ton of coal are therefore 141 oz. of vanadium and 11.24 oz. of platinum metals.

Table showing Value of Ash.

Per Ton of Ash.	Per Cent.	Troy Oz.	Value.
		Per Ton.	Dols.
Vanadium	19.37	958.8	10,000
Platinum	1.53	75.08	1,000

Counting the value of vanadium at 10 dols. to 15 dols. per oz. troy, and 13.50 dols. to 14 dols. per oz. troy for platinum.

New Books.

PETROLEUM. A Treatise on the Geographical Distribution and Geographical Occurrences of Petroleum and Natural Gas; the Physical and Chemical Properties, Production, and Refining of Petroleum and Ozokerite; the Characters and Uses, Testing, Transport, and Storage of Petroleum Products; and the Legislative Enactments relating thereto; together with a description of the Shale Oil and Allied Industries. By ROBERTON REDWOOD, F.R.S.E., Assoc. Inst. C.E., &c., Assisted by Geo. T. Holloway and other Contributors. In two Volumes, with numerous Maps, Plates, and Illustrations in the Text. Chas. Griffin and Co., Ltd., Exeter Street, Strand, 1896. Price 2l. 5s.

This work fills two volumes of large 8vo size, and is dedicated by the author to the memory of his father, the late Prof. T. Redwood. It contains as frontispiece to Vol. I. a Map of the World, showing the petroleum deposits as so far ascertained; Preface, in which full acknowledgment is rendered, both for the help of friends and of the aid of various periodicals and journals of applied chemistry. Next follows the Table of Contents, a List of Plates, one of which consists of the Map already mentioned, whilst another, that of Petroleum-Vapour Flame-Caps, forms the frontispiece to Vol. II. Besides these, there are distributed through the work 14 other plates, including maps showing the distribution of petroleum in Europe, the Bradford Oil-field, and the Caucasian Oilfields. Vol. I. ends on page 403, and contains 136 illustrative wood engravings; whilst Vol. II., commencing on page 404, is continued to page 873, when the work closes with a very complete alphabetical index. There are three Appendices, A, B, and C. A being a Statistical Report; B, one of Tank Steamers and Tank Sailing Vessels employed in the Export of Petroleum; and C, one of Import Duties levied on Petroleum. Vol. II. contains some 191 illustrative wood engravings. The various sections of the work are devoted to the following leading subjects:—I. General Historical Account of the Petroleum Industry. II. The Geological and Geographical Distribution of Petroleum and Natural Gas. III. The Chemical and Physical Properties of Petroleum and Natural Gas. IV. The Origin of Petroleum and Natural Gas. V. The Production of Petroleum, Natural Gas, and Ozokerite. VI. The Refining of Petroleum. VII. The Shale Oil and Allied Industries. VIII. The Transport, Storage, and Distribution of Petroleum. IX. The Testing

of Crude Petroleum, Petroleum and Shale Oil Products, Ozokerite and Asphalt. X. The Uses of Petroleum and its Products. XI. Statutory, Municipal, and other Regulations relating to the Testing, Storage, Transport, and Use of Petroleum and its Products.

ELEKTRO-METALLURGIE. Die Gewinnung der Metalle unter Vermittelung des Elektrischen Stromes. Von Dr. W. BÖRCHERS. Zweite, vermehrte und völlig umgearbeitete Auflage. Mit 188 Text-Abbildungen. 1896. London: Williams and Norgate, 11, Henrietta Street, Covent Garden. Edinburgh: 20, South Frederick Street. Oxford: 7, Broad Street. Price 14s.

8vo volume in paper cover, containing Preface, Table of Contents, 386 pages of subject-matter, and the alphabetical Index. The text is illustrated with 188 beautifully executed engravings and a few plans of installations. The plan of the work will give the clearest idea of its scope, arrangement, and contents. It is as follows:—Introduction. Electrolysis. Electrothermic Work. ALKALI- and ALKALINE EARTH METALS. EARTH METALS. Aluminium and the CERITE GROUP OF METALS. HEAVY METALS. Copper. Silver. Gold. Zinc. Cadmium. Mercury. Tin. Lead. Bismuth. Antimony. Chromium. Molybdenum. Tungsten. Uranium. Manganese. Iron. Nickel and Cobalt. Platinum Metals. To give an idea of the method of treatment adopted in the case of each of the above metals, the following is that followed in the case of GOLD. I. Preparation of the Ore. Washing. II. Solution of the Gold in Metals. III. Purely Chemical Processes of recovering Gold from Ores. IV. Electrolysis.

PRACTICAL STUDIES IN FERMENTATION. Being Contributions to the Life History of Micro-Organisms. By EMIL CHR. HANSEN, Ph.D., Professor and Director at the Carlsberg Physiological Laboratory, Copenhagen. Translated by ALEX. K. MILLER, Ph.D., and revised by the Author. London: E. and F. N. Spon, 125, Strand. New York: Spon and Chamberlain, 12, Cortlandt Street. 1896. Price 12s. 6d.

The author, in his Preface, states that "The investigations brought together in this book of his, treat in the main of the great questions of the circulation in nature of the alcoholic fungi, their relationship to the diseases of beer, the pure cultivation of yeast, and the employment of systematically selected species and races." The work forms an 8vo volume containing Preface, Table of Contents, 272 pages of subject-matter, with 19 woodcut illustrations, and an alphabetical Index. The classification of the text is as follows:—I. PURE CULTURES OF SYSTEMATICALLY SELECTED YEASTS IN THE FERMENTATION INDUSTRIES. 1. Wherein the new advance consists. 2. Hansen's Methods of Pure Cultivation. 3. The Contributions of Previous Investigators. 4. The Practical Results which have been achieved. 5. The Preparation of Pure Cultivated Yeasts on a Large Scale. II. RESEARCHES ON YEASTS. 1. Characteristics of the Saccharomyces. 2. High and Low Yeasts. 3. Investigations on Low-fermentation Yeasts which have been tested in practice. 4. On Variation. 5. Main Result. III. THE PRACTICAL EXAMINATION OF BEER IN THE STORAGE CASKS WITH REFERENCE TO ITS STABILITY. General. The Method and the Experiments. IV. THE TECHNICAL ANALYSIS OF AIR AND WATER FOR MICRO-ORGANISMS. 1. The Practical Results of Hansen's Air Analyses. 2. The Principles of Zymotechnic Water Analyses. V. WHAT IS THE PURE YEAST OF PASTEUR? VI. INVESTIGATIONS ON THE "DISEASES" OF BEER, PRODUCED BY ALCOHOLIC FERMENTS. 1. Introduction. 2. How the Doctrine of "Diseases" in Fermented Liquids was gradually developed. 3. Hansen's Investigations. VI. ON THE PRESENT POSITION OF HANSEN'S SYSTEM OF PURE YEAST CULTURE. 1. The Object of this Review. 2. Low-fermentation Breweries. 3. High-fermentation Breweries. 4. Distilleries and Yeast Factories. 5. Wine, Cider, and Fruit-Juice Fermentations. 6. Retrospect and Concluding Remarks.

BLEACHING AND CALICO PRINTING. A Practical Manual. By GEORGE DUERR, Assisted by William Turnbull. With diagrams, and upwards of 100 dyed and printed

patterns, designed to show various stages in the processes described. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1896. Price 12s. 6d.

8vo volume, containing Preface, in which it is stated that the work comprises in a condensed form the course of lectures annually given by the author to classes of students studying the Technology of Bleaching and Calico Printing. Next follow the table of Contents, list of Illustrations, some 23, with three plates of larger size, and 142 pages of subject-matter, including the alphabetical Index. After the Index follow 19 sheets of cottons, unbleached, bleached, printed, and dyed. The chief subjects treated of are as follows:—I. Bleaching. II. Printing. III. Mordants. IV. Styles of Calico Printing. V. Thickness. VI. Natural Organic Colouring Matters. VII. Tannin Matters. VIII. Oils, Soaps, and Solvents. IX. Organic Acids, Salts. X. Mineral Colours or Pigments. XI. Coal-Tar Colours. XII. Dyeing. XIII. Water. Theory of Colours.

HINTS ON THE TEACHING OF ELEMENTARY CHEMISTRY IN SCHOOLS AND SCIENCE CLASSES. By WILLIAM A. TILDEN, D.Sc., F.R.S. Loogmans, Green, and Co., London and New York. 1895. Price 2s.

THIS small treatise is intended for the guidance of teachers of elementary chemistry, and its keynote, as is indicated in the Preface, is, the inculcation of *accuracy of observation*. An example given as illustrative of the importance of acquiring the true art of investigating complex phenomena, furnishes exemplification both with regard to elementary chemistry and elementary chemical technology. It is that of the changes occurring when a piece of sheet copper is heated in the air, and, as Prof. Tilden shows, it requires for a complete answer observations—(a.) On the iridescent colours first visible; (b.) The black coating which succeeds; (c.) The red lining to the scales, which may be separated on cooling; (d.) The temperature at which these changes occur; (e.) The alteration in weight of the mass; (f.) Changes in the surrounding air, &c. The little work contains 76 pages of subject-matter, illustrated with seven or eight woodcuts, and containing an Appendix, with extracts from the Syllabus issued by the Department of Science and Art, 1895. An excerpt of the contents indicates the general plan of the work. I. Observation, Qualitative. II. Observation, Quantitative. III. Chemical Equivalents. The Law of Volumes. IV. Molecular Weights and Formulæ. V. Atomic Weights. Classification.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

CUSTOMS TARIFF OF NEW ZEALAND.

Board of Trade Journal, February 1896, 174.

(See also this Journal, January 1896, 57.)

Table of Exemptions from Duties of Customs.

No.	Articles.
CLASS V.—DRUGS, &c.	
316	Acids, viz.: boric, carbolic, in bulk; fluoric, muriatic, nitric, oxalic, oleic, pyrogallie, salicylic, sulphuric.
317	Concentrated extracts, or essences in liquid form or preserved in fat, for perfume-manufacturing purposes in manufacturing warehouses, in bottles of not less than 1 lb. in weight.
318	Disinfectants.
319	Drugs and chemicals, viz.: alum, sulphate of aluminium; sulphate of ammonia; anhydrous ammonia; aniline dyes; arsenic; bluestone, or sulphate of copper; borax; catechu; chloride of calcium; nitrate of silver; cochineal; creosote, crude or commercial; glycerine, crude; gum, arabic and tragacanth; gum benzoin; artificial gum arabic; gum dammar; phosphorus; potash, caustic; potash, and chloride of potash; pearlsh; cyanide of potassium; sal-ammoniac; saltpetre; acetate of soda, crude; soda-ash; caustic soda; nitrate of soda; silicate of soda; sulphate of soda; sulphide of sodium; strychnine; sulphur; chloride of zinc; iron sulphates; gall-nuts; turmeric; saffron; nitrous-oxide gas; tree washes; insecticides; maltine; chlorodyne.

CUSTOMS TARIFF OF NEW ZEALAND—cont.

No.	Articles.
320	Essential oils, except eucalyptus; cod-liver oil; oil of rhodium.
321	Horse-drenches.
322	Medicinal barks, leaves, herbs, flowers, roots, and gums.
323	Scrub-extermiator.
324	Sheep-dip; sheep-drenches; sheep-licks.
325	Surgical and dental instruments and appliances.
326	Scientific and assay balances, retorts, flasks, and other appliances for chemical analysis and assay work.
327	Water-hardening chemicals for brewers' use.

REVISION OF BRAZIL CUSTOMS TARIFF.

See Board of Trade Journal, February 1896, 182—185.

GENERAL TRADE NOTES.

THE MINING (COAL AND PETROLEUM) INDUSTRY OF THE DUTCH EAST INDIES.

See Board of Trade Journal, February 1896, 143.

FRENCH SUGAR FACTORIES AND THEIR METHODS OF PRODUCTION.

See Board of Trade Journal, February 1896, 145.

FRENCH MINING STATISTICS.

See Board of Trade Journal, February 1896, 148.

THE ESPARTO FIBRE INDUSTRY OF TUNIS.

See Board of Trade Journal, February 1896, 151.

GERMAN CEMENT.

Chamber of Commerce Journal, January 1896, 13.

There are some 63 cement works in the whole of Germany. The Rhine is the principal centre for this manufacture, but in the neighbourhood of Hamburg there are three or four in operation for the production of the article. The annual production of Germany amounts to nearly 11,000,000 barrels, giving employment to some 1,800 hands, whose annual earnings amount to some 698,780*l.* (*sic*). The largest customers for this article in Europe are Russia and Norway, and of Transatlantic countries, the United States, Brazil, Chili, and Venezuela. The exportation to Great Britain and British possessions is comparatively small. The following table gives approximately the quantity and value exported to European and other countries:—

Country.	CWTS.	£
Norway	58,500	6,700
Russia	31,353	2,300
United States	1,386,872	168,000
Brazil	416,310	40,200
Chili	131,000	13,000
Venezuela	103,000	9,800

CHEMICAL INDUSTRY IN ALICANTE.

Chemical Trade Journal, February 15th, 1896, 115.

Considering the size and commercial importance of the province of Alicante, the chemical industries occupy a prominent position.

One of the most important is that of soap-making. Of the 29 works that exist, there are 27 at work. These are chiefly situated round the towns of Alicante, San Vicente, Alcoy, Villena, Monovar, Novelda, Elche, Crevillente, and Callera. The combined yearly production of these 27 works is 12,500,000 lb. of soap.

The next most important industry is the extraction of oils. This process is carried out in two ways, viz., by extraction with a chemical solvent and by expression pure and simple in hydraulic presses. There are 27 works in operation in connection with the latter method, the chief of which are situated at Biar, Villenar, Alcoy, Muro, Elche, Elda, Novelda, Monovar, Villajoyosa, and Ces. These

seed-crushing mills employ 200 workmen. The chemical extraction with carbon bisulphide is carried on to a much more limited extent. There is only one works in operation, and that is situated at Alicante. The amount of oil extracted every year is about 500 tons.

There is another branch of the oil trade represented in Alicante in the shape of two petroleum refineries. Their combined annual production is very considerable, being estimated to be worth 14,000*l*. The number of workmen employed is 120. The wages vary from 1*s*. 3*d*. to 4*s*. 2*d*. per day.

UNITED STATES DRUG IMPORTS.

Chemist and Druggist, February 22nd, 1896, 291.

The following figures show the imports of some of the principal drugs into all the ports of the United States during the eleven months from January 1 to November 30 of 1894 and 1895 respectively:—

	1894.	1895.
Argol or crude tartar..... lbs.	23,592,189	26,285,473
Bark (quinine)..... "	2,488,643	1,800,227
Camphor (crude)..... "	1,278,892	1,137,437
Chlorate of potash..... "	1,061,901	4,549,670
Chloride of lime..... "	86,383,850	91,498,222
*Coal-tar colours and dyes..... dols.	1,883,591	2,558,902
*Glycerine..... lbs.	7,300,025	15,040,236
Gum arabic..... "	1,363,168	1,131,808
Opium (crude or manufactured)..... "	708,768	321,927
*Opium, prepared for smoking..... "	66,249	38,948
*Perfumery and cosmetics..... dols.	471,541	561,678
Quinine and other cinchona salts... oz.	9,906,142	1,715,761
*Soap (toilet)..... lbs.	677,690	729,721
*Soda—caustic..... "	40,813,438	62,857,278
Sal soda..... "	22,315,829	7,632,183
Soda ash..... "	254,128,849	258,679,276
All other salts of..... "	16,750,721	9,216,681
Vanilla..... "	154,911	185,272

* These goods are dutiable; the others mentioned in this note are free.

JAPANESE TRADE IN DRUGS AND CHEMICALS.

Pharmaceutical Journal, February 22nd, 1896, 152.

According to Mr. Gerald Lowther's report for the year 1894, drugs, medicines, and chemicals have, for many years, formed a very important item in the Japanese import trade, as there is a steadily increasing consumption in Japan. The values of drugs and chemicals imported for the past six years have been as shown in the following table:—

Year.	Value.
	£
1889	296,608
1890	331,208
1891	370,961
1892	363,760
1893	446,431
1894	393,313

It is stated that in each of these years Great Britain has had a valuable and important share in the trade. The principal items in the import list for 1894 were salicylic acid, bismuth sub-nitrate, amorphous phosphorus, potassium chlorate, sodium bicarbonate, caustic soda, alcohol, and saltpetre. Alcohol, silver nitrate, and salicylic acid were obtained almost exclusively from Germany, whilst caustic soda, sodium bicarbonate, potassium chlorate, and amorphous phosphorus were equally exclusively imported from England.

It will be noted that there was a considerable falling off in 1894 as compared with 1893, and during the first six months of 1895 there was, according to Mr. Ernest Satow, a further decrease in the value of drugs and chemicals imported equivalent to 118,625 dols., as compared with the corresponding period of 1894; but the next three months saw a change, a net increase being shown over the third quarter of 1894 of 206,318 dols. The value of the October trade, which is the latest recorded, is described as having reached the highest total ever attained in any one month by Japan, the total imports being valued at 12,030,656 dols.,

of which drugs and chemicals are credited with 280,314 dols., as against 487,275 dols. for the whole of the preceding three months.

The Japanese import trade may therefore be regarded as having been, during recent months, in an exceedingly healthy condition. The most interesting item in the exports from Japan, camphor, was exported to the value of 1,023,956 dols. during 1894, 649,457 dols. in the first six months of 1895, and 391,438 dols. in the next three months, a constant increase being thus perceptible during the past year. The figures for the previous five years showed a steady falling-off, and the quality of the product had deteriorated; but a guild was formed amongst the native sellers, and other steps have also been taken to effect a much-needed reform in the quality of the drug.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st January.	
	1895.	1896.
	£	£
Metals.....	1,640,662	1,681,443
Chemicals and dyestuffs.....	600,583	816,472
Oils.....	676,876	823,163
Raw materials for non-textile industries.....	2,693,507	3,189,712
Total value of all imports.....	36,743,481	38,473,856

SUMMARY OF EXPORTS.

Articles.	Month ending 31st January.	
	1895.	1896.
	£	£
Metals (other than machinery).....	2,033,598	2,558,834
Chemicals and medicines.....	462,467	761,859
Miscellaneous articles.....	2,220,621	2,813,085
Total value of all exports.....	18,224,236	21,127,168

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Bark, Peruvian... Cwt.	5,529	3,684	10,045	6,531
Bristles..... Lb.	203,190	429,783	40,804	52,090
Caoutchouc..... Cwt.	32,766	39,904	399,184	480,811
Gum:—				
Arabic..... "	7,743	5,228	13,200	14,522
Lac, Ac..... "	9,836	14,971	52,589	77,881
Gutta-percha..... "	8,491	3,756	70,020	31,413
Hides, raw:—				
Dry..... "	31,578	28,305	78,090	70,770
Wet..... "	40,828	58,199	82,195	124,057
Ivory..... "	908	794	39,146	40,062
Manure:—				
Guano..... Tons	3,479	870	19,943	3,080
Bones..... "	5,123	10,713	24,010	43,737
Nitrate of soda..... "	1,882	7,864	15,380	60,148
Phosphate of lime..... "	35,379	21,434	63,487	41,395
Paraffin..... Cwt.	73,274	67,783	74,139	71,854
Linen rags..... Tons	1,730	1,748	17,366	17,876
Esparto..... "	16,861	14,481	72,657	63,230
Pulp of wood..... "	23,595	21,170	120,623	115,757
Rosin..... Cwt.	70,944	211,826	15,253	50,901
Tallow and stearin..... "	128,312	296,394	157,538	234,301
Tar..... Barrels	1,918	901	1,018	392
Wood:—				
Hewn..... Loads	130,592	126,175	242,188	248,871
Sawn..... "	84,050	147,747	195,848	339,532
Staves..... "	6,577	10,190	38,017	67,178
Mahogany..... Tons	5,186	3,774	40,174	31,795
Other articles..... Value £	..	..	810,593	899,428
Total value.....	..	..	2,693,507	3,180,712

Besides the above, drugs to the value of 60,45*l*. were imported, as against 62,43*l*. in January 1895.

IMPORTS OF METALS FOR MONTH ENDING
31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore	7,588	4,402	78,382	30,072
Regulus	7,581	9,420	165,186	264,206
Unwrought	5,305	4,805	222,823	206,516
Iron:—				
Ore	289,029	469,657	189,521	331,353
Bolt, bar, &c.	3,169	1,934	26,120	41,139
Steel, unwrought ..	704	1,136	5,136	9,293
Lead, pig and sheet ..	13,321	11,158	126,678	121,986
Pyrites	49,736	54,487	83,782	90,565
Quicksilver	45,900	8,910	3,850	1,113
Silver ore .....	..	..	231,361	132,761
Tin	76,878	64,562	243,622	199,168
Zinc	4,701	6,208	69,172	92,280
Other articles ..	..	..	154,429	169,391
Total value of metals ..	..	..	1,600,662	1,681,443

IMPORTS OF CHEMICALS AND DYE STUFFS FOR MONTH
ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali	15,532	8,977	£ 10,435	£ 4,843
Bark (tanners' &c.) ..	15,434	16,640	5,183	5,993
Brimstone	29,990	55,857	5,860	6,557
Chemicals .....	..	..	85,797	116,523
Cochineal	279	533	1,808	3,315
Cutch and gambier Tons	2,978	2,645	62,663	57,150
Dyes:—				
Alizarin .....	..	..	21,972	20,417
Anilin and other ..	..	..	34,348	41,920
Indigo	13,190	19,151	222,152	336,752
Nitrate of potash ..	25,590	19,504	23,825	19,137
Valonia	3,201	4,412	37,693	49,568
Other articles ..	..	..	88,847	152,777
Total value of chemicals ..	..	..	609,583	816,472

IMPORTS OF OILS FOR MONTH ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa-nut	65,934	20,061	£ 73,805	£ 21,540
Olive	1,096	1,696	38,832	54,182
Palm	85,189	103,736	89,876	108,978
Petroleum	17,349,778	17,176,225	269,657	362,655
Seed	3,484	3,438	75,346	69,646
Train, &c.	1,027	927	15,690	16,450
Turpentine	28,911	69,362	29,414	79,096
Other articles ..	..	..	84,256	109,616
Total value of oils ..	..	..	676,876	823,163

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali	500,505	469,487	£ 120,368	£ 111,193
Bleaching materials ..	93,253	116,479	31,274	42,194
Chemical manures ..	27,728	29,655	203,069	201,025
Medicines .....	..	..	91,957	102,590
Other articles ..	..	..	212,969	304,857
Total value .....	..	..	662,667	761,859

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	7,905	10,631	30,587	41,431
Copper:—				
Unwrought.... "	40,027	39,232	85,064	92,136
Wrought..... "	30,405	41,569	79,837	111,476
Mixed metal... "	25,688	23,366	53,044	51,021
Hardware..... Value £	..	..	149,617	181,519
Implements.... "	..	..	97,593	117,095
Iron and steel... Tons	166,711	227,607	1,351,086	1,716,072
Lead..... "	2,527	3,307	31,191	44,568
Plated wares... Value £	..	..	19,372	30,380
Telegraph wires.. "	..	..	35,193	57,224
Tin..... Cwt.	10,678	10,255	33,673	33,293
Zinc..... "	14,207	10,272	9,295	12,347
Other articles.. Value £	..	..	56,013	70,272
Total value .....	..	..	2,033,598	2,558,834

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 31ST JANUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Gunpowder..... Lb.	360,400	649,800	9,214	16,064
Military stores.. Value £			104,733	158,692
Candles..... Lb.	1,213,800	2,539,900	31,669	40,443
Caoutchouc..... Value £			96,727	116,711
Cement..... Tons	24,593	20,612	39,639	33,678
Products of coal Value £	..	..	144,993	177,795
Earthenware ... ..	..	..	133,557	158,660
Stoneware..... ..	..	..	12,866	12,798
Glass:—				
Plate..... Sq. Ft.	89,463	158,613	4,824	8,508
Flint..... Cwt.	7,208	9,417	17,090	20,630
Bottles..... ..	50,627	66,800	23,845	31,265
Other kinds..... ..	18,004	23,675	12,069	19,247
Leather:—				
Unwrought	11,320	10,880	103,024	105,660
Wrought..... Value £			23,130	29,401
Seed oil..... Tons	3,663	1,007	74,818	79,755
Floorcloth..... Sq. Yds.	2,691,800	2,566,800	74,402	99,103
Painters' materials Val. £			105,715	132,590
Paper..... Cwt.	68,238	95,785	108,695	145,114
Rugs..... Tons	4,273	4,269	25,321	25,667
Soap..... Cwt.	44,925	71,440	48,562	70,005
Total value.....	..	..	2,220,621	2,813,085

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT, APPARATUS, AND
MACHINERY.

APPLICATIONS.

2150. R. Cunniffe. Improvements in and connected with machines for drying brewers' refuse and other materials or substances requiring similar treatment. January 30.

2543. H. H. Lake.—From A. S. Nichols. Improvements in drying kilns, and in the method of operating the same. Complete Specification. February 4.

2859. J. G. Lorrain. A new or improved method of and apparatus for filtering and purifying liquids. February 7.

2925. E. B. Caird and T. J. Rayner. Improvements in surface condensers and coolers. Complete Specification. February 8.

2930. S. H. Wright. An improved method of conveying air or other gases, and of producing vacua thereby, with apparatus therefor. February 8.
2957. H. A. Kent. Improvements in the construction of platinum vessels or apparatus for the concentration of sulphuric acid. February 10.
3063. J. Spittal. Improvements in condensers. February 11.
3112. F. N. Mackay. Improvements in refrigerating or cooling apparatus. February 11.
3141. J. M. Boustead. Improved apparatus for desiccating. February 11.
3196. W. McD. Mackey. Improvements in or connected with apparatus for concentrating sulphuric acid. February 12.
3218. W. A. E. Crombie. Improvements in apparatus for evaporating or drying. February 12.
3315. J. Laidlaw and J. W. Macfarlane. Improvements in centrifugal machines for separating fluids of different densities. Complete Specification. February 11.
3365. H. B. McKenna. Improvements in the treatment of hydrocarbons for the production of crystalline substances, and apparatus for treating and manufacturing same. February 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

2421. A. A. Robin. Differential low-pressure still for the distillation of volatile and inflammable compounds. January 29.
2452. J. Klein. Graduating or cooling apparatus and processes. February 5.
2717. F. E. Gateke. Method and apparatus for counter-acting, deflecting, and distributing gases and flames in chemical works, furnaces, or the like. January 29.
2722. F. H. Fyelman. Filtering process and apparatus. February 12.
2946. E. L. Pease and Ashmore, Benson, Pease, and Co. Retort for chemical processes. February 12.
4882. V. J. Kuess. Retort for distilling heavy bodies in general, and particularly gum and resin. February 5.
5496. J. B. Elliott. Evaporating apparatus. January 29.
5856. J. B. C. Krohnke. Apparatus for filtering liquids. February 5.
6868. H. Kropff. Apparatus for dehydrating gypsum and other finely-divided materials. February 19.
7286. E. W. Kuhn. Apparatus for sterilising liquids. February 19.
7425. H. Simmonds and J. Delaney. Kilns or furnaces applicable for burning lime and other minerals. February 19.
- 23,585. A. H. Wright. Improvements in bagasse filters. January 29.
- 24,097. W. R. Herring and M. Graham. Apparatus for charging inclined gas-retorts. February 19.
- 24,214. E. Powell. Improvements in furnaces. February 5.

1896.

469. J. U. Askham. Apparatus for separating substances of different sizes or specific gravities.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

1351. J. Hawley. Improvements in the construction of wood grids for gas purifiers. January 20.
1363. W. Beal. Certain improvements in and relating to the mantles of incandescent gas lights. January 20.
1475. R. Harrison. Improvements in and relating to the production of gases and vapour from mineral oils and other hydrocarbons, and in apparatus therefor. January 21.
1502. J. T. Brunner and H. Brunner. Improvements in the utilisation of coke-oven and other rich gases for manufacturing or heating purposes. January 21.

* See Note (*) on previous page.

1521. N. T. M. Wilsmore.—From D. Little. Improvements in incandescent gas or oil lighting. January 22.

1576. L. Denayrouze. Improvements in incandescent lighting with an intimate mixture of gas and air. January 22.
1681. W. H. Wheatley.—From F. Woernle. Improvements in the manufacture of incandescence bodies for illuminating purposes. January 23.
1682. W. H. Wheatley.—From C. Schmid. Improvements in the manufacture of incandescence bodies for illuminating purposes. January 23.
1750. J. C. Mewburn.—From La Société Anonyme du Combustible Intensif. Improvements in the manufacture of fuel briquettes or blocks. January 24.
1817. C. C. Walker. Improvements in apparatus for enriching or carburetting gas. January 25.
1841. P. Stiens. Improvements in incandescent mantles. January 25.
2000. C. Kortwich. Glow bodies for incandescent gas lighting. Complete Specification. January 28.
2269. J. Moeller. Improvements in incandescent gas lamps. January 31.
2332. G. Holdsworth and G. S. Wilkinson. Improvements in apparatus for generating acetylene gas. February 1.
2452. J. Lehmann. Improvements in burners for incandescent gas lighting. Filed February 3. Date applied for February 1, 1896, being date of application in France.
2553. W. Schoning. Improved process for producing fuel from turf or peat. Complete Specification. February 4.
3142. F. S. Thorn and C. Hoddle. A new and improved acetylene gas generator and container. February 12.
3219. E. B. Pym and J. Gore. Improvements in apparatus for use in the manufacture of acetylene gas. February 12.
3324. C. M. Schnander. Improvements relating to the manufacture of fuel blocks. February 13.
3335. T. H. Gittins. Improved fuel. February 14.
3338. J. H. Exley. Improvements in or appertaining to apparatus for the manufacture of acetylene gas. February 14.
3461. G. Isaac. New process for the production of an indestructible incandescent substance for use with illuminating gases. February 15.
3464. J. C. Hall, H. C. A. Dance, and A. R. Hall. An automatic acetylene gas generator. February 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

3351. P. Brentini. New or improved process and apparatus for the manufacture of gas for lighting and heating purposes. February 19.
3424. D. Hancock, J. B. Craig, and A. H. Hancock. Incandescent carburetted air or gas lighting, and apparatus therefor or connected therewith. February 19.
3425. D. Hancock, J. B. Craig, and A. H. Hancock. Carburetting apparatus. February 19.
3187. H. Strache. Process and apparatus for the generation of water-gas from coke, coal, or other fuel. February 19.
6101. L. M. Bullier. Method of rendering acetylene and other gases rich in carbon suitable for lighting and heating purposes. January 29.
6300. A. McDougall. Treatment of coal to adapt it more economic use as fuel and in the manufacture of gas. January 29.
6777. E. Gearing. Acetylene generating and storing apparatus. February 12.
6870. D. W. Sugg. Incandescent gas burners. February 12.
7281. H. S. Elworthy and P. D. Henderson. An improved process and apparatus for the separation of carbonic-acid gas from the products of combustion or other mixed and less soluble gases. February 19.
- 16,502. E. Dueretet and L. Lejeune. Apparatus for use in the production and utilisation of acetylene. February 19.

21,381. J. Roubal. Manufacture of carbon rods for arc lights. February 19.

1896.

771. M. Seipp. Pulverulent and small furnaces. February 19.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

1489. J. Imray.—From La Soc. Anonyme des Matières Colorantes et Produits Chimiques de St. Denis. Manufacture of colouring matters from triphenylmethane-resisting alkalis and dyeing green and blue. January 21.

1645. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of stable double salts of chloride of zinc and the diazo or tetraazo compounds respectively of amidoazo and diamidoazo compounds. January 23.

1956. G. W. Johnson.—From The Chem. Fab. vorm. Goldenberg, Geromont, and Co. Improvements in the manufacture or preparation of the imide of orthosulphobenzoic acid. January 28.

2196. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of direct-dyeing azo colouring matters. January 30.

2446. S. Pitt.—From L. Cassella and Co. Improvements in the manufacture of azo dyes. February 3.

2705. W. H. Claus and A. Ree. The production of blue colouring matters. February 6.

2771. T. R. Shillito.—From J. R. Geigy and Co. Improvements in the manufacture of polyazo colours or dyes. February 6.

2946. Levinstein, Lim., and I. Levinstein. Production of new sulpho-acid and of colours derived therefrom. February 10.

2999. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of sulphonic acids of the meta-amidophenolphthaleines and their alkyl derivatives. February 10.

3000. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of colouring matter from substituted fluoresceines. February 10.

3028. S. Pitt.—From L. Cassella and Co. Improvements in the production of polyazo dyestuffs. February 10.

3035. J. Y. Johnson. From The Chemische Fabrik Griesheim. A process for the reduction of nitro-benzol and its homologues by means of hydro-sulphide of sodium. February 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6176. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuff, and materials therefor. February 19.

6328. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. Manufacture or production of dyestuffs. February 5.

6697. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. The manufacture and production of azo dyes of the benzidine and analogous series. February 5.

6967. F. E. Mafat. Process and apparatus for extracting the colouring matter from dyewoods. February 5.

7170. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of dyestuffs from substituted fluoresceins. February 12.

7237. J. Imray.—From La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis, and D. A. Rosenstiehl. Manufacture of azo colouring matters, dyeing unmordanted cotton in acid, neutral, or alkaline bath. February 12.

7498. J. Duxbury.—From E. A. Mitchell. An improved "kaki" dye. February 19.

7549. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new substantive dyestuffs. February 19.

7969. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of direct-dyeing colouring matters. February 19.

21,812. C. D. Abel.—From L. Durand, Huguenin, and Co. Manufacture of new nitrated oxazine colouring matters dyeing with mordants. February 19.

1896.

698. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of colouring matters dyeing wool green-black to blue-black. February 19.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

1370. F. N. Turney. Improvements in apparatus for degreasing and cleansing wool, cotton waste, and like fibrous material. January 20.

2213. J. C. Anderson. Improvements in and relating to process of and apparatus for the treatment of wool. Complete Specification. January 30.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6015. J. R. Barlow and H. Duxbury. Manufacture of coloured figure fabrics. February 5.

8053. J. B. Rapetout. An improved process for treating textile materials in order to render them less liable to be spotted or soiled. February 19.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

1375. J. Berry. Improvements in the printing of water-proof fabrics and apparatus therefor. January 20.

1407. J. Y. Johnson.—From E. G. May, Söhne, and Co. Improvements in the production of coloured figures or designs and ornamental effects. January 20.

1618. W. Hirsch. Improvements in the production of designs upon woven fabrics. January 23.

1757. W. B. Silverlock. An improved apparatus for brushing or removing the bronze or other powder from the end of the surface of paper or other material after the paper has passed through the bronzing machine. January 24.

2423. J. Sanders and T. H. Sanders. Improved process of dyeing browns and fawns. February 3.

2840. T. Halliwell and J. Stones. Improvements in apparatus for dyeing, bleaching, or scouring fibrous materials. February 7.

2814. A. H. Brownlow and J. Stansfield. An improved method of dyeing. February 7.

2971. T. Hoyle and Sons, Limited, and J. A. O'Loughlin. Improvements in dyeing yarns and fabrics made wholly or partly of cotton and other vegetable fibres. February 10.

3058. W. Hepworth-Collins. Improvements in machinery and process for scouring, bleaching, dyeing, and otherwise treating yarn and other spun fibrous materials in cops or in similar compact forms. February 11.

COMPLETE SPECIFICATION ACCEPTED.

1895.

2860. C. E. Middleton, F. P. Middleton, and A. T. Middleton. Dyeing apparatus. February 12.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

1417. P. C. Bunn. Improvements in methods of utilising Weldon mud and similar wastes produced in the manufacture of alkalis. January 21.

1458. J. F. Hutcheson. Manufacture of sodic cyanide. January 21.

1667. T. Fairley. Improvements in the manufacture and purification of ammonium nitrate and other salts. January 23.

1668. T. Fairley. Improvements in the manufacture of ammonium nitrate and sodium salts. January 23.

1729. F. Perez. Improvements in or relating to the manufacture of salt. Complete Specification. January 24.

1900. J. J. Holden and H. Baum. Improvements in the manufacture of cyanides. January 27.

1980. H. R. Angel. Improved method for making ferrite and ferrate of soda. January 28.

2021. R. J. Friswell and Brooke, Simpson, and Spiller, Ltd. Improvements in the manufacture of nitric acid. January 28.

2271. F. T. B. Dapre. Improvements in the preparation of chloride of magnesium solutions. January 31.

2489. W. Garroway. Improvements in the manufacture of sodium and potassium silicates, and of nitric and sulphuric acids. February 1.

3131. P. J. Beveridge. Improvements in obtaining chlorine from hydrochloric acid or chlorides, and the recovery of by-products. February 11.

3196. W. McDouneil Mackey. See Class I.

3230. F. L. Bartelt. Improvements in the manufacture and production of polysulphides of potassium and sodium. February 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

3509. J. W. Swan and J. A. Kendall. Manufacture or production of cyanides. February 19.

6711. A. R. Scott and T. Henderson. Purifying acetates. February 12.

7287. J. Raschen and J. Brock. Manufacture of chlorine, and in the treatment of by-products of the said manufacture. February 19.

7288. J. Raschen and J. Brock. Manufacture of ammonia and its salts from nitrogen-oxychlorides or nitrogen oxides. February 19.

7436. H. S. Elworthy and P. D. Henderson. Methods of solidifying carbon dioxide, and of utilising the solidified substance. February 19.

8314. J. Brock and J. Hawliezek. Manufacture of bicarbonate of soda. February 19.

10,412. W. P. Thompson.—From J. Finlay and E. W. Derry. Manufacture of cyanides and other cyanogen compounds. February 19.

18,406. G. B. Baldo. See Class XI.

23,580. C. Kellner. Manufacture or production of metallic cyanides, particularly cyanide of potassium and of sodium. February 19.

23,591. Manufacture or production of alkaline chlorates. February 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

1571. T. W. Simpson and W. H. Bradshaw. Improvements in the manufacture of glass bottles, and in apparatus for the same. January 22.

1794. J. W. Onnrod. Improvements in kilns for use in the manufacture of bricks, terra-cotta goods, tiles, and the like. January 25.

1834. J. Jacques and W. E. McCalka. A new or improved manufacture of articles in glass, tile, pottery, metals, and like substances by a process for producing thereon letters, figures, or designs in permanent colours. January 25.

2114. P. Chapuy. An improved process for the manufacture of porcelain bricks and other constructional elements and apparatus therefor. January 29.

3245. The Cleland Pottery Co., Ltd., and R. A. Mathieson. A new or improved appliance for lifting plastic hollow pottery ware. February 13.

COMPLETE SPECIFICATION ACCEPTED.

1895.

4776. F. Gridlin. Producing the appearance of embossed glass. January 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

1408. G. L. Falconar. Improvements in the manufacture or production of blocks or slabs for use for flooring, paving, or in step or staircase, or wall construction, and for analogous purposes. January 20.

2114. P. Chapuy. See Class VIII.

2223. F. Turner. Improvements in the manufacture of cement or artificial stone. January 30.

2285. C. W. Bradshaw and H. A. H. Moore. An improved method of manufacturing refined bitumen for asphalt, electrical, and other purposes. January 31.

2451. D. J. J. Froment. Improvements in the treatment of marble and similar stone. February 3.

2613. W. Beer.—From H. Luschen. A new or improved manufacture of artificial marble for building, decorative, and other purposes. February 5.

2614. F. W. Maxwell and W. Beer. A new or improved manufacture of artificial stone for building, decorative, and other purposes. February 5.

2746. E. Buehboldt. Improvements in or connected with paving and paving blocks. Complete Specification. February 6.

2843. H. Stumonds and J. Delaney. Improvements in kilns or furnaces applicable for burning lime, cement, and other minerals. February 7.

3131. W. P. Thompson.—From F. Hasselmann and A. Sonnemann. A new or improved process for impregnating fibrous substances such as wood, peat, or the like. February 11.

3232. J. T. Hanson. A new method of constructing fireproof floors, flats, partitions, and walls. February 13.

3351. G. Viggars. An improvement in the manufacture of bricks and tiles. February 14.

3373. G. H. T. Ferrington. Improvements in tiles for lining walls, ceilings, and other parts, and in the machinery for manufacturing the same, as well as in the mode and means for mounting the same. February 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6868. H. Kropff. See Class I.

23,981. F. Ludewig. A new or improved composition for preventing the formation or accumulation of moisture, nitre, or acids in or upon walls and other like surfaces, said composition being capable of being made into artificial stones or bricks for building purposes. February 19.

24,674. F. B. Bond. Fireproof flooring, roofing, beams, bressummers, and the like. February 5.

24,898. M. Nahusen. Process for the manufacture of cement and cement-mortar. February 5.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

1438. G. Tomkinson and A. J. Ash. Improvements in furnaces for heating iron and steel billets previously to rolling the same into sheets and plates. January 21.

1454. H. Martin. Machine for discharging residues from retorts in zinc or spelter furnaces. January 21.

1455. H. Martin. Machine for charging retorts in zinc or spelter furnaces with ore or other material containing zinc. January 21.

1462. J. B. Torres. Improvements in extracting gold, silver, and other metals from ores and other compounds. January 21.

1469. E. L. Oppermann. An improved apparatus for effecting the amalgamation of gold and the like metals in ores with mercury. January 21.

1970. R. B. Boulton. The application or inlaying of metal or alloy, or amalgams, when in a softened condition, in or upon any hard substance devoid of life, and which has been formed into any pattern, lines, letters, or designs. January 28.

2049. J. B. Torres. Improvements in extracting gold, silver, and other metals from ores and other compounds. January 29.

2225. H. H. Bush and J. J. Shedlock. New or improved process and means for extracting metals from their ores. January 30.

2327. T. M. Ash and H. N. Weldon. An improved process for plating or coating non-metallic articles with metals. February 1.

2631. S. H. Levi. Aluminium splice. February 5.

2781. F. B. Last and J. R. Wright. Improvements in and apparatus for the manufacture of iron and steel. February 6.

2792. R. Wallwork. Improvements in apparatus for hardening and tempering metals. February 7.

2931. J. S. Wallace and J. Castell-Evans. An improved process for obtaining metals from refractory ores. February 8.

2997. E. J. M. Servais and P. Gredt. Process for the direct production of iron and steel and other metals from their ores. Complete Specification. February 10.

3054. J. Robertson. Improvements in shaping, forging, drawing, solidifying, and squirting metals, and in means and apparatus therefor. February 11.

3086. J. B. Torres. Improvements in or relating to the extraction of gold, silver, and other metals from ores and the like. February 11.

3201. J. B. Torres. Improvements in or relating to the extractions of manganese from ores and the like, and preparations of compounds therefrom. February 12.

3202. E. L. Oppermann. A new or improved process or means for extraction of gold and other such suitable metals in dry crushed ore. February 12.

3209. C. T. J. Oppermann. Improvements in the means of extracting gold or other precious metals from their ores. February 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1828. J. Miles. Extracting metals and metallic products from ironstone or argillaceous ironstone from coal and its products, burnt or unburnt. February 5.

4027. H. E. Newton. From The Farbenfabriken vormals F. Bayer and Co. Process and means for protecting iron, steel, and like materials from rust. January 29.

5513. L. Ronseau. Furnaces for smelting metals. February 5.

6673. H. J. Ridley. Method and apparatus for coating metal plates with tin, terns, or other metals or alloys. February 5.

7847. W. P. Thompson. From La Société Neo-Metallurgie Marbean, Chaplet and Co. An improved process of manufacturing improved alloys of refractory metals with more fusible metals. February 5.

18,034. H. Leitner. Oxidising lead and lead compounds for the construction of electrical accumulators. February 12.

23,817. R. Baumann. Facilitating the smelting of brass and other metal turnings and similar fine-metal scrap. January 29.

24,803. L. Pelatan and F. Clerici. Means or apparatus for the obtaining of precious metals from ores or materials containing them. February 12.

1896.

244. F. T. Franke. Annealing and tempering furnaces. February 12.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

1401. A. A. Naville, P. A. Guye, and C. E. Guye. Improvements in electrical gas-reaction apparatus. January 20.

1511. F. E. W. Bowea. Improvements in the manufacture of filaments for electric incandescent lamps. January 21.

1559. J. H. Dunn and J. Parsons. Improvements in making gases and steam by electricity. January 22.

1564. D. G. Fitzgerald and C. N. Stewart. An improved process for utilising peroxide of lead in the manufacture of elements for voltaic batteries. January 22.

1575. Siemens Bros. and Co., Ltd.—From Siemens and Halske. A process for the electrolytic production of zinc from its ores. Complete Specification. January 22.

1669. W. Turner. Improvements in or relating to electric batteries. January 23.

1678. W. Digby.—From A. E. Woolf. Improvements in electrodes for electrolytical purposes. January 23.

1905. H. Maxim. Improvements in furnace-blasts, and in process and in means or apparatus for electro-thermally treating materials, for the reduction of metals, production of carbides, acetylene, cyanogen, cyanides, nitrides, and the fixation of nitrogen. January 27.

2285. C. W. Bradshaw and H. A. H. Moore. See Class IX.

2435. C. Buderus and J. Menz. An improved dialytic process of decomposing stable salts and thereby creating electrical energy. February 5.

2594. A. J. Boulton.—From F. Villani. An improved electrolytic process for extraction of caustic alkali and of hydrochloric acid from a chloride. February 4.

2666. J. E. Preston. An improved fluid for use in galvanic batteries and the like. February 5.

2909. L. Fadero and H. Lumley. Improvements in secondary or storage batteries. February 8.

3022. H. H. Lake.—From H. J. Tudor. Improvements in and relating to the electrodes of secondary batteries. February 10.

3091. R. Linde. Improvements relating to the composition of the filling paste of accumulator batteries. Complete Specification. February 11.

3322. J. Fuchs and L. Thiemann. Improvements in electric batteries. February 13.

3359. E. Bailey and J. Dunn. Improvements in electrical furnaces for volatilising metallic and other ores. February 14.

3361. J. Kirkwood. The electro-plating of iron and other metals and alloys and the electro-reduction of metallic iron. February 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

2998. The Cowper-Coles Galvanising Syndicate, Ltd., and S. O. Cowper-Coles. Apparatus for manufacture of copper, zinc, and other metal sheets, strips, or wires electrically. February 12.

4154. The Cowper-Coles Galvanising Syndicate, Ltd., and S. O. Cowper-Coles. Apparatus for use in electro-deposition. February 5.

7364. J. Wetter.—From The Elektrizitäts-aktiengesellschaft vorm. Schuckert and Co. Electrolytic manufacture of alkali chlorates. February 5.

18,406. G. B. Baldo. Obtaining caustic soda, hydrogen, and chlorine by electrolysis of sea water, and in treating the bye-products obtained during such process. February 5.

22,574. C. J. Grist. Manufacture of insulating compositions for electrical purposes. February 19.

24,516. L. Epstein. Secondary voltaic batteries. February 5.

1895.

130. R. J. Gulcher. Electric accumulators. February 12.

XII.—FATS, OILS, AND SOAP MANUFACTURE.**APPLICATIONS.**

2217. J. Jack. Improvements in and relating to the extracting and recovering of oil from fish, fish refuse, or other oil-producing animal or vegetable matters. January 31.

2511. J. Jack and M. Blake. Improvements in and relating to the extracting and recovering of oil from fish, fish refuse, or other oil-producing animal or vegetable matters. February 4.

2896. J. Stockhausen. A new or improved soap. Complete Specification. February 5.

3181. G. B. Hay. Improvements in the manufacture of saponaceous compounds suitable for the relief and cure of perspiring hands. February 12.

3312. W. Hanley. Improvements in the manufacture of soft and other soaps. Complete Specification. February 13.

3328. G. D. Macdonald and The London and Dundee Syndicate, Ltd. Improvements in or relating to the marking of soap tablets, cakes, or bars with indelible colour. February 13.

3329. G. D. Macdonald and the London and Dundee Syndicate, Ltd. Improved means and apparatus connected with and for the marking of soap tablets, cakes, or bars with indelible colour. February 13.

COMPLETE SPECIFICATION ACCEPTED.

1895.

2471. A. Warwick, J. Smith, and P. W. Nicolle. Manufacture of washing powders. February 5.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.**APPLICATIONS.**

1892. J. Ockermüller. Improved anti-corrosive and process of manufacturing same. January 27.

2201. A. J. Boulton.—From L. P. Converse. Improvements in materials or compounds for waterproofing fabrics. Complete Specification. January 30.

2219. C. Sullivan. Improvements in the production of paint. January 30.

2276. P. C. D. Castle.—From The Gum Tragacanth Supply Co. Improvements in or relating to the treatment of and apparatus for separating the husk of locust-bean kernels from the cotyledons. January 31.

2568. J. L. Pollock. Improvements in air- and water-proofing varnishes or compositions. February 4.

2677. H. Birkbeck.—From P. W. Wierdsma and J. Kuipers. The manufacture of a new or improved substance or product suitable for use as a substitute for vulcanite, hard woods, or other hard materials, or for other uses or purposes for which same may be applicable. February 5.

2681. H. Hawkins and S. H. Hawkins. Improvements in the manufacture of pigments. February 5.

2755. J. Barclay. Improvements in the treatment of india-rubber and india-rubber compounds or substitutes for india-rubber. February 6.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1882. V. J. Kness. See Class I.

5924. W. Lutwyche and W. B. Lutwyche. Translucent enamel. January 29.

16,398. K. Deney. Pigments or lakes suitable for the manufacture of wall papers. January 29.

17,786. R. A. Sloan.—From The Inch Non-Corrosive Metal Co. Improved metallic paint and method of making same. January 29.

24,063. J. C. Sellars. Compound or material for use in connection with non-oilaceous protective coverings or paints. January 29.

25,009. H. H. Lake.—From T. Benfield. Process of making oxide of lead. February 5.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.**APPLICATIONS.**

1587. M. Hocquet. The manufacture of new compounds or composition from cork and other materials for use as substitutes for wood, leather, and other substances, or for other purposes to which same may be applicable. January 22.

1875. Baron A. von Mansberg. Process for rendering leather waterproof. January 27.

2572. H. L. J. Roy. Process and apparatus for the rapid tanning of hides, applicable also for dyeing and otherwise treating leather. Filed February 4. Date applied for, July 4, 1895, being date of application in France.

2993. A. Zandroni. A new adhesive and agglutinating substance. February 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1820. C. Marter and I. Levy. Process for treating animal skins. January 29.

7555. A. Sinan, H. Sinan, and E. Gouin. Process for decolorising and clarifying tannic extracts. February 19.

24,950. A. K. Y. Anderson and J. Mackintosh. A process for treating hides and skins in the manufacture of leather. February 5.

XV.—AGRICULTURE AND MANURES, Etc.**APPLICATIONS.**

2542. S. S. Wallace and J. Castell-Evans. Improved processes for the production of nitrogenous and other substances. February 4.

2678. J. G. Wilburgh. Improvements in the treatment of apatite and other mineral phosphates, and manufacture therefrom of products suitable for fertilising purposes. February 5.

2956. D. Cross. Improvements in artificial manures. February 10.

COMPLETE SPECIFICATION ACCEPTED.

1895.

6112. W. Hutchinson and A. H. Knight. Preparation of basic slag for fertilising purposes. January 29.

XVI.—SUGARS, STARCHES, GUMS, Etc.**APPLICATION.**

1960. E. Shaw. Improvements in and relating to boiling sugar and other syrups. January 28.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,171. G. Kassner. Separation of sugar from sacchariferous solutions, juices of plants, and the like. February 19.

24,456. C. Hellfrisch. Process for the treatment of potato starch with chlorine under heating. February 19.

XVII.—BREWING, WINES, SPIRITS, Etc.**APPLICATIONS.**

2030. W. Wrenmore. Apparatus for infusing hops. January 28.

2150. R. Cunliffe. See Class I.

2587. A. Myers. Improvements in processes of manufacturing fermented and distilled liquors. Complete Specification. February 4.

2684. B. Rothenbuecher. Improvements in apparatus for producing crushed malt, and a process of producing wort from the said malt. Complete Specification. February 5.

3098. A. J. Boulton.—From The Pabst Brewing Company. Improvements in or relating to the collection and utilisation of air-free carbonic acid gas from fermentation and apparatus therefor. Complete Specification. February 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

3480. A. Rawinet. Apparatus for manufacture or production of malt. February 12.

5329. F. Colley. Manufacture of malt, and malt houses for treating same. February 12.

5780. P. Pavrez. Treating malt and grain in brewing and other operations. February 12.

7286. E. W. Kuhn. See Class I.

24,387. D. Young. From C. Ballock and C. M. Reed. Method and apparatus for purifying and refining alcoholic liquors. February 12.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY, AND DISINFECTANTS.

APPLICATIONS.

A.—Chemistry of Foods.

1827. M. C. A. Ruffin. Manufacture of an edible fat from cocoa or coprah oil. January 25.

2081. W. F. Maclaren and A. S. Fleming. Improvements in the manufacture of condensed-milk products. Complete Specification. January 29.

2176. A. B. Pinto. Preserving meat by the help of electricity. Complete Specification. January 30.

2709. J. Dunn and W. Dunn. Improvements in treating barley to obtain a new alimentary product. Complete Specification. February 6.

2815. J. Rose. Improvements in the manufacture of butter, butterine, margarine, or the like. February 7.

3090. C. Kellner. Improvements in the reduction of organic compounds. February 11.

3103. A. J. Boulton.—From W. Meadows. An improved food and processes of preparing the same. Complete Specification. February 11.

3130. W. P. Thompson.—From The New Process Food Co. Improvements in and relating to granulated or powdered food extracts. Complete Specification. February 11.

3250. T. Hyatt. Improvements in alimentary substances, in their manufacture, and in putting up or conditioning them for domestic use. February 13.

B.—Sanitary Chemistry.

1555. W. D. Scott-Moucrieff. Improvements in apparatus for the treatment of sewage. January 22.

2063. J. Hamer. Improvements in the treatment of sewage and in apparatus therefor. January 29.

3047. J. B. Petrie. Improvements in the construction of settling tanks or lodges, used in the purification of sewage and other foul waters, and in the clarification of manufacturers' liquid compositions. February 11.

C.—Disinfectants.

1409. A. J. Boulton.—From F. Fritzsche and Co. An improved manufacture of an antiseptic disinfectant. January 20.

1679. W. Digby.—From A. E. Woolf. Improvements in the manufacture of disinfecting, deodorising, and bleaching agents. January 23.

1978. S. Wohle and A. C. Irwin. Manufacture of detergent. January 28.

2197. E. Hermite, E. J. Paterson, and C. F. Cooper. An improvement in the preparation of electrolysed chloride solutions for disinfecting and like purposes. January 30.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Chemistry of Foods.

1895.

3513. E. Markham. Process of preserving eggs. February 19.

17,844. J. D. Postle. An improved method or process for the preservation and storage of perishable organic substances by cold. January 29.

22,344. A. F. Jara. Method and apparatus for preserving milk. January 29.

24,282. W. P. Thompson.—From M. Braumann and A. Braumann. Preservation of green vegetables and the like. January 29.

24,293. H. J. Haddan.—From E. Freixa. An improved process of manufacture of nitrogenised water. January 29.

B.—Sanitary Chemistry.

1895.

22,545. E. W. Ives. Extracting precipitated sludge or solids from the bottoms of inverted cone-shaped precipitating tanks for sewage or waste water. January 29.

C.—Disinfectants.

2724. M. R. Latham. Improvements in employment of disinfectants. February 5.

XIX.—PAPER, PASTEBOARD, ETC.

APPLICATIONS.

1555. C. Raymond. Improvements in the manufacture of gelatinised paper or other fabrics suitable for the reproduction by printing with fatty inks of writings, drawings, and the like. January 22.

2388. F. W. Hall. Improved apparatus for straining paper pulp and the like. Complete Specification. February 3.

2553. A. H. Harrison. Improvements in the manufacture and treatment of paper pulp and paper for disinfecting, deodorising, and dissolvable purposes, and in the mode of advertising devices thereon. February 5.

3031. F. F. Aichburg. Improvements in toilet paper. Complete Specification. February 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

2205. A. J. Boulton.—From C. Schmid. A new benzene-sulphonic acid and artificial musk. January 30.

3192. G. H. R. Dabbs. Improvements in and apparatus for the production of extracts of tea or other matters. February 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7169. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of assimilable iron compounds. February 12.

19,702. F. Hartmann. Process for manufacturing a solution containing sulphurous acid for curative purposes. February 19.

1896.

9. W. Majert. The manufacture or production of an ammonium compound of casein. February 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.**APPLICATIONS.**

2415. T. A. Garrett and W. Lucas. Improvements in photographic films to be acted on by Röntgen rays. February 3.

3613. B. I. Edwards. Improvements in colour photographs and apparatus for producing and viewing the same. February 19.

XXII.—EXPLOSIVES, MATCHES, Etc.**APPLICATIONS.**

1440. T. Hawkins, E. E. Carr, and A. Wellby. An improved smokeless explosive. January 21.

1768. W. Hope. Improvements in gunpowders and explosives. January 24.

1769. W. Hope. Improvements in pellets and grains of gunpowder of any kind. January 24.

2294. J. C. Thompson. Improvements in fuzes for explosive projectiles or shells. January 31.

2575. H. H. Lake.—From Fried. Krupp Grusonwerk. An improved process and apparatus for the manufacture of explosives. February 4.

2725. L. Caucheteur. Composition of a paste intended for matches. February 6.

2924. O. Imray.—From F. C. Glaser. Manufacture of a new gunpowder. February 8.

3023. H. H. Lake.—From Sprengstoff Actien Gesellschaft Carbonit. An improved method of and apparatus for measuring the power or the volume of the gases resulting from the explosion of explosives. February 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6289. W. D. Borland. Explosives. February 5.

12,325. E. Ungania. Manufacture of smokeless powder. February 12.

23,242. R. Weyel. Method of manufacturing explosives for blasting purposes and for use as ammunition. February 19.

24,725. W. Weiffenbach. Manufacture of pyrotechnic compounds. January 29.

PATENT UNCLASSIFIABLE.**APPLICATION.**

2090. G. L. A. Kulemann and J. Baier. A new and improved manufacture of a material suitable as a substitute for whalebone. Complete Specification. January 29.

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

[Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

The Annual General Meeting will be held in London on Wednesday, July 15th next. Full particulars will appear in a subsequent issue.

The prices will be as follows:—

To Members (see Rules 25 and 27) who make application with remittance, not later than June 30, 1896.....	Each copy	5s.
To Members (see Rules 25 and 27) who make later application; Libraries, Corporations, and Exchanges on the Society's List, and Past Members (see Rule 30).....	Each copy	10s.
To Subscribers.....	"	12s. 6d.
To others.....	"	15s.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. EYRE and SPOTTISWOODE, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,000 per month.

MEMORIAL TO THE LATE PROF. HUXLEY, F.R.S.

This Memorial will take the form of a statue to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science, while the surplus will be devoted to the furtherance of biological science. Donations towards the fund should be sent to Mr. G. B. Howes, Hon. Sec. Huxley Memorial Committee, Royal College of Science, South Kensington, S.W.

MEMORIAL TO THE LATE PROF. PASTEUR.

At a meeting of the Provisional Committee of the British Section of the Pasteur International Memorial, held on March 21st last, Sir Joseph Lister in the chair, it was unanimously resolved, "That application be made for subscriptions towards the erection of a monument to Pasteur in Paris from persons in the United Kingdom, India, and the Colonies, interested in science and the various industries which have been benefited by Pasteur's labours." An Executive Committee was formed consisting of Sir Joseph Lister, Sir John Evans, Sir Henry Roseoe, Dr. Thorne Thorne, and Prof. Percy Frankland (Hon. Sec.). Subscriptions may be sent to Sir John Evans, who will act as Hon. Treasurer, at the Royal Society, Burlington House, W.

ADDRESS TO PROF. CANIZZARO.

At a meeting of Council held on the 23rd inst. it was unanimously resolved to present an address of congratulation to Prof. Canizzaro on the attainment of his seventieth year of age, which occurs on July 12th next. The drafting of the address was placed in the hands of the Hon. Foreign Secretary of the Society.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

This Congress will be opened in Paris, possibly at the Hotel "des Agriculteurs de France," on Monday, July 27th next, and will continue for about ten days. All enquiries and adhesions should be addressed to the General Secretary of the Conference, 196, Bd. Magenta, Paris.

LIST OF MEMBERS ELECTED 23rd MARCH 1896.

Andreoli, Gabriel, 147, Coldharbour Lane, London, S.E., Electro-Chemist.
 Barbour, Sam., c/o F. H. Faulding and Co., Adelaide, S. Australia, Manufacturing Chemist.
 Billington, Chas., jr., Wolstanton, Staffordshire, Brass-founder.
 Bird, Jno. B., Minver House, Bateman Street, Cambridge, Manure Manufacturer.
 Brown, Jas., Kimberley Gardens, Bloomfield, Belfast, Ireland, Brewer.
 Burnham, Mather H., Houghton, Lake Superior, Mich., U.S.A., Mining Engineer.
 Clennell, John E., Rand Central Ore Reduction Company, Box 1891, Johannesburg, S.A.R., Analytical Chemist.
 Flammer, E., c/o Dr. Lewkowitzsch, Lancaster Avenue, Fennel Street, Manchester, Manufacturing Chemist.
 Filton-Smith, J., Nerquis, Mold, North Wales, Brewer.
 Gray, Thos., Technical College, 201, George Street, Glasgow, Lecturer in Chemistry.
 Hewitt, J. Theo., Technical Schools, People's Palace, Mile End Road, E., Lecturer.

Littell, Robt. Ballantine, Setanket, Long Island, N.Y., U.S.A., Chemist.
 Lord, Jno. Lloyd, 5, Commercial Buildings, Love Clough, near Rawtenstall, Chemist and Manager.
 Meisel, C. F. A., 44, Strong Place, Brooklyn, N.Y., U.S.A., Chemist.
 Muir, J. Martin, c/o Muir Bros. and Co., Moscow, Russia, Chemical Manufacturer.
 Muir, Wm., 5, Angel Place, Upper Edmonton, Middlesex, Merchant.
 Perkins, Chas. W., 215, Main Street, New Britain, Conn., U.S.A., Chemist and Druggist.
 Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
 Powter, Philip, Champ D'Or French G. M. Company, Lim., Johannesburg, S.A.R., Mining Engineer.
 Prochazka, Br. Geo. A., 138, West 13th Street, New York, U.S.A., Colour Manufacturer.
 Steel, Fred. W., c/o Fiji Sugar Company, Lim., Tamaqua, Navua River, Fiji, Analytical Chemist.
 Stewart, Robt. Patrick, 37, High Street, Linlithgow, N.B., Analytical Chemist.
 Stubbs, Augustus J., 4, Calle de Luchana, Madrid, Spain, Mining Engineer.
 Tutbill, Jos. B. T., Salem Gas Light Company, Salem, Oregon, U.S.A., Chemist.

CHANGES OF ADDRESS.

Allen, A. H., 10 Park Lane; Broomfield Road, Sheffield.
 Brindley, G. F., 10 Oldbury; retain Journals until further notice.
 Brown, Wm., 1/o Queensland; 44, Warwick Street, Sunderland.
 Burnham, J. C.; on it "Gunpowder Factory" from address.
 Claus, C., 1/o Jeffrey Square; 88, Yeldham Road, Hammersmith, W.
 Colquhoun, L.; Journals to Nobel's Explosives Co., Lim., Perranporth, R.S.O., Cornwall.
 Cook, E. M., 10 Park Place; Room 819, 150 Nassau Street, New York, U.S.A.
 Cowper-Coles, S.; Journals to 39, Victoria Street, Westminster, S.W.
 Crawford, D., 60, Holly Avenue, Jesmond; and (Journals) c/o Langdale's Chemical Manure Co., Lim., St. Laurence, Newcastle-on-Tyne.
 Formoy, J. A., 10 Forest Hill; Chestham, Grange Road, Sutton, Surrey.
 Greaves, J. A. R., 10 Grappenhall; Woodlands Park, Timperley, Altrincham.
 Handy, Jas. O.; Journals to 325, Water Street, Pittsburg, Pa., U.S.A.
 Harzer, C. A., 1/o Billiter Street; 79½, Gracechurch Street, E.C.
 Herzmann, Dr. M., 1/o Hetzgasse; c/o Dr. Auerbach, III. Salzgasse 15, Vienna, Austria.
 Holloman, F. R., 10 Plaistow; c/o Tennant's Agency, San Fernando, Trinidad, W.I.
 Hopkins, Gerald V., 10 Antofagasta; Nicholaston House, Penmaen P.O., Swansea.
 Hutton-Moss, F. R.; Journals to Box 722, Johannesburg, S.A.R.
 Jackman, E. J., 10 Stoke Newington; 60, Belgrave Road, Hford, Essex.
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 King, C. M., 1/o Godliman Street; c/o C. D'Oyley Mears, 132, Upper Thames Street, E.C.
 King, Sidney J., 10 47; 49, Arundel Square, Barnsbury, N. Lagerwall, Dr. Ivar, 10 Paris; 3, Princes Street, London, E.C.
 Lascelles, J. H., 10 Calcutta; P.O., Delhi, India.
 Leslie, Hugh M.; Journals to Balaghat Mysore Mines, Lim., Oorgaum, Mysore Prov., South India.
 Lowson, J. G. Flowerdew; Journals to Hollycot, Lasswade, N.B.
 Miller, A. R., 10 Hillhead; Cambuslang, near Glasgow.

Ollerenshaw, S., 1/o St. Helens; 96, Davyhulme Lane, Urmston, Manchester.
 Paine, Standen, 1/o Exchange Street; c/o F. B. Bengier and Co., Lim., Otter Works, Manchester.
 Petty, A., 1/o Upper Clapton; 287, Eglinton Road, Shooters Hill, S.E.
 Philip, Arnold, 1/o Edinburgh; Merchant Venturers' Technical College, Bristol.
 Pilkington, G.; Journals to Old Market Place, Bury, Lancashire.
 Powell, A. Ernest, 1/o Fallowfield; Craigowan, Clarendon Road, Whalley Range, Manchester.
 Rhodes, Jas., 1/o Caldercruix; Beech House, Newtown, via Stockport.
 Sefton-Jones, H., 1/o 31; W. P. Thompson and Co., 322, High Holborn, W.C.
 Smith, Jno. W. (of Mass. Inst. of Technology); Journals to 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A.
 Spiller, Arnold, 1/o Canonbury; Gladstone Villa, Sydney Road, Enfield.
 Towner, Rev. G., 1/o Stratford; 7, Suffolk Terrace, Gordon Road, Southend.
 Veitch-Wilson, J., 1/o Wandsworth Common; Wadhurst, Culverden Road, Balham, S.W.
 Wade, Jno., 1/o London; Wyvenhoe, Purley, Surrey.
 Walker, W. Sloane, 1/o Erith; c/o Walker, Lim., Litherland, near Liverpool.
 Waller, Dr. Elwyn, 1/o Columbia College; 440, First Avenue, New York, U.S.A.
 Warner, H. G., 1/o Wandsworth; 45, Mornington Road, Bow, E.
 Whitehead, Jas., 1/o Huddersfield; Roach Place, Rochdale.
 Williams, Thos., 1/o Birmingham; Tolearne, Wendron, near Helston, Cornwall.

MEMBERS OMITTED FROM LIST.

Gibbs, W. T., Masson P.O., Prov. Quebec, Canada, Manufacturing Chemist.
 Moszczenski, J. von, 121, Wayne Street, Jersey City, N.J., U.S.A., Analytical and Consulting Chemist.
 Small, Evan W., Sunnyside, West Park, Newport, Mon., Director of Technical Instruction.
 Sutherland, Jas., c/o British Aluminium Co., Lim., Larne Harbour, co. Antrim, Ireland, Chemist.

Liverpool Section.

UNIVERSITY COLLEGE, BROWNLOW STREET.

Chairman: G. Schack-Sommer.

Vice-Chairman: Eustace Carey.

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P. Bateson.	E. Scott.
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F. Hurter.	H. Tate, jun.
C. A. Kohn.	A. Watt.
E. K. Mospratt.	

Hon. Treasurer: W. P. Thompson.

Hon. Local Secretary:

T. Lewis Bailey, University College, Liverpool.

SESSION 1895-96.

April 1st, 1896:—

Annual Meeting for Election of Members of Committee.
 Mr. J. Beveridge. "The Wood Cellulose Industry of Scandinavia."

Dr. C. A. Kohn. "A Modified Schrötter Apparatus for the Estimation of Carbonic Acid."

May 6th, 1896.—Mr. W. J. Orsman. "Interaction of Carbonic Oxide and Coal Dust."

Meeting held on Wednesday, March 4th, 1896.

DR. GUSTAF SCHACK-SOMMER IN THE CHAIR.

SORGHUM SUGAR MANUFACTURE IN SPAIN.

BY DR. G. SCHACK-SOMMER.

I HAVE great pleasure in bringing before you samples of sorghum sugar which I have brought with me from Malaga. Sorghum has been grown there for several years past from seed procured from America, and the results obtained have been very satisfactory. The seed is sown at the end of March, or not later than the 15th April. The later it is sown the quicker it will grow, but the plant is smaller and thinner than if sown early. By the middle of September the culms are filled with a juicy and saccharine pith which, if squeezed out, will show a polarisation of about 10 per cent., with a quotient of purity of about 66 per cent.

The saccharine strength, however, increases up to the time of ripeness, when it reaches to a polarisation of 18 per cent. with a quotient of purity of about 82 per cent., and the woody matter is then about 12 per cent. The quotient of purity, however, seems to be deceptive in this case, for the manufacturer, who was kind enough to give me the samples which I am showing you here, obtained only 4½ per cent. of first product and 1 per cent. of second product, altogether 5½ per cent. instead of the 7 or 8 per cent. which might have been expected. The relatively low yield, as explained to me, was due to the abundance of gummy matter in the juice, the extraction of which was impossible for want of proper appliances. As, however, the molasses went to the manufacturer's own distillery, and it pays very well to distil molasses in Spain, I think there is no inducement for exerting skill and spending money on experiments, &c. in order to extract more white sugar, and I therefore, do not ask you to accept the above as a final result of what can be done with sorghum as a source for sugar. Before leaving this subject I must not omit to mention that the same plant that goes to the factory is first stripped of its panicles, which are thickly crowded with a very nutritive grain. The seed tops vary from 15 to 25 per cent. of the total weight of the whole plant. It is an excellent fodder, and is also prepared in various forms for human food. The Earl of Winchelsea is going to sow some of this seed experimentally on his Cable farm this year, and I hope to be able to report upon this trial some time in the autumn.

THE ANALYSIS OF CHROME ORE AND FERRO-CHROMIUM.

BY E. H. SANITER.

In August 1895 I read a paper on the above subject before the Iron and Steel Institute; in December last, Dr. Rideal and Mr. S. Rosenblum read a paper before the London Section of this Society (this Journal, 1895, 1017—1019) on the same subject which is largely devoted to showing that the methods advocated by myself are inefficient, and my theory incorrect. A desire to correct this impression and a modification in the methods will, I hope, be sufficient excuse for bringing before you this paper, a copy of which I have also sent to Dr. Rideal.

The modifications recommended by Dr. Rideal and Mr. J. Rosenblum, owing to the laborious grinding of the materials and the increased time of fusion can only be regarded as a retrograde step so far as speed is concerned.

Of the efficiency of the decomposition attained I am not qualified to speak, not having tested them, and I venture to think that the practical demonstration of my method which I am about to give, on comparatively coarse powders, will convince you that it is unimportant whether Dr. Rideal obtained complete decomposition or not by his method. Before proceeding with the demonstration I will read you the description of the methods.

Estimation of Chromium in Chrome Ore.

Time occupied for analysis: $\frac{3}{4}$ of an hour.

Preparation of the Sample.—The sample is moderately finely ground in an agate mortar.

The Capsule.—A nickel capsule is used. This should not be so heavy as to retard fusion. I find the following dimensions suitable:—2 ins. wide by 1 in. deep, weight about 20 grms.; one capsule at a cost of 1s. 6d. lasts for about 50 fusions.

The Method.—3 grms. sodium peroxide and 0.5 gm. chrome ore are weighed into the capsule and thoroughly mixed. The capsule is now held by means of tongs in a good hot Bunsen flame. As soon as the mass begins to melt, a circular motion is given to the capsule to prevent the chrome ore from settling to the bottom; the fusion and shaking must be continued for about three minutes, when the ore will be completely decomposed. The temperature should be just short of visible red; this will give a very liquid melt.

When the capsule has cooled, it is placed in a large porcelain basin and cold water is put into it, which causes the melt to dissolve rapidly, the basin being required to catch any "spits" which would otherwise be lost.

The capsule and dish are now rinsed into a large beaker; the capsule is again half filled with water, which is heated to boiling, and is thoroughly "conched" and rinsed out. The whole is diluted to about 300 c.c. with hot water and made pink with permanganate of potash. 100 c.c. of dilute hydrochloric acid (1 and 1) are now gradually added and the solution boiled till clear, when 150 c.c. of hot water are added and boiling continued for 10 minutes, by which time all the chlorine is driven off.

The solution, about 500 c.c. in volume, after cooling is titrated with ferrous sulphate and bichromate of potash in the usual manner. In this quantity of solution the nickel salts from the capsule do not interfere with the sharpness of the final point of the titration.

Estimation of Chromium in Ferro-Chromium.

Time occupied for analysis: 1 hour.

Preparation of the Sample.—The ferro-chromium is crushed in a steel-crushing mortar until the whole of the sample passes through a sieve of 10,000 holes to the square inch.

The Method.—4 grms. peroxide of sodium, 0.75 gm. peroxide of barium, and 0.3 to 0.5 gm. of ferro-chromium* are mixed together in a nickel capsule; the process is then carried out exactly as in the case of chrome ore, except that a larger excess of permanganate of potash is added to prevent the peroxide of barium during solution reducing any of the chromate.

[The demonstration was then proceeded with, the result obtained by the time the paper was concluded appearing eminently satisfactory to those present.]

The history of the use of peroxides for this purpose has already been sufficiently discussed in the papers referred to, and I only wish further to remark that neither Donath nor Kinnicent and Patterson used peroxide of sodium with the peroxide of barium.

Dr. Rideal, referring on the first page of his paper to peroxide of sodium in the aqueous solution of the melt, says: "In the numerous analyses of chrome ore, ferro-chromium, and chrome steel we have had occasion to make, we have found that an excess of undecomposed sodium peroxide is in almost all cases present in the aqueous solution of the melt."

This does not agree with my experience when the peroxide is fused at the temperature used by me, and this seems to be confirmed by Dr. Rideal himself, as on turning to the next page we find the following in the description of the process for ferro-chromium:—

"The melt easily dissolves in the hot water, the solution obtained being of a deep purple colour, due to the formation

of the ferrate, which is abundantly formed during the fusion. The solution also contains sodium manganate."

We thus see that in this case, presumably a description of the 10 determinations given below, not only was there no excess of peroxide of sodium, but peroxide of sodium was actually added to decompose the manganate and ferrate.

Dr. Rideal criticises the statement in my former paper that "In dissolving the water solution of the melt sulphuric acid could not be used owing to the presence of barium peroxide, and on attempting to use hydrochloric acid it was found that a considerable quantity of chromate was reduced by it." After deep consideration he has come to the conclusion that I meant something quite different, i.e., chromate of barium, instead of peroxide of barium.

As I still believed my statement to be correct I made the following experiments to place the matter beyond doubt:—

Expt. No. 1.—A known weight of chromate of barium was fused with peroxide of sodium and the water solution of the melt was rapidly filtered and washed twice.

The chromate was then determined in the soluble and insoluble portions as follows:—

	Per Cent.
Insoluble chromate.....	51.8
Soluble	48.2

Only a trace of barium was found in the soluble portion.

We therefore see that barium chromate is actually decomposed to a considerable extent by fusion with peroxide of sodium.

Expt. No. 2.—0.3 gm. ferro-chromium was fused with 0.75 gm. peroxide of barium and 4 grms. peroxide of sodium. The water solution of the melt was filtered and washed twice. The washing was not continued further as it was noticed that the hot water was decomposing the barium peroxide, as shown by the evolution of gas. The chromium was then determined in both portions.

	Per Cent.
Chromium in insoluble portions	6.08
.. soluble ..	56.12
Total	62.20
Chromium present	62.195

Decomposition was quite perfect in three minutes.

This experiment shows that chromate of barium is not formed as suggested by Dr. Rideal, or that if formed to a slight extent it is probably due to the decomposition and solution of the peroxide of barium by the hot water solution, although it is very probable that the chromate found in the water insoluble residue was due to the incomplete washing. This experiment also gives indirect evidence of the presence of peroxide of barium in the residue.

No chlorine was liberated on treating the water insoluble residue with dilute hydrochloric acid, and yet no undecomposed ferro-chromium was found; Dr. Rideal's discovery, that nascent chlorine assists in its solution, is therefore superfluous.

Expt. No. 3.—Similar quantities of ferro-chromium and peroxides as in No. 2 Expt. were fused. The water solution was then boiled for 10 minutes, as directed by Dr. Rideal, to decompose all peroxide of sodium, and diluted to 300 c.c. with hot water, 100 c.c. of dilute hydrochloric acid (1 and 1) were then added and boiling continued; as soon as the solution cleared a further quantity of 150 c.c. of water was added and boiling continued for 10 minutes. After cooling, the solution was titrated in the usual way. Although there was no undecomposed ferro-chromium, it was found that a considerable reduction of the chromate had taken place, as shown below:—

	Per Cent.
Chromium present	62.195
.. found.....	58.750
Showing a reduction of	3.445

This shows that the reduction of chromate can only be due to the action of the hydrochloric acid on the barium peroxide present in the residue, as suggested by Dr. Clark in the discussion on my previous paper.

* I prefer to use such a quantity as will not require more than about 0.6 gm. of iron (in the ferrous state) to reduce the chromate in order to avoid the excessive green colour, which interferes with the titration.

The following analytical results indicate the capabilities of the method :—

Chrome Orc.

	Chromium, per Cent.
Clark's magnesia method	27.40
Stead's tribasic	27.45
Sodium peroxide	27.50

Another sample of chrome ore containing 37.81 per cent. of chromium was completely decomposed in three minutes.

Ferro-Chromium.

	1st Sample.	2nd Sample.
	Chromium, per Cent.	Chromium, per Cent.
Stend's tribasic method.....	26.37	26.93
Sodium and barium peroxide method.....	26.30	26.93, 26.90, 26.96

3rd Sample.

	Chromium, per Cent.
Independent chemists, gravimetric method....	62.25
" " sodium and barium per-	
oxide method.....	62.20
The author, sodium and barium peroxide	
method.....	62.195

In conclusion, I have to thank Mr. T. H. Byrom for his kindness in assisting me with the demonstration this evening.

DISCUSSION.

Dr. S. RIDEAL and Mr. S. ROSENBLUM sent the following comments on the paper:—

In its present form, we should imagine that Mr. Saniter's process can be made to furnish good results, but one must not forget that there are already some 20 or more different processes for the analysis of chrome ores, of which the same may be said. In selecting a standard process from this great variety one must be guided by the consideration: which of the processes affords the greatest economy as to time and work, and is the most logical from a chemical standpoint? As regards the time necessary for the analysis, Mr. Saniter's method leaves nothing to be desired. With respect to the grinding of the material, Mr. Saniter regards our suggestion, that fine grinding is essential, as a retrograde step. We can only repeat what we said in our paper, that we never succeeded in decomposing a moderately finely-ground chrome ore in one fusion, but that sometimes two or three additional fusions were necessary, and that therefore fine grinding was an economy in time. Mr. Saniter's notion of the term moderately fine may be different from ours and, therefore, we will not further insist upon this point.

We cannot understand how Mr. Saniter obtained such good results by his old method, as the undecomposed peroxide of hydrogen must have reduced some of his chromate, a fact which he seems to have overlooked. If as Mr. Saniter contends there is no undecomposed sodium peroxide in the solution of the melt, how is it that in his final modified process he recommends the addition of permanganate of potash and hydrochloric acid? This modification is obviously intended to decompose the sodium peroxide; but it seems to us that it is a longer and more inconvenient method, owing to the presence of chlorine, than the one suggested by us, which consists in boiling the solution for 10 minutes before the addition of acid. We have proved that 10 minutes boiling is sufficient to decompose 1 gram. of sodium peroxide.

We are glad to notice that Mr. Saniter confirms our statement as to the interference of nickel salts in the final point of the titration in his original process, and submit that our method of filtration of the nickel oxide is preferable to that now suggested by him of relying on dilution to obviate this difficulty.

In the analysis of ferro-chrome the addition of barium peroxide is still, in our opinion, useless, and at the same time complicates the process by necessitating the introduction of Stead's process. We would further ask Mr. Saniter

why he preferred hydrochloric acid to sulphuric acid for the solution of undecomposed barium peroxide. This could hardly be due to the interference of barium sulphate in the end titration, as this precipitate is formed in any case in this process by the addition of ferrous sulphate. If the insoluble residue is barium peroxide and not barium chromate, as we suggested, then the addition of acid would liberate hydrogen peroxide, and re-oxidation by Stead's process would become necessary. Again, if barium chromate was absent the barium peroxide could be more conveniently removed by filtration. The reduction, in our opinion, is due, as in the former case, chiefly to the action of the acid upon undecomposed sodium peroxide; and as barium chromate is certainly present in the residue, the addition of hydrochloric acid is necessary for its solution. Although Mr. Saviter has attempted to prove the absence of barium chromate by fusing sodium peroxide with barium chromate, we have proved that barium peroxide fused with sodium chromate is converted into barium chromate, and this is what really takes place in fusing a ferro-chrome with the two peroxides.

When the ferro-chrome was not finely ground we found some of it was left undecomposed after fusion by Mr. Saniter's barium peroxide method, but that when the hydrochloric acid and permanganate was added the chlorine formed brought this into solution. In our paper on this subject this point has been misprinted. We satisfied ourselves that in the barium peroxide process, the chromium exists after fusion in three conditions, viz., sodium chromate, barium chromate, and a small portion of unaltered ferro-chrome (if the substance is not sufficiently finely ground), and we determined their amounts by a method, the details of which can be given. When we add sodium peroxide to decompose the ferrate and manganate formed, we do this in order to ensure a *larger* excess of sodium peroxide, and Mr. Saniter must not conclude that we are ignorant of the fact that it is already present.

Dr. C. A. KOHN asked Mr. Saniter whether the sodium peroxide he used was free from iron. He had found that it contained a considerable amount of iron, and was not available for complete analysis of chrome iron-ore. Also, had Mr. Saniter tried the decomposition of chrome iron-ore electrolytically in presence of caustic potash, and, if so, how did the results obtained compare with those got by the method described.

Mr. G. WATSON GRAY said that in the December number of the Journal he was astonished to find that Dr. Rideal and Mr. Rosenblum mentioned that the higher classes of chrome ore were more troublesome to decompose than the lower. His experience was the reverse. There were samples of the lower qualities that decomposed very readily, and samples of the higher qualities that decomposed equally readily, but the samples that took the most time and patience were probably the lower class chrome ores which were on the market, and the sample mentioned by Mr. Saniter as showing 27.49 per cent. was one of the very worst to decompose.

With regard to the filtering of the manganese, iron, and nickel oxides he had not noticed that their presence was any more objectionable than in the case of testing a manganese ore, where bichromate solution was used. If the solution was too strong it certainly interfered with the clear perception of the final point, but those who were accustomed to make determinations of peroxide or total manganese by means of ferrous sulphate and bichromate were well aware that if the solution was reasonably dilute, there was no trouble in arriving at the final point, and, when a small amount of copper or nickel was present, trustworthy results could readily be obtained: so that to occupy time in filtering off the insoluble oxides of iron, manganese, and nickel appeared to be a great waste of time without any counterbalancing advantage. The amount of nickel that came from the crucible he used was certainly not worth taking into consideration, the crucible having already stood about 100 fusions and being still in good condition.

The method, as given by Mr. Saniter, worked equally satisfactorily in his (Mr. Gray's) hands. When he first used peroxide of sodium (about 12 months ago) he did not get good results, but the failure appeared to be in the

mode of heating, as he then used ore much more finely ground.

The amount of "spits" with the peroxide method did not appear to be more than what he should expect, if he simply used caustic soda. When using Dr. Clark's original method, it was necessary to cover over the dish to prevent loss when dissolving the melt in warm water.

Referring to Dr. Kohn's question about the presence of iron in peroxide of sodium, he (Mr. Gray) had found varying amounts, as well as other impurities, such as silica and phosphorus. He therefore thought it desirable to pass the peroxide through a fine sieve and then estimate the impurities, if it was intended to be used for any other determination than chromium.

Mr. SANITER, in reply to Dr. Kohn, said he had analysed sodium peroxide completely, but could not state from memory how much iron it contained. There was only a small amount of sulphur and silica and a trace of phosphorus. In doing a complete analysis of chrome ore or ferro-chrome, he always did a blank analysis along with it, to check the impurities.

With regard to the electrolytic method he had no experience; these methods were generally too complicated for ordinary use. He was quite in accord with Mr. Gray in finding the richer chrome ores the more readily decomposable; he agreed also that with ferro-chromes, in the lower percentages, the oxide of iron formed impeded the reaction, but nevertheless the method had been found to work perfectly on ferro-chromes containing only 10 per cent. of chromium. He also believed in using two different methods in important cases as a check on each other, when two good methods were available, such as those of Dr. Clark or Mr. Stead.

Dr. Rideal stated that he (Mr. Saniter) had modified the methods; that was true, but the modifications were not vital, the methods as given last year worked perfectly. He found no reduction of chromium, but he considered, when it was pointed out by Dr. Clark in the previous discussion, that an excess of peroxide might sometimes be present, and he therefore modified the method accordingly. Dr. Rideal said that he (Mr. Saniter) confirmed his statement that nickel salts interfered with the final point in the titration. It was a well-known fact that nickel salts interfered in concentrated solutions, and for that reason he had always worked with a dilute solution as stated. In preference to simple dilution Dr. Rideal preferred a tedious filtration and washing. It was quite possible that with the prolonged fusion (15 minutes) recommended by Dr. Rideal so much nickel might be obtained from the crucible as to render filtration absolutely necessary.

Dr. Rideal after suggesting a reason, which proved to be incorrect, as to why sulphuric acid could not be used to dissolve the water insoluble residue of the melt containing barium peroxide, now asked for an explanation; he (Mr. Saniter) would give him the facts; the sulphuric acid would not dissolve the water insoluble residue, the reason for which was sufficiently explained by the experiments detailed. Dr. Rideal still doubted the presence of peroxide of barium in the melt, but that also he considered conclusively proved by the experiments in the paper; further, by fusing sodium chromate and barium peroxide together it was attempted to prove that chromate of barium was formed during the decomposition of ferro-chrome; some chromate of barium may have been obtained under the conditions of the experiment, because most reactions were reversible by reversing the relative quantities of the reacting materials or omitting one, as in the present case, no peroxide of sodium being present, which is used in large excess during the fusion.

Dr. Rideal also stated that he had found a portion of the ferro-chrome to be dissolved by the chlorine liberated. In the first place, it seemed a matter of relatively small importance whether the solution was effected by chlorine or otherwise, so long as all the chromium was obtained in solution in the form of chromate. But putting that aside, the statement was so interesting that he had made an experiment to see if he could dissolve ferro-chromium in this way with nascent chlorine. Finely powdered ferro-chromium was mixed with a large excess of

permanganate of potash crystals and excess of hydrochloric acid was added; it was found, however, that under these conditions no more chromium was dissolved than with hydrochloric acid alone. He might say with regard to the method itself, that during the last five or six days they had tested 25 samples of ferro-chrome coming in in the ordinary course of daily work. These had varied from 11 to 33 per cent. of chromium, and in no case had there been any difficulty. Only yesterday a sample of ferro-chrome was taken, pounded, and analysed in three-quarters of an hour.

Manchester Section.

ROOMS OF THE CHEMICAL CLUB, VICTORIA HOTEL.

Chairman: George E. Davis.

Vice-Chairman: Peter Hart.

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R. Forbes Carpenter.
R. S. Dale,
C. Dreyfus.
H. Grimshaw.
J. M. Irving.

M. J. Langdon,
I. Levinstein.
W. H. Perkin, jun.
Sir H. E. Roscoe.
E. Schneck.
W. Thomson.

Hon. Local Secretary:

J. Carter Bell.

Bank House, The Cliff, Higher Broughton, Manchester.

Meeting held Friday, February 7th, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

RECENT DEVELOPMENTS IN THE MANUFACTURE OF CHLORATES.

BY J. GROSSMANN, PH.D.

On the 9th January 1882, the late Walter Weldon published a paper entitled "On some Recent Improvements on Industrial Processes," in which he completed the history of the manufacture of chlorates up to that date. He there gives first a history of the origin of the chlorate of soda industry, and then proceeds to give an account of the methods patented by Mr. Pechiney, of Salindres, for its manufacture; he also incidentally mentions that a certain amount of danger attaches to the attempts which have been made to utilise the mother-liquor from chlorate of potash by treating it with hydrochloric acid. He further gives an account of the process of separating calcium chloride from calcium chlorate by the action of cold, as designed by Mr. Pechiney. But his account, as far as these points are concerned, is really an account of the development of these industrial processes in France; and as the most important of them, that of manufacturing chlorate of soda, originated to the best of my knowledge in England, though I have no doubt that Mr. Pechiney discovered it quite independently, I will first give an account of my work on that salt as carried out between the years 1876 and 1878.

Early in 1876, when I was chemist to Messrs. Jos. C. Gamble and Son, of St. Helens, I received from them samples of chlorate of soda such as were then in the market, and instructions to try and find a method for manufacturing these articles. On examining the samples I came to the conclusion that they were made from chlorate of potash by two processes, viz., by the action of tartaric or silico-fluoric acid. As the price was then about 2s. 6d. per lb., I saw a liberal margin even for the tartaric acid process, and worked this process out, recovering the tartaric acid and bringing the cost to somewhere about 1s. per lb. Unfortunately by that time the price of chlorate of soda had gone down to 1s. 6d. or 1s. 9d. per lb., with a prospect of further reduction if any more were thrown on the market. In 1877, Colonel Gamble, the head of the firm, suggested

that I should try whether, on boiling down a mixture of salt and sodium chlorate in solution, the salt would separate out. On making this experiment I found that the salt did actually separate out, and it then became only a matter of detail to establish the manufacture of chlorate of soda from crude chlorate eistern liquor. I precipitated the latter by carbonate of soda, and boiled down, fishing out the salt and crystallising the chlorate of soda from the mother-liquor. It may be of interest to give a description of an operation as carried on in 1878 and copied out from the laboratory book of the Gerard's Bridge Works.

A chlorate eistern was finished without muriates. It was 27½ Tw., and contained per cb. ft.—

Cl as chlorate.....	Oz.
„ chloride.....	14.92
	83.70
	98.62

The proportion of chlorine as chlorate to chlorine as chloride is as 1 to 5.6.

45 lb. of crystallised soda of 98 per cent. $\text{Na}_2\text{CO}_3 + 10\text{Aq}$ were dissolved in water, and the above liquor added to it until only little sodium carbonate was in excess, while steam was passed through and the mixture well stirred. It took about 130 lb. of the chlorate eistern liquor = 1.8 cb. ft. The precipitate of carbonate of lime was dense and settled well. The liquor after settling was drawn off. It was 11½ Tw. cold, and contained per cb. ft.—

Cl as chlorate.....	Oz.
„ chloride.....	7.33
	42.30
	50.23

The proportion of Cl as chlorate to Cl as chloride is now as 1 to 5.85. The quantity of chloride has increased owing to the salt present in the soda crystals. The liquor now occupied 3.7 cb. ft., and contained per cb. ft.—

Chlorate of soda.....	Oz.
Sodium chloride.....	22.70
	70.7

The precipitate of carbonate of lime was washed twice. The first wash-water was 4 Tw., and contained 6.55 oz. Na per cb. ft. The second wash-water was 1 Tw., and contained 1.07 oz. per cb. ft.

All the liquors were mixed together and boiled down in a pot with a steam jacket. When about 48 Tw. (hot), salt begins to fall out. When about 62 Tw. hot (= 69 Tw. cold), the liquor contained per cb. ft.—

NaClO_3	Oz.
NaCl	330.5
	385.0

When about 72 Tw. hot (= 80 Tw. cold), it contained per cb. ft.—

NaClO_3	Oz.
NaCl	420.0
	192.0

The liquor was then boiled down further in the laboratory, filtered, and put away for crystallising. The fished salt was repeatedly extracted with water and the liquor therefrom evaporated to crystallisation. In this way I got—

41.2 oz. crystals of 96 per cent. NaClO_3	Oz.
In the mother-liquor from these.....	38.70
„ rough salt.....	9.59
„ liquor from rough salt.....	4.56
„ salt, second quality.....	3.32
„ „ first quality.....	6.48
„ washings.....	1.88
	1.85
	66.38

Calculated.....	79.50 oz.
Therefore loss.....	16.5 per cent.
Yield.....	83.5 „

The mother-liquor has always very much the same composition. It is about 80 Tw. and contains per cb. ft. about 400 oz. chlorate of soda and from 120 to 160 oz. sodium chloride.

The crystals slightly washed, and not well, dried contain—

NaClO_3	Per Cent.
NaCl	93.86
Moisture by difference.....	3.40
	2.74
	100.00

and a little sulphate and carbonate of soda, but no iron lead, or tin.

The liquors were in this experiment evaporated more slowly than in previous experiments. Some of the salt was a little coarser, but not sufficient to make any difference in the washing out of the salt.

These experiments were finished early in 1879, and I then had also accounted for the loss of 16½ per cent. and satisfied myself that on a large scale the yield would almost be theoretical, and that on re-crystallising the crude crystals very pure NaClO_3 could be obtained, as the following analysis will show:—

NaCl	Per Cent.
Moisture.....	0.03
NaClO_3	0.34
	99.63
	100.00

It was then that Col. Gamble's great experience and technical knowledge gave the real practical finishing touch to the work. He suggested that instead of carbonate of soda, I should use salt-cake for decomposing the chlorate liquors, and this being found to work satisfactorily, Messrs. Jos. C. Gamble proceeded to erect a plant for the manufacture of one ton of chlorate of soda per week at their Hardshaw Brook Works in St. Helens. The question was at that time discussed whether a patent for this process should be taken out, but it was decided not to do so.

In 1881 Mr. Pechiney took out an English patent for that identical process. As Messrs. Gamble had then already been working the process for some time, Mr. Pechiney's patent was practically void. Still it had the effect of making the process known to all, and I am not surprised that under these circumstances Messrs. Gamble, as I am informed, paid Mr. Pechiney a royalty, and thus practically acknowledged his patent. I have never inquired into their reasons for doing so, but from the context it only appears to me a further illustration of that wonderful combination of a sound knowledge of chemistry, engineering, and business methods which have justly raised Col. Gamble to the high position amongst technologists which he so worthily occupies.

It may be interesting to mention that whereas for the first 12 months it seemed almost impossible to sell as much as 50 or even 25 tons per annum, the production in this country at the present date by this process alone is about 500 tons per annum, besides what is made by the magnesium process to be mentioned further on.

I now come more particularly to my own work on chlorates in connection with chlorate of baryta. When I had finished my experiments on chlorate of soda, it occurred to me that it might be possible that a mixture of barium chloride and sodium chlorate in solution would decompose on boiling down in such a manner that salt would separate out, and chlorate of baryta would predominate in the mother-liquor. A small experiment satisfied me that this reaction did take place. I then made a number of experiments on a larger scale: the salt which separated was fished out and washed, the liquor filtered hot and left to crystallise; the first crystallisation yielded crystals which contained 72 per cent. of barium chlorate. On re-crystallising these twice, pure crystals containing only 0.025 per cent. NaCl were obtained. From an entry in the old laboratory book I find that in March 1881, I had established that the composition of the crystals of chlorate of baryta was $\text{Ba}(\text{ClO}_3)_2 \cdot 11\text{H}_2\text{O}$, a matter on which the text-books seemed to be doubtful up to then. A plant was put up at Gerard's Bridge in 1881 for the manufacture of chlorate of baryta. The plant and process have since passed over to the United Alkali Co., who are still carrying it on. The process was not patented, and it is an extraordinary thing, reflecting

great credit on the many chemists who must have been connected with it, that this process has been working for 15 years without becoming known; it was only brought before the public four months ago in the opening address of our Chairman, Mr. Davis. The production of chlorate of baryta in this country by my process amounts to about 30 tons per annum. Its use is almost entirely pyrotechnical, a small quantity being used for making other chlorates in solution, by decomposition with different sulphates.

I next directed my attention to the manufacture of chlorate of ammonium. Before making experiments upon this substance I went to see my friend the late Prof. Schorlemmer in Manchester, but found that even he, whose knowledge was phenomenal, could give me no further information than what was contained in the text-books, viz., that it was likely to be explosive. An experiment made on the small scale showed that on boiling down a mixed solution of ammonium chloride and sodium chlorate, sodium chloride separated out. I then made an experiment on a larger scale; the solution of sodium chlorate and ammonium chloride was boiled down in a steam-jacketed enamelled pan, the salt was fished out, and the hot concentrated solution filtered. I thus, on cooling, obtained a large crop of crystals of ammonium chlorate, NH_4ClO_3 (about 30 lb.); this was well drained, and, for fear of accidents, I placed it in an iron pot and carried it myself into a large empty shed. But within 24 hours it exploded with great violence, knocking a large hole into the bottom of the iron pot. This finished my experiments on chlorate of ammonium, which, but for the unfortunate property of exploding at the wrong time, might be a very useful article in the manufacture of explosives. It is a very curious fact that, of two samples which I took at the same time and placed in sealed bottles, one exploded about six months later, and the other may not have exploded yet, as I have never heard any more about it.

This brings us to the beginning of 1882, when I left Messrs. Gamble to commence business on my own account in an entirely different direction; but before giving a short account of what progress has been made since then in the manufacture of chlorates, I will refer again to the remark made by Mr. Weldon that a certain amount of danger attaches to the process of treating the mother-liquor from chlorate of potash with hydrochloric acid. I had made a number of experiments as early as September 1876 on the laboratory scale, and found that if the mother-liquor is run into the acid and steam passed through at the same time, there is not the slightest danger in this process, and I obtained bleaching powder testing 35.7 by it. I repeated these experiments on a large scale in a Weldon's still, and worked a number of operations, being all the time either in the still-house or on the top of the still. The evolution of chlorine was quite regular, and there was no sign of any explosion. I am particular in mentioning this, as there are so many erroneous statements unfortunately found in our literature, copied from one book to another for generations by the gentlemen who make it their business to write books, that I consider it the duty of every chemist to correct such statements whenever he has the opportunity to do so.

There is nothing to record in the year 1882, except that a patent was taken out by T. W. Bottomley and R. F. S. Molesworth (this Journal, 1882, 67) to make chlorate of soda from chlorate of potash or from crude chlorate of lime liquors by decomposing them with bitartrate of soda. As by that time chlorate of soda was below 1s. per pound, it is not likely that the patentees made a large fortune out of that patent. In 1883 a remarkable patent was taken out by W. Weldon (Eng. Pat. 99) ; it related to, viz.:—"Improvement for the recovery of sulphur from alkali waste." At that time Mr. Weldon was greatly enamoured with Schaffner and Helbig's process, which consists in boiling alkali waste with chloride of magnesium. In order to get magnesium chloride cheap, he proposed—for the first time, as far as I know—to use milk of magnesia instead of lime for the manufacture of the crude chlorate liquors, to crystallise out the chlorate of potash in the usual way, and to use the mother liquors for the evolution of sulphuretted hydrogen from alkali waste. It is extraordinary that a man of Mr. Weldon's experience should have been carried

away by his anxiety to obtain magnesium chloride in solution for the express purpose of Schaffner and Helbig's process so far as to have entirely overlooked the advantages which might be derived from this process for the manufacture of chlorates. At that time Schaffner and Helbig's process must have shown distinct signs of failure: in any case Mr. Weldon did not proceed with the patent. On the 31st October of the same year, however, Messrs. E. K. Muspratt and G. Eichelmann took out an almost identical patent for the express purpose of making chlorates; that is, they proposed to pass chlorine gas through magnesia suspended in water. The chlorate which remained in the mother-liquors was to be liberated by hydrochloric acid, and magnesium chloride and chlorate of potash were thus to be made as it were in one operation. There can be no doubt that this process constitutes one of the greatest improvements that have been made in the manufacture of chlorates, although it has the inevitable objection which all processes have, by which two articles are made at the same time, viz., that it is impossible to determine the exact cost price of each. Moreover, to a certain extent the production of chlorates would have to be regulated by the ability to sell the resulting magnesium chloride. By a further patent taken at the same date the same inventors apply that process to the manufacture of chlorate of soda, decomposing the crude chlorate of magnesium liquor by carbonate of soda or caustic soda.

In a previous patent, August 15th, the chloride of magnesium was re-converted by evaporating the mother-liquors and heating. In 1884, on April 5th, a patent was taken out by J. Wilson, Berwick-on-Tweed (Eng. Pat. 5975), for passing chlorine through a mixture of magnesia and chloride of potassium, and for recovering chlorine, hydrochloric acid, and magnesia by evaporating the resulting mother-liquors and heating them in a muffle furnace. I may briefly mention that in 1885, at the International Inventions Exhibition in London, Messrs. J. Muspratt and Sons exhibited for the first time in this country potassium chlorate and sodium chlorate made by the magnesium process; and Messrs. Gamble exhibited chlorate of soda and chlorate of baryta made by my process.

In 1886, November 6th (Eng. Pat. 14,344), Mr. J. W. Kynaston obtained a patent by which he proposed to remove part of the calcium chloride in the chlorate of potash mother-liquors by boiling the latter with lime. An oxychloride is formed, which crystallises out on cooling, and which he claims to be a very stable compound when suspended in a solution of calcium chloride. I had made similar experiments while at Messrs. Gamble's works, but the results which I got were never satisfactory, and I am afraid Mr. Kynaston has not been able to overcome the difficulties either, as to the best of my knowledge the process is not in use anywhere. In 1887, June 8th (Eng. Pat. 8217), G. H. Bolton, J. R. Wyld, and H. Auer took out a patent entitled "Improvements in or relating to the manufacture of permanganate of soda, or of a mixture of the same with other disinfecting or oxidising matters." They proposed to use chlorine for the purpose of converting potassium manganate into permanganate; chlorate is formed at the same time, and the two salts are to be separated by evaporation and crystallisation. The same inventors took out another patent on July 13th, 1888, entitled "Improvements in the manufacture of permanganates and chlorates," by which they treat a solution of manganate of soda with chlorine, and thus got a mixture of sodium permanganate, chlorate, and chloride in solution, which they evaporate to about 90° Tw. They then add potassium chloride almost equivalent in quantity to the sodium permanganate, and on letting the solution cool permanganate of potash crystallises out. The mother-liquor is further concentrated to 130° Tw., when more sodium chloride can be fished out, and the liquor will yield another crop of permanganate crystals. The mother-liquor from this is treated with sulphuretted hydrogen or a soluble sulphide to remove the manganese, and then contains a mixture of chlorate and chloride of soda, which can be worked up into chlorate of potash or chlorate of soda as required.

On 20th October 1888 (Eng. Pat. 15,097), a patent was taken out by J. R. Wyld, M. J. Hamill, and H. Auer,

entitled "Improvements in or appertaining to the separation of chlorate of potash or magnesium or other similar salt in mother-liquor from solutions thereof."

The purpose of this patent is to subject the mother-liquors from the manufacture of potassium chlorate, in which from 15—20 per cent. of the chlorate is lost, in a suitable apparatus to the action of cold, when about two-thirds of the chlorate in solution will be crystallised out, and can be recovered. This, no doubt, is one of the greatest advances made within the last 10 years in the manufacture of chlorates, but as Mr. M. J. Hammill has given a full description of it in this Journal, March 30th, 1889, it is not necessary for me to enter any further into the details of it. The process is worked very satisfactorily by the United Alkali Company, in St. Helens. On the 16th February 1887 (Eng. Pat. 2786), a patent was taken by Messrs. E. K. Muspratt and G. Eschelmann for "Improvement in the manufacture of chlorates, and the magnesium hydrate suitable for use therein." They propose in this patent to use magnesium hydrate in preference to magnesia, and describe the way in which to prepare the hydrate. On the 16th October 1889 (Eng. Pat. 16,460), D. Gamble, St. Helens, patented as a communication from A. R. Pechiney, Salindres, "Improvements in the manufacture of chlorate of soda." This patent consists in mixing salt-cake, lime, and water, and passing chlorine through the mixture, thus really doing in one operation what had been done in two operations up till then.

On the 19th May 1893 (Eng. Pat. 10,053), A. J. Boulton, London, patented, as a communication from A. Nieske, of Dresden, "Improvements in or relating to the manufacture of chlorates." He mixes the "octagon" liquors with chloride of potassium and then adds sufficient salt-cake to decompose all calcium chloride. He evaporates, fishes out the salt, and crystallises the chlorate of potash from the concentrated solution. There is a guileless remark in that patent, that if it be intended to make chlorate of soda, the chloride of potassium is not to be mixed with the "octagon" liquors; but where in that case the difference comes in between this method and the one worked out in St. Helens, and which Pechiney patented in 1881, is more than I can understand. He also proposes to treat strontium or barium hydrates with chlorine, and convert these into chlorate of potash and chlorate of soda; but neither of these processes are likely to be used much in the near future, nor does the patent appear to me to be particularly strong. A patent was taken out by K. J. Bayer (Eng. Pat. 17,978) under the title of "Improvement in the manufacture of potassium chlorate," the object of which is to recover chlorine lost as calcium chloride in the manufacture of potassium chlorate; and for this purpose oxide of zinc is used instead of lime. Three equivalents of oxide of zinc are mixed with one equivalent of potassium chloride and heated to 98° C. with a suitable quantity of water; chlorine is then admitted. Potassium chlorate crystallises out on cooling. After decantation, the mother-liquor is evaporated to about 60° B., when on cooling a further quantity of potassium chlorate is obtained. Finally, the mother-liquor is evaporated to dryness, with addition of a little hydrochloric acid to decompose any traces of chlorate.

There are two patents relating to the manufacture of potassium chlorate and sodium chlorate from their respective carbonates. The first of these patents, taken out by J. Hargreaves, of Farnworth-in-Widnes, and Thomas Bird, of Cressington (Eng. Pat. 18,526), is entitled "Improvements in the manufacture of chlorates of sodium and potassium." The chlorate is made by passing chlorine into a solution of caustic soda, sodium carbonate, or bicarbonate. The absorbing vessels are specially constructed with agitators. The gas is passed through these, so that the gas enters where the conversion into chlorate is almost completed. During the reaction sodium chloride is deposited, and, where sodium carbonate is used, some bicarbonate. To render all the soda available, agitators are employed. To separate the chlorate from the salt, the contents of the absorber are run off into a filter or centrifugal, steam in either case being forced downwards through the residual mass of chloride. The solution so obtained is evaporated to a strength of 100°—120° Tw. and run into crystallisers.

When the chlorine has to be aspirated through the absorbers by an exhaustor, the exit gases are passed over soda or other suitable medium to remove all traces of chlorine gas that may have passed away unabsorbed.

According to the other patent taken out by T. T. Best and J. Brock, Liverpool (Eng. Pat. 19,189), entitled "Improvements in the manufacture of chlorate of soda," chlorine, preferably diluted by inert gases, is passed into a concentrated solution of sodium carbonate to saturation. The process is preferably conducted at ordinary temperature, and should not rise above 100° F. The cleared solution is concentrated to cause sodium chlorate to salt out, and it is then set to crystallise.

It is evident from the last two patents that the minds of those connected with the manufacture of chlorate are now working again in the direction of using sodium carbonate for the purpose. I must confess that I cannot see any economy in these patents, even if they were taken out for getting rid of unsaleable weak soda ash. Considering that there are practically six equivalents of salt formed for every equivalent of chlorate, I cannot help looking upon these patents as a very expensive method of making salt. In conclusion, I may say that I have not touched in any way upon the electrical methods used for the production of chlorates, as there is at present too little known of them to enable me to give a satisfactory report.

DISCUSSION.

Mr. GRIMSHAW: With regard to the attempt to use zinc oxide instead of calcium oxychloride, Dr. Grossmann did not say whether it was proposed to pass the chlorine into water, leaving the chlorate behind, or whether it was left for someone else to try this process, in which case they would require to be pretty well guarded, as the explosion took place at or near the surface of the liquid, and it was surprising the force which was produced. He endorsed Dr. Grossmann's views as to calcium oxychloride. It was a remarkably suitable compound so long as it was immersed in the mother-liquor, and it was very easily crystallised, but the crystals soon decomposed on coming in contact with the air.

The CHAIRMAN said it was very enjoyable to hear how chemists had gone through fire and water in making these compounds on a large scale. Just before Dr. Grossmann commenced manufacturing them, a certain firm in London started to make chlorate of ammonia, and they proceeded to boil down this liquor in steam-jacketed pans, which resulted in the demolition of the buildings in which the operations were conducted. In this case they did not produce the crystals, whereas Dr. Grossmann had got the crystals, and the explosion followed. With reference to Dr. Grossmann's statement as to using up all the rough chlorate mother-liquors, in his (Mr. Davis's) time at St. Helens these mother-liquors were used up by running them into the acid and passing them into the chamber with a weak bleaching powder, and then taken to the chlorate pipkins and finished off. They soon found it was not safe to continue this process, and the heavy top-stones were removed.

Dr. GROSSMAN, in reply to Mr. Hart, said that Mr. Gamble commenced the chlorate of potash process at St. Helens in 1848. It was considered at the time to be a most unsaleable article—about half a ton a week was made. It could not be made at the price—half a crown a pound. Fifteen years ago a large firm of match makers in this country used five tons a week of chlorate of potash, and they were using considerably more at the present time. In reply to Mr. Grimshaw's remarks about zinc oxide, he had no further information about the process than what was set forth in the specification; and he should think it very unlikely from the properties of zinc chloride, and from the way in which it behaved in boiling down, that the yield would be very great. With reference to the Chairman's remarks as to the explosions in London, he was not aware that anyone had worked at the process at the same time.

Meeting held Friday, March 6th, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

ON DESTRUCTORS FOR CONSUMING TOWN REFUSE—THEIR REQUIREMENTS, DEFECTS, AND MODES OF IMPROVEMENT.

BY STEVENSON MACADAM, F.I.D., F.R.S.E., F.I.C., F.C.S., ETC.

THE subject of destructors for consuming the refuse of towns has, in recent years, assumed much importance, owing to an increasing difficulty in getting quit of house-garbage, shop-sweepings, and other offensive matters, all as comprehended under the general title of Police Manure.

The difficulty has arisen partly from a change in the character of the manure. Previously much faecal matter or night-soil was incorporated with the material, but the water-carriage system so largely adopted in cities such as Edinburgh, and the pail system used in many parts of cities and towns in England, have withdrawn much of what was of fair fertilising properties, and have necessarily left the remainder of less manurial value.

Attempts have been made to meet the difficulty of disposal of the material by acquiring the right to old quarries and dis-used brickfields, and depositing the refuse there; but such accumulations of putrescent matter have resulted in being a nuisance alike to the atmosphere in the neighbourhood and to the water drainage from such localities. The authorities of populous places have therefore had to face the necessity of providing other outlets or means of disposal.

The employment of destructors for the purpose is comparatively of modern date, as it was only in 1876—20 years ago—that the first destructor was systematically employed for the treatment of town refuse, and for reducing it to an innocuous residue.

Simultaneously, attempts were made by a process of sorting and sieving the refuse, to deal with it in a satisfactory manner—using the finer portions for compounding a manure with night-soil, fish-remains, &c., and otherwise by classifying the remainder and partially consuming it. But whilst such a mechanical process was somewhat successful as a stage in the operations, and is still kept up in a few places, yet there has been of recent years, and still is, a general agreement of opinion amongst all those who have considered the subject, that the most satisfactory results in dealing with town refuse must be looked for in the treatment of it in well-constructed and well-worked destructors.

The general nature of town refuse collected in populous places is much the same in quality. The main part consists of the contents of ash-buckets, including cinders, coal ashes, refuse vegetables, tea leaves, fish cleanings, and bones, animal debris of all kinds, dead dogs, cats, rats, &c.—not to speak of old tin cans, broken crockery, &c.; then we have the contents of shop buckets, including floor sweepings, cinders, and coal ashes, waste papers, &c.; and further, from certain shops and markets there are putrid meat and fish, decaying fruit, &c., &c. All of these materials, with a little selection and withdrawal of occasional pots and pans, broken fenders, aerated water and other bottles, must be disposed of in the destructor.

Now a good working destructor must be prepared to consume all the organic part of town refuse under three conditions:—

1st. That the inflaming part of the refuse shall be burned into non-smelling and practically innocuous gases;

2nd. That a good cinder shall then be obtained, which will continue to burn and glow, without evolving foul gases; and

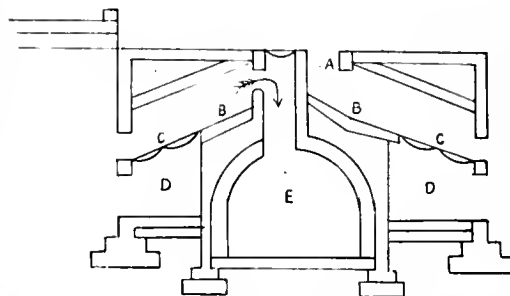
3rd. That ultimately a hard, vitreous, or glassy residue shall be obtained, commonly known as clinker, which will be practically non-smelling, and which may be utilised for road making and in cement making.

These conditions necessarily require to be supplemented by the arrestment of all escaping dust by careful working of the destructor proper, and by providing efficient dust chambers for the temporary lodgment of the finer dust.

When all these conditions are properly fulfilled, the refuse from towns may be consumed in destructors without becoming a nuisance to the neighbourhood, either as to smell or dust. These satisfactory results have been attempted in several forms of destructors.

The Fryer's destructor, Fig. 1, was practically the earliest in

Fig. 1.



A, Feed-hole; B, dead hearth; C, fire-bar grating; D, ashpit; and E, main flue to chimney.

use, and the larger number of destructors in operation in the Kingdom are on this plan. Each cell or furnace has a fire-bar grating of 5 by 5 feet, with a dead fire-clay hearth behind of 4 by 5 feet, making altogether a cell area of 9 by 5 feet. The fire-bars have an upward slope from the front towards the back of 1 in 3. When each cell or furnace is properly started, the town refuse is dropped in by a feed opening right down on the dead hearth, where it may lie for a time drying and stewing. It is then raked forward over the cinder on the fire-bars, and active combustion of the lighter parts at once ensues, whilst stewing and combustion of the heavier parts also takes place. The products of combustion, as well as those of stewing, go out at the back of the cell or furnace quite near the feed opening, and pass into the main flue without being brought over the hotter part of the hearth, where the red-hot cinder lies. In the re-charging of each cell with more refuse, the stuff again falls on the dead hearth, and, whilst there, the drying and stewing vapours are at once carried out by the back into the main flue, and are not brought over the hotter part of the cell or furnace. It follows, therefore, that there is ample opportunity afforded for imperfectly consumed gases to escape unburned into the main flue, from which, unless the temperature there is very high, they must escape to the chimney and hence into the atmosphere of the neighbourhood. My observations on the Fryer's destructors in actual operation have not led me to the conclusion that, under ordinary care and attention, they can be worked satisfactorily. Indeed, at only one station, viz., at Whitechapel in London, did I see this destructor fulfilling all the conditions of a destructor, and the success there was mainly due to the apparatus being under the constant charge of skilled stokers and under high-class supervision.

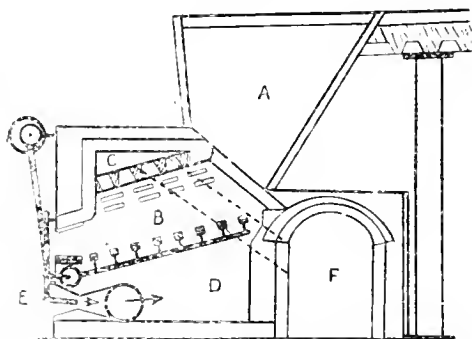
In the Fryer's destructor proper, the supply of air to the cells or furnaces is entirely determined by the draught in the chimney stalk necessarily causing a suction of the air through the burning refuse matter. There is no forced draught of any kind under the fire-bars, and the ashpits are quite open. The general result of working this destructor, therefore, is that the heats are not sufficient for fully dealing with the combustion of the refuse. There is a tendency for foul-smelling gases to pass away unconsumed; for the cinder stage to be only a dull red-heat, and for the clinkering of the residue to be imperfect. I have seen the stuff dragged out of this destructor in an inflaming condition, and the cinder and clinker still glowing and burning, and evolving organic and sulphur gases most abundantly, rendering the atmosphere quite suffocating and nauseous, whilst the fine dust was being blown about all around and over into neighbouring properties.

The imperfectly burned gases leaving the Fryer's cell, and going by the main flue to the chimney, are supposed to be consumed in the main flue, but unless the temperature there is a full red heat, about 1,500° F., these gases cannot

be properly burned there. As I have often seen the main flue at a black-red heat, not above $1,000^{\circ}\text{F.}$, it was impossible that the organic gases could be rendered innocuous. The deficiency has apparently been admitted at several stations by the construction in the main flue, between the cells and the chimney, of a cremator where coke is being burned, and the gases travel over the bed of red-hot coke, and are there consumed. In this way the admittedly imperfect combustion of the refuse products in the cells is met by the use of a cremator, which requires extra labour, and involves additional cost in fuel.

In the Horsfall destructor, Fig. 2, there are two important

Fig. 2.



A, Hopper feeder, generally dispensed with; B, fire-bar grating; C, escape service flue at front; D, ashpit; E, steam air-blast; and F, main flue to chimney.

improvements, and both conducing to more perfect combustion. First, whilst the cells are fed from behind, the escaping gases and vapours pass away from the cells near the front of the furnace; and second, that a steam-air blast is introduced below the fire-grate in a closed ashpit, which admits of a forced air draught being sent through the burning refuse.

The first of these improvements is carried out by providing a number of openings in the side wall and roof near the front of each cell, which communicate directly with a branch or service flue leading to the main flue, and through which all the burned gases and escaping vapours must leave the cell, and ultimately pass to the chimney stalk. As each cell is fed from behind, either by a hopper, or as generally practised, through a back-feed opening, it necessarily follows that any stewing process which may occur when the refuse is freshly thrown in, takes place at the back of the furnace, away from the outlet flue, and that vapours produced at the back of the hearth must pass over the whole bed of material lying on the hearth before they escape at the front part of the cell.

In principle, therefore, the Horsfall destructor cell should do the work of more fully burning the refuse gases than in cells where the feeding of the refuse and the escaping gases and vapours take place at the same end of the cell; but for practical working, and having regard to the raking forward of the fresh refuse over the whole available hearth, it does follow that there is too little glowing hearth over which the organic smelling vapours are compelled to pass, to admit of the regular and efficient raising in temperature and combustion of the whole into non-smelling and innocuous gases.

The second improvement, consisting of the steam-air blast, is not only of great service in admitting of a full draught of air permeating the fire-bars and quickly raising the temperature of the refuse debris on the fire-bar grating beyond what is possible by mere chimney-draught; but, in addition thereto, the steam, in passing through the glowing carbonaceous cinders, becomes broken up and yields two highly combustible gases, viz., hydrogen and carbonic oxide, and such being afterwards burned in the atmosphere of the cells and in the service and main flues, most materially assist in raising the temperature and in consuming the noxious-smelling gases evolved from the fresh or non-charred town refuse, and aiding in these being changed into innocuous and non-smelling gases.

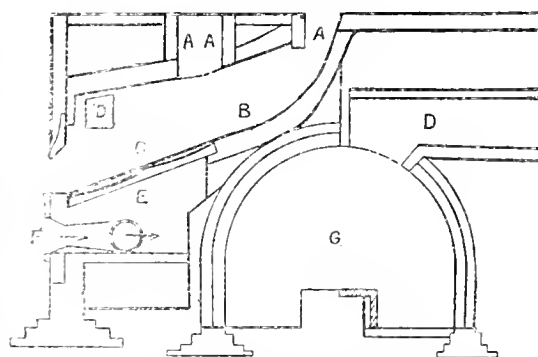
Difficulties, however, do arise in working the Horsfall destructor, owing to the closing up of the comparatively small escape openings leading into the escape service flue, which is due to partial fusion of the brickwork at the high temperature and the adhesion of dust particles to the sides of the openings. The result is the reduction of the openings and draught, and the lessening of the power of the destructor, until the apparatus has been thrown out of work for repairs. Even when working properly, each cell is independent of every other cell, and if any heavy charge of green stuff be thrown in, the temperature of the cell may become materially lowered, so as to admit of foul-smelling gases passing away unconsumed for a time.

The Bradford and Leeds destructors were originally Fryer's, but they did not work satisfactorily. The temperature obtained by the chimney draught was too low for the proper combustion of the smelling gases, either in the cells or in the main flues. The results were that complaints were made of the existence of a nuisance. At both places, alterations were made in the destructor by closing in the ashpit and admitting the air by steam air-blasts into the closed ashpit, and thence by forced draught through the fire-bars and refuse burning thereon.

This improvement at once brought up the temperature in the flues from a barely visible red, about $1,000^{\circ}\text{F.}$, which it was previously, to a cherry-red heat, $1,500^{\circ}$ to $1,600^{\circ}\text{F.}$, and even higher. I have personally seen the pyrometer showing fully $1,500^{\circ}\text{F.}$ in the main flues in these destructors. These results proved conclusively the advantage of the steam air-blast for raising the destructor cells to a proper heat for consuming the refuse and burning the smelling vapours into innocuous gases. After the use of the steam air-blast in closed ashpit, the complaints as to a nuisance ceased. The clinker is now also properly burned, and forms an innocuous fused residue incapable of evolving any noxious gases.

At Leeds, Mr. Hewson, the borough engineer, made further improvements by constructing a new furnace, Fig. 3, where the

Fig. 3.



A and A A, feed-holes; B, dead hearth; C, fire-bar grating; D, exit service flue at front; E, ashpit; F, steam air-blast; and G, main flue to chimney.

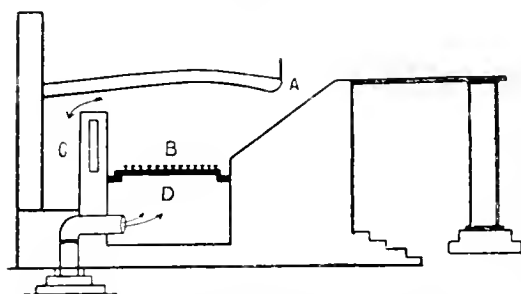
outlet flue from the cell passed away from near the front of the cell; so that, whilst the feeding was at the back, the escape of fumes was near the front, and the gases and vapours practically passed over the whole surface of the cell before they escaped to the flue and chimney. Still, as each cell continues to be worked by itself, the re-charging with town garbage must reduce the efficiency of the single cell to burn properly its own gases for a time, and during this period smelling gases must tend to escape to the flues, and thence by the chimney to the atmosphere.

At Warrington, the Beaman and Deas' destructor is being worked, as also a converted Fryer destructor. The latter has been improved by closing in the ashpit and admitting a blast of air driven by fanners. The result has been much increase of heat and better combustion. Still, the feed opening and the flue escape are at the back of the cell alongside of each other, and the smelling gases

are not brought over even the single glowing hearth when it is in proper heat.

The Beaman and Deus' destructor proper, Fig. 4, consists

Fig. 4.

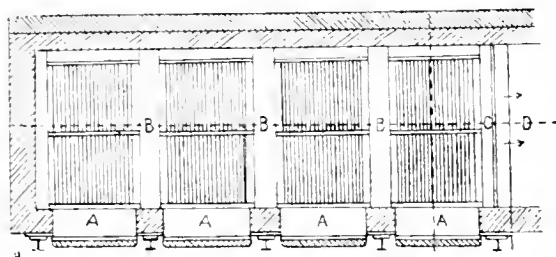


A Feeding inclined plane; B fire-bar grating; C main flue to boilers or chimney; and D ash-pit with fan air-blast.

of a cell which is fed at the one side and the escaping gases pass away from the opposite side of the cell into a main flue. The hearth is 5 feet by 5 feet, and there is no dead plate. The fire-bars are very close to each other, and little dust passes through. The ash-pit is closed, and a blast of air driven by fans enters the pit and flows through the furnace bars and thence through the refuse fuel. From actual observation, I know that the temperature obtained is very high—probably 2,000° F. in the main flue,—and there is little chance of any smelling gases escaping. With careful stoking the vapours have always some red-hot surface to pass over, and the temperature in the main flue is sufficient to cause their combustion into innocuous gases. It would only be when the cell was heavily charged with fresh refuse, and the temperature lowered for the time, that anything could escape destruction.

The Meldrum destructor, Fig. 5, differs materially from

Fig. 5.



A A A A Four cell grate furnaces; B B B B dead plates between the cell grates; C fire bridge; and D main flue to boilers and chimney.

any of the preceding destructors in arrangement, for several of the grates—say four—are placed side by side, and separated only by dead plates, so that the various cell gratings virtually form a quadruple combination hearth. As each cell grate has an independent ash-pit, which is closed in and fed with air under pressure, preferably by steam air-blast, it follows that the several grates can be worked separately or in combination as desired. Whilst at full work the destructor is practically a single cell which may be fed and clinkered off at four places at regular intervals, and thus a somewhat constant temperature of the whole may be looked for. The escape gases may be passed away from the back of each fire-grate into a common flue leading to boilers or the chimney, or they may be transmitted sideways over the various grates and thence over a common fire-bridge in the direction of the boilers or chimney. My inspection of this destructor at full work satisfied me that an excellent temperature could be got up and maintained in the various grates when all the doors were closed, but the mode of charging the respective grates by hand feeding, with the doors open, led to the entrance of much air into the combination, which must necessarily have a cooling influence on

the whole, and lessen the efficiency of this destructor for consuming the smelling gases evolved from the foul garbages, especially when the newly charged grate is near the chimney end of the combination.

Other destructors might also be referred to, but the essential points included in the less known constructions have been already mentioned in those forms of destructors which have been described.

The difficulties connected with destructors in general for the thorough combustion of the refuse and the escaping gases into innocuous matters, arise mainly from the varying condition of any single cell from time to time, so that, even when it is possible to get up the proper temperature when the cell is in full blast and in the cinder and clinkering stage, yet, when the charging operations are proceeding, and for some little time thereafter, the temperature becomes lowered below what is required for efficient treatment of the refuse and its products. To overcome the deficiencies, recourse has been had to the use of cremators, which practically form part of the main flue, and where a bed of red-hot coke or other fuel is supposed to be constantly burning, and over which the smelling gases must pass and ought to be consumed. The suggestion and construction of these cremators is an admission of the inefficiency of the destructor proper, and are a mere whitewashing of an imperfect machine. The cremators are costly in working, are not properly attended to, and though I have repeatedly looked at them during my inspection of the destructors, and have even been told beforehand that they were in operation, I have never yet found one of them in actual full work, though otherwise they were in serviceable condition. A cremator should not be called upon to check or rectify the imperfections of any destructor, and the destructor proper should be capable of doing its own work.

After full consideration of the efficiencies and deficiencies of the various forms of destructor presently in use in different parts of the kingdom, and a large number of which I have personally inspected, I have arrived at the conclusion that not one of them accomplishes, so satisfactorily as should be done, the thorough combustion of town refuse into innocuous matter—gaseous and solid—with that certainty which should remove the word nuisance from the operation.

There are good points in all the destructors, and I have endeavoured to take advantage of the better parts in each destructor, and put these together—so far as these are jointly workable—and have combined therewith an important additional improvement, by causing every set of two cells to work together by a duplex reversible action, which will ensure double efficiency in destroying the refuse and removing any cause of nuisance.

The fires in each single cell must always slacken or deaden down when a fresh charge is added to the cell, and in any case—even when well burning—there must always be a very limited space in each cell for the vapours produced within itself to come in contact with the red-hot glowing cinder within its own hearth, or even with the burning gases passing away from the single cell. Consequently, where only one cell of a destructor is worked independently of every other cell, so far as each cell and its contents are concerned, there must always be ready opportunities for the escape of improperly-burned vapours from the cell, but where two cells are so connected together, then the vapours coming from the one cell can be fully burned by passing over the second cell, and proper and efficient combustion can be insured.

I propose, therefore, that each two cells of a destructor shall work into each other's hands, and that where one of these cells shall be so far burned as to be all aglow and the hearth quite red-hot, the other of these cells shall be at the re-charging point, and that the green-smelling organic gases evolved from the latter shall be transmitted, by a side communicating flue, over the red-hot surface of the hearth of the former or glowing cell, and then this process shall be reversed, when the alternate cell shall come to be charged with fresh refuse.

The three conditions required for the proper working up of town refuse in any destructor can be most readily and

efficiently carried out by this duplex system. These three conditions are—

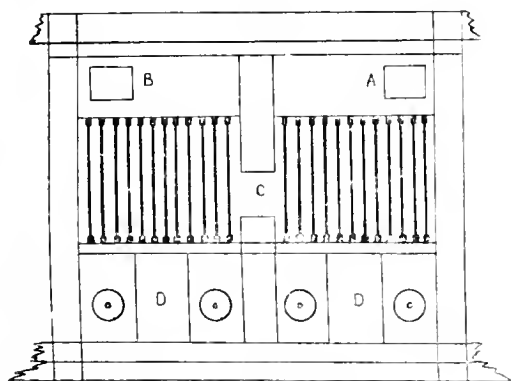
1st. That the inflaming part of the refuse, and the gases and vapours arising therefrom, shall be at once brought in contact with a surface of red-hot fuel, and be consumed into non-smelling and innocuous gases;

2nd. That thereafter a good, clear-burning cinder shall be obtained on the hearth, which will continue to burn and glow, whilst only emitting ordinary chimney gases; and

3rd. That finally a well-made clinker will be formed, practically free from carbon and sulphur, and non-smelling, which can be easily removed, and being devoid of combustible elements, will readily cool down like a bit of red-hot brick, and leave a dead clinker.

These three stages, viz., inflaming, cindering, and clinkering, will, in practical working, be carried on alternately in each of the two cells forming the duplex system; taking care always that the gases from the inflaming stage in the one cell are transmitted over the red-hot cinder stage in the other cell, and thence, when burned, passing into the flue leading to the chimney stalk.

Fig. 6.



Thus Fig. 6 is a front vertical section of the improved destructor representing the two cells A and B arranged to work into each other by the duplex system. Each is provided with an exit service flue at the back which can be opened or closed by a damper, and there is a flue connection between the two cells at C, near the front of the cells. Granting that cell B has passed into the cinder stage, and the whole hearth is red-hot and aglow, then cell A, which is also in fire, is charged with fresh refuse from the feeding-hole at the back, which is spread over the cell floor. The damper of A being closed, no partially consumed vapours can escape in this way, but the damper of B being open, all the smelling vapours from A must be carried by the flue C over the glowing cinders and burning gases in B, and after being consumed into non-smelling innocuous gases, will escape by the open service flue of B into the main flue, and thence into the chimney.

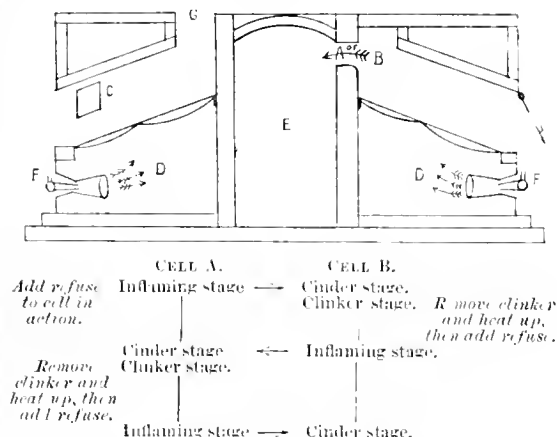
This operation will go on till the charge in A cell has become cindered, when the contents of B cell will be found to be more or less clinkered. The irons are then used in B cell to remove the masses of clinker to the surface of the ashes, and thence out of the cell to an iron barrow placed conveniently in front. Thereafter, the furnace door of B cell being closed to raise the temperature of the remaining cinder bed lying there, the current is reversed in the cells by opening the damper in cell A and closing the damper in cell B, and thus B cell becomes ready to receive the fresh charge of town refuse, the fumes from which will pass by the connecting flue C over the red-hot cinder bed of A, and after thorough combustion by the flue at A, to the main flue and chimney.

The general arrangements of the Duplex destructor may also be observed from Fig. 7, which is a transverse vertical section of the apparatus. A or B showing the position of the service flues of the coupled cells as entering the main flue, C is the connecting flue forming the communication between the two cells which are worked together, D is the

closed ashpit under the cell fire-bar gratings, E is the main flue leading to the chimney, F is the steam air-blast, and G is the feeding-hole for charging the cell with fresh garbage.

Probably the various stages in the working of the Duplex destructor may be more readily observed in the following statement, where the arrows represent the direction in which the vapours and combustion gases will travel in the cells on their way to the main flue and chimney.

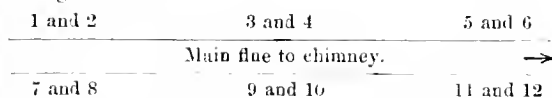
Fig. 7.



And so on, repeating the operations, and reversing the flue currents, as each fresh charge of the town refuse is added alternately to either of the two cells working on this duplex system.

By this method of consuming the refuse, it is apparent that one of each two cells is always, when in the cinder and clinker stage, not only burning off its own material, but is also acting as a live cremator for the thorough heating and combustion of the noxious vapours and gases from its neighbour cell, and that good office it is fulfilling without any extra trouble than merely reversing the flue currents by alternately opening one damper and closing another, and at absolutely no cost for coke or any other sort of fuel, or even labour. Moreover, the beneficial operation is carried out in the immediate presence of and under the constant eye of the man responsible for the proper working or stoking of the respective cells, and the thorough combustion of the refuse.

The working of a large bench of such duplex cells would be quite as easy and would be more effective than by any other system. Thus a bench, say, of 12 cells, either in a single row, or, still better, divided into two rows of six each, placed back to back, and with the main flue between, would have the coupled or duplex cells arranged as follows:—



On the one side, cells 2, 4, and 6 would be in the cinder stage, and would have their service flue dampers open to the main flue, and the cells 1, 3, and 5 would be in the inflaming stage, and have their gases and vapours respectively carried through 2, 4, and 6 to the main flue and chimney; whilst on the other side 7, 9, and 11 would be in the glowing cinder stage and their dampers open and the inflaming, probably smelling, gases from 8, 10, and 12 would be passing over their glowing hearths. In this way no two immediately opposite cell service flues would ever be open at the same time for the escape of the burning gases to the main flue and chimney, and thus the reversing process considered so essential in this improved destructor would be still further carried out in the main flue.

The duplex cell system may be best worked out with the aid of a forced steam air-blast F directed into the closed ashpit D below the furnace bar-grating. A fan air-blast would be also serviceable in the same position. 1

am not, however, at all sanguine that mere chimney draught, which has practically failed in other destructors, could be depended upon for efficiency, even when aided by my new system. I am decidedly favourable to the steam air-blast—two steam jets with air-funnels being provided for each cell and entering the closed ashpit in front at the sides, leaving the centre of the ashpit door to be opened for removing the fine ashes which have passed through the fire-bars. The ordinary disposition of these arrangements, as indicated in Figs. 6 and 7, will be found serviceable. With the steam air-blast, one great advantage lies in the steam undergoing breaking up in contact with the red-hot carbonaceous cinder of the cell hearth, and yielding the combustible gases, carbonic oxide and hydrogen, so useful from their own combustion in materially raising the temperature of the cells and flues, and thus aiding in bringing about complete combustion of the noxious smelling gases evolved from the garbage.

One important part of any well contrived destructor is that there should be no dead hearth for the stewing of the refuse garbage. The whole bed of the cell or furnace should be a living fire-grate, through the bars of which air should permeate and assist in consuming the organic matter over the whole extent of the hearth. Such being the case, the actual fire hearth in the duplex cell may be enlarged so as to include part at least of the space taken up by the dead hearth in other destructors, and give a living fire-grate surface of at least 8 ft. by 5 ft. or 40 ft. of burning area, instead of 25 ft. as in most destructors. The enlarged fire hearth will necessarily increase the amount of refuse which can be efficiently dealt with in each cell, and at the same time ensure that the garbage is not stewed or smothered, during which period the most objectionable vapours and gases are disengaged.

The common way of charging the cells with fresh refuse is objectionable. The material is tipped down practically on the top of the cells, where it becomes heated and often fired, and offensive vapours are evolved. Even during the charging, the material is apt to be blown about while it is being shovelled into the feed-hole, and much dust is wafted away to the neighbourhood. I am strongly in favour of the waggon-charging system introduced by Burnos and Brodie at the destructor in Vauxhall Road, Liverpool. The waggon runs on rails, is divided into compartments, eight or so in number, and the carts conveying the refuse are tilted right into the waggon compartments. Each compartment contains a full charge for a destructor cell, and the waggon being run over the feed-hole of the cell, the cover of the cell and the bottom of the compartment of the waggon can be simultaneously opened, when the charge of refuse at once drops into the cell, and immediately thereafter the cell and compartment are again closed up. The whole operation is a question of seconds, and there is practically no dust evolved and no smell disengaged.

The question of the particular form of fire bars in a destructor does not, in my opinion, affect much the working of the destructor. I am rather favourable to stationary fire-bars with little space between each of the bars, so that as little fine matter as dust shall fall through into the ashpit. I believe more in effective clinkering for the removal of the ash matter in a semi-fused state, so that little actual dust need pass through between the fire-bars. In any case, when the ash pan door is open for the removal of its contents the dust should be well watered, if not already damp from condensed steam, before being shovelled out into a barrow, and the material should be buried, so as to keep it from being blown about after drying. The space between the fire-bars should be more regulated, so as to suit the influx of the air by the steam air-blast than for the removal of the fine dust from the fire grating of the cell; and what is sufficient for the supply of air for proper combustion will be ample for the dropping down of the necessary ash dust.

The question of dust nuisance arising from refuse destructors cannot be overlooked, as in many places it forms an undoubted nuisance and cause of complaint. It may arise from several causes:—

1st. From the raw green refuse being tilted down by the carts in positions where the wind can blow it about,

and by the ordinary shovel way of feeding the cells. Such can be obviated by paying proper attention to the reception yards being efficiently enclosed, and by using travelling waggons for charging the cells.

2nd. From the improper raking out of matter from the front of the cells either wholly or partially burned. This is a most unnecessary and improper procedure, and rendered doubly a nuisance when water is thrown on the rakings, which causes disruptive discharges in the hot material and a great increase in dust and smell. Such may be obviated by insisting on proper clinkering of the cell refuse and by the removal of nothing but clinker, thoroughly burned, and practically non-smelling, and which quickly cools down.

3rd. From excessive and unnecessary movements of the fire-bars, especially when rocking or oscillating bars are in use, and the ashpits are open to the air. Such can be obviated by having closed-in ashpits, and by drenching the ashes with water before removal.

4th. From excessive draught in the flues and chimney, when much dust and even half-consumed papers are swept onwards by the current, and are seen passing out at the chimney head, and thereafter fall down on neighbouring property. Such may be obviated by placing screens with $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch meshes in the main flue near to or at the bottom of the chimney, for the arrestment of the papers, and by admitting of the finer dust being deposited in properly constructed dust chambers. Attempts have been made to arrest the dust by placing balling walls, columns, or plates in the ordinary flues, but these are often restrictions in the area of the flue, and are of little use in arresting the dust, owing to the current or draught failing to be checked by such obstructions, which practically form restrictions in the area of the flue.

Dust chambers can be of little use unless the current of air or draught is temporarily lessened by expanding the main flue to several times its own area, or by causing the main flue to enter and leave a large dust chamber which is several times the area of the main flue. The current of air or draught in the main flue of a destructor may be as high as 20 to 40 miles an hour, and if the flue goes direct to the chimney without any expansion of its area, it is impossible that any large proportion of the dust escaping from the cells can be deposited in the flue and the chimney. But enlarge the area to double that of the main flue—or cause the main flue to enter and leave a dust chamber with twice its area—before it reaches the foot of the chimney, and the air current or draught will be reduced from 20 or 40 miles an hour to half the speed, viz., 10 or 20 miles an hour; and if the area of the main flue or dust chambers be quadrupled, then the speed of the air current or draught will fall to 5 or 10 miles an hour; and in either case, especially in the latter, much dust will cease to be carried forward, and will be deposited in the expanded flue or dust chamber. I am of opinion that every dust chamber should be at least four times the area of the main flue of the destructor, so that if the main flue is 10 ft. by 6 ft., or 60 ft. in area, the dust chamber should be at least 240 ft. by 12 ft., or 240 ft. in area. And if balling arrangements, such as walls, columns, or screens, are introduced, then further allowance must be made for the space occupied by these, so as to ensure that a free area of the full size and capacity shall be left for the due settlement of the dust, without its efficiency being neutralised by air currents and eddies circling round the balling arrangements.

The following statement may be taken as a summary of the main points and advantages of the duplex destructor:—

1st. That the three stages in the consumption of town refuse, viz., inflaming, cindering, and clinkering, are fully recognised as a working basis.

2nd. That each two cells of the destructor can work into each other, so that the green or smelling gases of the one cell are thoroughly consumed over the red-hot cinder-hearth of the other cell.

3rd. That the action of these cells is reversible by the mere act of opening and shutting dampers, and such constitutes a duplex reversible system.

4th. That the requisite temperature of the cells of the destructor is fully brought up and maintained by steam air

blast or fanner-air blast, introduced below the fire-bars. Preferably the steam-air blast.

5th. That the clinker is thoroughly burned out, and is alone removed from the cells, excepting the fine dust which passes through between the fire-bars into a closed ash-place.

6th. That the clinker so removed is practically free from carbon and sulphur, and may be allowed to deaden or cool down in the open air, without the addition of any water.

7th. That the contents of the closed ash-place, if not moist from condensed steam, are drenched with water before they are removed from the ashpit, and that thereafter they are buried to avoid unnecessary dust in the immediate locality.

8th. That the flue-gases, including dust, are passed through enlarged flues or dust chambers—at least four times the area of the main flue—so as to slacken the speed of the air currents or draughts, and admit of the deposition of the dust before the gases reach the chimney. That this deposited dust shall be periodically removed from the flues and be buried, so as to keep it from being blown about.

Keeping these conditions in view, I have no fear but that the combination of the duplex reversible cell, with the wagon feeding arrangement, steam-air blast in closed ashpit, and enlarged dust chambers, will ensure that the refuse of towns can be properly and efficiently consumed in the improved destructors without becoming a nuisance to the neighbourhood, and at the same time with manifest advantage to the community.

Whilst regarding it desirable that the duplex system of working destructor cells or furnaces should be carried out under all the conditions stated above, and in apparatus constructed on the general lines recommended in this paper, there can be no doubt that the system admits of application, to some extent, in the various forms of destructors presently in use in populous places, and that without much structural alteration. Thus, in the Fryer's destructor, where one of the main objections to its efficiency lies in the garbage being fed at the back, and the vapours being led away almost alongside the feeding-hole, giving rise to offensive gases escaping into the main flue, and thence, by the chimney stalk, to the surrounding atmosphere, the difficulty would be greatly met by working each two cells on the duplex system. For this purpose it would only be necessary that a communicating flue be cut out the division wall between the two cells, and near the front, as shown in Figs. 6 and 7, at C, and that dampers be provided in each cell, which can be opened and closed as required, and thus each two cells of the Fryer arrangement might be worked on the duplex system, and the smelling gases of one of the coupled cells be compelled to pass over the glowing hearth of the connecting cell. Of course, the forced steam air-draught or fanner air-draught, with closed in ashpit, ought to be used at the same time, so as to ensure proper temperatures and the thorough combustion of the refuse and of the gases evolved therefrom. The same arrangement of connecting each two cells of the Leeds destructor by a communicating flue, and the alternate opening and shutting of the respective dampers, would also materially add to their efficiency for completely consuming all offensive matters and gases. By this simple device of connecting each two cells in the Fryer's and Leeds destructors, and reversing the currents, each cell would alternately act as a cremator for the other cell practically coupled with it, and the working power of the destructors would be materially enhanced. At the same time, when new apparatus is being constructed, the full conditions of the duplex reversible system ought to be adhered to, so that the maximum benefit of the system may be ensured.

At first consideration of the duplex system, it might be supposed that the arrangement is too complicated to be carried out by an ordinary workman. In reality, however, the system does not introduce any difficulty in the working of an efficient destructor. The main points about any destructor must be thorough efficiency in the machine for dealing with the town refuse, and skilful men to work the machine. Ordinary labourers will not do for any destructor, you must have trained and intelligent stokers accustomed to furnace work, and who will take a pride in

manipulating a machine which can do its work well. Under these circumstances, a man will feel that he has some satisfaction in the discharge of his daily duties, and will not fail to get the most out of the destructor. There is really no more complication in working duplex reversible cells in the improved destructor than there is in the alternate firing of the furnaces of two boilers placed side by side with each other, and the intelligent stoking of which keeps down the disengagement of black smoke from the steam boiler chimney head. In the duplex destructor, the attendant will simply keep the two cells which communicate with each other at different stages of the same process, by alternate charging and working off the contents of the cells in a manner similar to that in which any intelligent stoker keeps up the fires under his steam boilers, by alternate coaling or firing of the different hearths so as to ensure proper combustion with a minimum escape of black smoke.

Destructor Smells and Dust.

In concluding this paper reference may be made to the nature of the evidence which can be led in cases of nuisance from the destructors, which may be due either to inefficiency of the apparatus employed or to want of skill in the working of the process.

The smells may arise :—(1st.) From the tipping or charging shed, where the materials are emptied out of the carts, and are often spread more or less over the tops of the furnaces, where they are subjected to much heat, and undergo a process of drying and stewing, with the result that vapours with a "singel-like destructor odour" are markedly observable, and which are distinctly noticeable in the atmosphere of the neighbourhood to the leeward of the destructor. In high winds, even semi-consumed dirty papers may be blown about and fall in neighbouring properties.

2nd. From the furnace vaults or drawing chambers where the material is dragged out or raked out of the cells in a more or less imperfectly burned state, with the result of the disengagement of volumes of vapours with the singel-like destructor odour, accompanied and succeeded by sulphurous anhydride, and in places where water is used for quenching the red-hot debris the sulphurous anhydride is succeeded by sulphuretted hydrogen. Placing oneself in the line or track of the wind, the respective smells may be clearly observable at a distance of hundreds of yards from the destructor. A hypothesis has been suggested that the sulphur compounds, viz., sulphurous anhydride and sulphuretted hydrogen may neutralise each other, but practically they cannot do so, as the first has the start of the second, and a gentle wind of the velocity of $3\frac{1}{2}$ miles an hour will sweep on the sulphurous anhydride at the rate of 5 ft. in the second, or 100 yards in a minute, and such column of polluted air containing sulphurous anhydride will precede a second column (when water has been added) where sulphuretted hydrogen is present, notwithstanding the difference in density or the respective rates of diffusion of the gases. The practical result therefore is that the two sulphur gases can be distinctly observed in the atmosphere of the neighbourhood, even by the sense of smell, and no doubt they exert their respective deleterious actions on plant life, and more or less affect the vitality of the shrubs and other vegetation.

3rd. From the chimney head due to the imperfect combustion of the organic matter and vapours in the cells and flues. No doubt a good height of chimney, 180 ft. or more, will tend to distribute the fumes more widely throughout the atmosphere, but in a badly constructed or worked destructor, where the temperature is too low for the perfect and complete combustion of the fumes, there will necessarily be evolved from the chimney head a decided fetid singel odour which may be shortly stated as "the destructor smell." The escape of such foul gases from the chimney head depends much on the temperature of the cells, service flues, and main flue. We cannot be satisfied with a temperature less than that of a cherry-red heat—1,500° to 1,600° F. in the flues—and even the higher temperature of a yellow-red or orange—about 2,000° F.—may be held to be advantageous. Anything like a black-red heat—about 1,000° F.—must be regarded as of little service for the complete combustion-destruction of organic-smelling gases.

TABLE A.—ANALYSES OF SAMPLES OF DUST FROM DESTRUCTOR AT EDINBURGH, TAKEN AT DIFFERENT DATES IN 1894-95.

In 100 Parts of Dust.	From Floor of Destructor Vault where Cells are Discharged.			From outside Yard at Destructor.		From Ground beyond the Outside Yard.		From Leaves of Plants in Neighbourhood.	
	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)
Carbonaceous organic matter	13.72	13.83	12.08	14.76	13.16	12.24	11.68	14.84	15.16
Siliceous matter	51.04	53.12	54.28	51.49	53.36	53.04	50.56	55.40	57.80
Oxide of iron	5.42	7.64	5.72	5.14	5.68	6.36	6.84	5.28	4.94
Alumina	10.20	10.52	8.24	8.62	9.56	9.08	10.92	8.64	7.82
Lime	1.88	3.88	4.51	5.77	5.28	4.86	4.23	4.35	3.05
Alkaline salts	1.46	3.85	6.32	5.20	4.96	5.92	5.32	4.16	4.74
Carbonic acid, moisture, &c.	7.28	7.11	8.85	9.11	8.00	8.50	7.45	7.33	6.49
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Sulphur calculated as sulphuric anhydride.	3.74	3.24	3.65	4.16	4.13	3.51	3.71	4.15	3.38

TABLE B.—ANALYSES OF SAMPLES OF ORDINARY ROAD DUST FROM MACADAMISED ROADS IN EDINBURGH AND OUTSKIRTS, TAKEN ON DIFFERENT DATES IN 1894-95.

In 100 Parts of Dust.	(10.)	(11.)	(12.)	(13.)	(14.)	(15.)	(16.)	(17.)	(18.)
Carbonaceous organic matter	3.06	4.86	4.12	4.52	5.26	4.38	2.88	4.12	3.56
Siliceous matter	79.36	78.08	80.02	80.32	79.64	77.44	82.24	78.84	81.52
Oxide of iron	6.64	6.28	7.14	4.64	5.92	7.45	5.58	5.82	5.18
Alumina	3.32	2.64	2.48	2.04	1.96	2.32	2.14	1.94	2.70
Lime	2.82	2.37	1.82	2.06	2.68	2.60	2.04	2.44	1.75
Alkaline salts	1.30	2.28	1.14	1.52	1.32	1.25	0.84	2.62	2.34
Carbonic acid, moisture, &c.	3.50	3.49	3.28	4.00	3.22	4.56	4.28	4.22	2.95
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Sulphur calculated as sulphuric anhydride.	1.38	1.71	1.56	1.23	1.12	1.64	0.98	2.06	1.25

TABLE C.—ANALYSES OF SAMPLES OF RAILWAY DUST TAKEN ON DIFFERENT DAYS IN 1894-95, AND PASSED THROUGH SIEVE OF 1,600 MESHES TO SQUARE INCH.

In 100 Parts of Dust.	Collected from Permanent Way of Railway.					Collected from Foot Platforms of Railway.			
	(19.)	(20.)	(21.)	(22.)	(23.)	(24.)	(25.)	(26.)	(27.)
Carbonaceous organic matter	8.28	10.36	10.24	7.82	8.68	6.84	16.12	9.42	6.28
Siliceous matter	70.32	71.28	69.78	75.66	70.97	80.67	75.16	77.62	70.12
Oxide of iron	7.04	6.52	7.84	5.86	8.16	2.14	2.16	2.56	9.76
Alumina	4.56	3.86	1.96	1.68	2.64	1.92	1.14	1.16	4.76
Lime	1.92	1.44	1.52	2.47	1.99	1.83	2.92	2.71	3.31
Alkaline salts	2.72	1.94	3.14	1.44	2.25	1.25	1.76	1.54	0.84
Carbonic acid, moisture, &c.	5.16	4.90	5.52	5.07	5.31	5.05	6.74	4.19	4.96
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Sulphur calculated as sulphuric anhydride.	1.73	1.92	2.38	1.75	1.59	1.45	1.23	1.63	1.82

TABLE D.—ANALYSES OF SAMPLES OF LOCOMOTIVE AND RAILWAY-CARRIAGE DUSTS, &c., TAKEN ON DIFFERENT DAYS IN 1895.

In 100 Parts of Dust.	From Locomotive Fire-box under Funnel.	From Locomotive Tubes and Chimney Funnel.	From Roof of Railway Tunnel Bridge.	From Inside of Railway Carriages, not Floors.	From Roof of Dwelling-House close to Railway Station
	(28.)	(29.)	(30.)	(31.)	(32.)
Carbonaceous organic matter	38.08	62.68	38.64	8.56	8.22
Siliceous matter	50.88	26.92	16.24	65.42	75.60
Oxide of iron	2.36	4.12	3.68	10.24	5.38
Alumina	0.44	1.36	1.34	2.44	1.66
Lime	2.37	0.85	14.06	5.25	2.47
Alkaline salts	1.78	2.36	2.76	1.32	1.12
Carbonic acid, moisture, &c.	4.90	1.71	23.28	6.77	5.55
	100.00	100.00	100.00	100.00	100.00
Sulphur calculated as sulphuric anhydride.	2.13	1.85	2.56	1.81	1.26

The dusts must also be included as main factors in any nuisance from the operations of an inefficient or badly worked destructor. These dusts may arise (a) from the charging sheds where the town garbage is thrown down from the carts, (b) from the furnace vaults during the drawing or discharging of the cells, and (c) from the vaults where water is thrown upon the hot *débris*, either by buckets or fire hose. In the latter case the clouds of steam are accompanied by much fine dust in suspension.

As a preliminary to the investigation of the destructor dust and its identification from ordinary road dust, and even railway dust, when the destructor is placed in the immediate neighbourhood of railway lines, it is advisable to separate the coarser particles from the real fine dust, and that without any attempt to pulverise or reduce the larger pieces. This is most readily done by sifting the dust through sieves, and the trials made by me showed that a wire-gauze sieve with 1,600 meshes to the square inch—being 40 by 40—only kept back paper ash and lumps, small stones, cinders, &c., and the real dust which was liable to be blown about readily passed through the meshes. Indeed part of this fine dust would pass through a sieve with 6,000 meshes to the square inch. The proportions of 1,600 meshes to the square inch were found most suitable for working with all sorts of dust, whether destructor dust, road dust, railway dust, or field dust.

The identification of destructor dust may be carried out partly by chemical and partly by microscopic means. Firstly, it is found that when the dust is diffused through the atmosphere by sifting it through the fine sieve in front of the nose, the peculiar singed-like fetid odour characteristic of the destructor smell, is distinctly observed, exactly similar to that noticeable in the drawing vaults of the destructor. The same singed fetid odour is noticed on the person and clothes after each inspection of the apparatus, and when the mere running of the fingers through the hair, or the brushing or shaking of clothes, at once evolves sufficient dust to give rise to the peculiar characteristic odour. Secondly, when the dust is heated on platinum foil over a lamp, when the organic matter is burned away with the same destructor odour; and, thirdly, when some of the dust is added to water and the latter heated, when the steam evolved gives out a similar destructor smell.

Under the microscope and using powers of 70 to 140 diameters the destructor dust exhibits a marked lava-like or almost glassy structure of the fine particles, which is largely due to the disruptive action of the water thrown on the slaggy *débris* which had been withdrawn from the cells. The magnified particles are mainly jagged on the edges and very adherent, whilst here and there minute balls or bombs and the moulds from which these have been blown are observed. The same structure is seen when the dust is fully burned on platinum or when heated with nitric acid so as to destroy the organic matters, which leaves a residue markedly siliceous and glassy in texture and composition.

All of these general characters are observed in the dusts taken from the discharging vaults of a working destructor where water is thrown on the red-hot *débris* taken from the cells, as also from the dust collected from the outside yards and grounds, as well as from the fences and walls, as well as stems and leaves of plants, examined in the neighbourhood, and even on the scum taken from a sheet of water situated 100 yards from the destructor.

The facility with which wind will carry destructor dust is even greater than in the case of ordinary road dust, for whilst the latter has a specific gravity of 2.434 (water = 1.000) the destructor-gas has the specific gravity of 1.989, being a difference of 0.445 less density; and being therefore about 20 per cent. lighter than ordinary road dust, the destructor dust—equally fine in particles—is more readily lifted by winds and carried on in suspension. When deposited, however, as a layer on the leaves and stems of plants the destructor dust adheres more firmly to such owing to the jagged edges.

Ordinary road dust when diffused through the air by sifting through the fine sieve does not evolve any particular odour, and the same negative result is given when the road dust is heated with water. If placed on platinum and heated over a lamp the road dust merely evolves a slight

corky straw odour, and has no singed fetid smell. Under the microscope, the road dust is observed to consist of small stones, somewhat rounded and weathered, with only an occasional fragment of jagged glassy material.

Railway dust as taken from the permanent-way and from passenger platforms, when diffused through the atmosphere yields no particular odour; when boiled in water it emits a slight sulphury smell; and when heated on platinum foil it evolves a burned coal odour, without any singed fetid smell. Under the microscope, the fine particles are found to consist of minute cinders and minute stones—cinder- and stone dust—with few fragments of jagged glassy material. The same characteristics are observed with other railway dusts, such as those taken from the tops of railway tunnels, from the iossides (not floors) of railway carriages, and from railway waiting-rooms.

The quantitative analyses of the various dusts also bring out the difference between destructor dust on the one hand and ordinary road dust and railway dust on the other.

Thus destructor dust taken from the drawing vaults outside yards, and grounds, yielded

12 to 15 per cent. of organic matter and
50 to 55 per cent. of siliceous matter,

and destructor dust taken from the leaves of plants (principally laurels) growing in the neighbourhood of a destructor gave

15 per cent. of organic matter and
55 to 58 per cent. of siliceous matter,

whilst ordinary road dust yielded

2½ to 5 per cent. of organic matter and
80 per cent. of siliceous matter,

and railway dust from the permanent way gave

10 per cent. of organic matter and
fully 70 per cent. of siliceous matter.

The detailed analyses of many samples of all these kinds of dusts, as specially determined in a recent destructor inquiry, are given in tables A, B, C, and D on page 168.

Nottingham Section.

UNIVERSITY COLLEGE, NOTTINGHAM.

Chairman: F. J. R. Carulla.

Vice-Chairman: J. M. C. Paton.

Committee:

L. Archbutt.	T. Mason.
F. Clowes.	J. O'Sullivan.
J. B. Coleman.	C. Taylor.
H. Forth.	G. J. Ward.
W. G. Johnston.	R. Lloyd Whiteley.
J. F. Kempson.	

Treasurer: S. J. Pentecost.

Hon. Local Secretary:

J. T. Wood, 29, Musters Road, West Bridgford, Nottingham.

SESSION 1895-96.

April 15th.—Mr. John White, F.I.C. "Filtration and Domestic Filters."

May 6th.—Mr. L. Archbutt, F.I.C. "An Evaporation Test for Cylinder Oils."

Meeting held Wednesday, March 4th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

A paper by Mr. L. Archbutt on "An Evaporation Test for Cylinder Oils" was down for reading, but was unavoidably postponed until the May meeting.

THE ESTIMATION OF OXYGEN BY ALKALINE SOLUTION OF PYROGALLOL.

BY PROF. FRANK CLOWES, DSC.

THE author stated that it frequently happened in his laboratory that carbonic oxide was found in the residual gas from Brin's oxygen, after the oxygen had been absorbed by alkaline pyrogallol solution.

Check experiments, made by passing the oxygen over red-hot copper oxide, proved that no carbon dioxide was produced in this process, and that carbonic oxide was not, therefore, present in the original oxygen.

The alkaline pyrogallol solution used for the absorption contained 10 grms. of pyrogallol and 24 grms. of potassium hydrate in 100 c.c. This solution had been repeatedly used for the absorption of oxygen from atmospheric air, and it had always given perfectly satisfactory results, no carbonic oxide being evolved in the process.

Some experiments made with the above pyrogallol solution showed that it began to evolve carbonic oxide when the percentage of free oxygen present in the gaseous mixture exceeded 28. When a less percentage of oxygen than this was present, as is the case in atmospheric air, no carbonic oxide was evolved. When the proportion of oxygen in the mixture was made to gradually increase beyond 28 per cent. the volume of carbonic oxide kept increasing, until when the oxygen reached over 90 per cent. of the gaseous mixture, the volume of carbonic oxide evolved during the absorption reached 6 per cent. of the volume of oxygen absorbed.

It was found that if the absorption of the oxygen was followed by the absorption of the carbonic oxide by means of cuprous chloride solution, a perfectly accurate estimation of oxygen was obtained, presuming, of course, that no carbon monoxide was present in the original gaseous mixture. This was proved by estimating the percentage of oxygen in separate portions of one and the same mixture by means of the above pyrogallol solution followed by cuprous chloride solution, by absorption with phosphorus, and by firing with excess of hydrogen. The results obtained by the three methods were identical.

Experiments were then made in order to ascertain the effect of varying the proportion of pyrogallol to potassium hydrate in the solution. It was ascertained that if the proportion of potassium hydrate to pyrogallol was sufficiently increased no carbon monoxide was evolved during the absorption of oxygen, even when the oxygen was practically unmixed with other gases. A solution containing in 100 c.c. 10 grms. of pyrogallol and 120 grms. of potassium hydrate did not evolve any appreciable quantity of carbon monoxide during the absorption of oxygen under the ordinary laboratory conditions. The quantity of pyrogallol might be reduced in the above solution to 5 grms.

Prof. Ramsay finds that traces of carbon monoxide, which can be found spectroscopically, are always evolved during the absorption of oxygen by any alkaline pyrogallol solution. The amount evolved, however, when proper precaution is taken in preparing the solution is too small to affect the reading of the volume in a gas apparatus.

It will be evident from the results obtained by these experiments that serious error may be introduced into the estimation of oxygen by pyrogallol solution, unless the solution is prepared in such a way as to contain a sufficient excess of the caustic alkali. In the account given of this determination, it is not uncommon to omit all directions for the preparation of the pyrogallol solution, and it would therefore be naturally inferred that the composition of the absorbent solution is without influence upon the result of the absorption.

In the course of the investigation it was found that an alkaline solution of hydroquinone absorbs oxygen from a gaseous mixture, slowly but completely, and without evolving any carbon monoxide. The absorption is known to be complete when the absorbent solution, after having been shaken up against the interior of the vessel, flows down without producing a blue film. The similar absence of a brown film during the absorption by alkaline pyrogallol is usually accepted as an indication that the

absorption of oxygen is complete. The solution of hydroquinone used for the absorption of oxygen contained 18 grms. of hydroquinone and 24 grms. of potassium hydrate in 100 c.c.

The author expressed his acknowledgment to Percy Jackson for carrying out the experimental work involved in the above research.

DISCUSSION.

MR. JACKSON remarked that the absorption of oxygen by phosphorus was not always successful. It failed when certain hydrocarbon gases and vapours were present in the air, or when the proportion of oxygen was large, but when the phosphorus did absorb the oxygen, the absorption was rapid and complete.

THE CHAIRMAN said that he was pleased to infer from what had been said by Dr. Clowes that the error due to improperly prepared alkaline pyrogallate solution was not present in the test of the exit gases from sulphuric acid chambers, since oxygen was present in too small proportion to cause evolution of carbonic oxide.

MR. WARD supposed that the absence of CO in the original sample of gas was an essential requisite of accuracy in the experiments which had been detailed, in which the carbonic oxide produced during absorption with pyrogallate was subsequently absorbed and allowed for.

DR. CLOWES replied that no CO must be present originally, else the results would be erroneous.

MR. CAVEN made a reference to the possible presence of CO in the gases produced during the organic combustion of water residues by the Frankland process. Such CO would be calculated as nitrogen, and would seriously affect the determination of nitrogen in the organic matter.

DR. CLOWES: The error would be very serious with improperly prepared pyrogallate solution, and unless the analyst was satisfied that this error was impossible under the circumstances of the absorption, it would certainly be wise to make a final absorption with cuprous chloride solution before finally reading the volume of the residual nitrogen.

SOME PROPERTIES OF FERRIC PHOSPHATE.

BY R. M. CAVEN.

(*This Journal*, 1896, 17.)

DISCUSSION.

DR. CLOWES acknowledged indebtedness for a considerable amount of original work which Mr. Caven in his modesty did not claim. He thought confusion might arise in the minds of some readers of the paper by the phosphate radicle being sometimes called phosphoric acid; it might have been better if the expression "phosphate radicle" had been used throughout. He regarded the absence of colour in the first experiment made with HCl as conclusive that there was no FeCl_3 present, and he considered that this view met with further support from the fact that a solution of this salt gains in colour as it becomes more neutral. The paper will have some influence on our present analytical phosphate table, which will certainly have to be modified and, probably, simplified. The instance of hydrolysis of ferric salt given by Mr. Caven was not an isolated one, since ferric acetate solution undergoes a similar decomposition with the formation of a basic salt. Mr. Caven had only trodden on the fringe of the subject, and he (Dr. Clowes) hoped the author might find time to continue his investigations.

MR. I. J. PENTECOST remarked that ferric sulphate used by dyers under the name of "iron liquor or nitrate of iron" also underwent a decomposition on dilution with water, similar to that which had been described, and he believed that in mordanting with this substance some ferric hydrate was fixed on the fibre.

A solution of ferric pyrophosphate in ammonia had been used to a small extent as a cotton mordant.

MR. WILKINSON described an anomalous case in which when working with a solution consisting of a salt of zinc and sodium phosphate, on adding NH_4HO after NH_4Cl the zinc phosphate did not come down at all. He would like to know whether Mr. Caven could offer any explanation.

Mr. FORTH said that he found great difficulty in getting pure phosphates. When washing with water the impurities present might affect the result. He would like to know whether Mr. Caven had worked with the pure or with the commercial salt.

Dr. J. J. SUDBOROUGH considered the example mentioned by Mr. Pentecost as hardly a parallel one with the others in which hydrolysis occurred. The presence of the various organic substances acid and basic of the fibres upon which the ferric hydrate was deposited greatly altered the conditions of the case.

He also suggested that the colour of the residue after boiling FePO_4 with water or NH_4HO solution, might be an indication whether it consisted of a definite basic salt or of a mixture of FePO_4 and $\text{Fe}(\text{OH})_3$.

Mr. J. GOLDING pointed out the great interest that was attached to Mr. Caven's paper from an agricultural chemist's point of view.

He cited the method generally employed for the determination of the insoluble phosphates in acid manures by the precipitation from the hydrochloric acid solution of tribasic phosphate of lime by the addition of ammonia in slight excess, and mentioned a case in which he had had to abandon this method, owing to the presence of an appreciable quantity of iron, which, as Mr. Caven had shown, would vitiate the result of the determination.

Mr. CAVEN, in replying to the discussion, said that in the case of zinc salts, the precipitate formed on neutralizing a solution in which PO_4 was present, would be redissolved on adding excess of NH_4HO , since zinc phosphate is soluble in this reagent. The zinc could therefore be precipitated by ammonium sulphide in the usual way without the previous elimination of the PO_4 .

In reply to Dr. Sudborough he said that on boiling FePO_4 with NH_4HO , the salt quickly changed in appearance and, if granular, became coated with a dark red substance which appeared to be $\text{Fe}(\text{OH})_3$. He was of opinion that the fact of the gradual removal of the PO_4 , and also the appearance of the product, showed the improbability of a definite basic salt being formed at any stage of the operation. The change on treatment with hot water was so slight that no alteration in colour was noticed until after gentle ignition, when the mass appeared darker than unwashed FePO_4 .

In concluding, Mr. Caven thought that the phosphate table likely to be of most use for general qualitative analysis, would be one in which concise directions are given for the speedy removal of all the PO_4 as a phosphate of known composition, in such a manner that the course of the analysis can be quickly proceeded with in the ordinary way.

is often a matter of some difficulty when two or more of these bodies are present in a mixture.

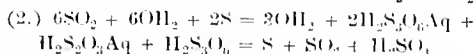
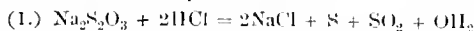
We have sought in the classical archives of chemistry for reliable methods, and although we have found some of a fragmentary character yet their application has resulted in dissatisfaction.

A study of the modes of manufacture of the various thionates will reveal the fact that it is very easy to produce one or more of these compounds in our attempts to analyse mixtures of the materials from which they may be made. By the interaction of sulphuretted hydrogen upon sulphurous acid, pentathionic acid and the other compounds which characterise "Wackenroder's solution" (Debus, C. J., *Ann.*, 278, &c.) may be obtained.

By the digestion of sulphur with an acid sulphite, or, what is the same, by the heating of a solution of a thiosulphate with a mineral acid, trithionates are formed.

These facts dawn with unpleasant effect upon the minds of those who attempt to analyse complex mixtures of the radicals referred to, using methods which are presumably standard. Should the salt or solution be alkaline, one is advised to neutralise—with the sure result of liberating sulphuretted hydrogen, and, if a sulphite be present, also sulphurous acid—gases which in mutual reaction produce one or more of the thionates.

If the sulphates are to be determined we are advised to boil with oxygen-free water and hydrochloric acid in an oxygen-free space—presumably to prevent the oxidation of sulphurous acid; but if a thiosulphate is present sulphuric acid in no mean proportion is sure to be formed, and the accuracy of the estimation is entirely vitiated. There can be no doubt that thiosulphates when boiled with dilute mineral acids are partly converted into trithionic acid, which in its turn is decomposed, with the formation of free sulphur, sulphurous acid, and sulphuric acid:—



It is somewhat remarkable that thiosulphate of soda gives more sulphate when boiled with dilute hydrochloric acid in an oxygen-free space than when boiled in the open; but we have repeatedly proved this to be the case; in the open this salt has given us $2\frac{1}{2}$ per cent. of Na_2SO_4 ; in oxygen-free space it has yielded as much as $4\frac{1}{2}$ per cent. of this body.

There can be no doubt that the sulphate is due to an intermediary formation of trithionic acid; as by iodimetric titration the thiosulphate gave us 100 per cent. of $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{Aq}$; no sulphates were present, and none were formed by interaction with $\frac{N}{10}$ iodine (absence of sulphites); other tests showed the entire absence of dithionates, trithionates, tetrathionates, and pentathionates.

In order to accomplish—

(1.) *The Estimation of Sulphates in Presence of Thiosulphates, &c.*—None of the methods in vogue were of any value, and it was only after repeated failures that we worked out a completely satisfactory process to accomplish this object.

Hydrochloric acid speedily decomposes thiosulphate solutions, even in the cold, and sulphates are formed; acetic and oxalic acids have a similar result, and citric acid gives with barium chloride a precipitate which is too finely divided to admit of filtration within any reasonable period. Although barium chloride gives no precipitate with even moderately strong solutions of the alkaline thiosulphates, yet as soon as a sulphate is thrown down in the presence of a thiosulphate a very large proportion of barium thiosulphate will be found in the precipitate.

We find that an excellent result may be obtained by adding a solution of 5 gms. of tartaric acid to the solution, which is then precipitated by barium chloride in the cold; the precipitate can be readily filtered off, and the thiosulphates are kept in solution without suffering decomposition.

Some sulphite of barium remains in the precipitate on the filter, but this can be completely and safely removed by finally washing with hot dilute hydrochloric acid and boiling water.

Yorkshire Section.

Chairman: C. F. Tetley.

Vice-Chairman: J. J. Hummel.

Committee:

H. E. Aykroyd.
J. E. Bedford.
F. W. Branson.
T. Fairley.
N. Farrant.
A. Hess.

W. Leach.
W. Mc'D. Mackey.
A. G. Perkin.
C. Rawson.
Geo. Ward.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, Yorkshire College, Leeds.

Meeting held at the Queen's Hotel, Leeds, on Monday,
February 24th, 1896.

MR. THOS. FAIRLEY IN THE CHAIR.

SULPHIDES, SULPHITES, THIOSULPHATES, AND SULPHATES: THEIR ESTIMATION IN PRESENCE OF EACH OTHER.

BY F. W. RICHARDSON, F.C.S., ETC., AND H. E. AYKROYD.
ALTHOUGH it is not a difficult task to estimate any one alone of the radicals referred to in the title of this paper, it

The results obtainable by this method will be submitted for comparison towards the sequel.

2. *The Estimation of Sulphides* can be readily made by means of a standard ammoniacal zinc solution prepared according to Schwarz's method (see Sutton's Volumetric Analysis), and of such strength that 1 c.c. = 0.0016 gm. S as sulphide.

Our experiments were tried solely with the simple sulphides, but it would not have been a very difficult matter to determine the amount of "polysulphides" present, as these would be precipitated as polysulphide of zinc, the sulphur content of which would represent the character and quantity of the polysulphides to be determined. Nickel sulphate was used as the indicator, and was found to give excellent results.

To remove sulphides from the solution prior to examination for sulphites, thiosulphates, and sulphates, a slight excess of the ammonia zinc chloride was added, and the mixture was filtered. By our process this method appears to be wholly free from objections.

3. *Estimation of Sulphites and Thiosulphates*.—If one attempts to estimate sulphite of soda alone by the titration of its aqueous solution with decinormal iodine perplexing results are sure to be obtained, and we find that the use of oxygen-free water does not add much to the simplification of the problem.

Degree of dilution and temperature have much to do with the differences obtained, but degree of neutrality is even of greater import; indeed, free sulphurous acid in even very dilute solutions gives very erratic figures when titrated with decinormal iodine. A solution of SO_2 which gave 56 per cent. of SO_2 by complete oxidation to sulphuric acid and subsequent estimation in the form of barium sulphate, furnished the following figures with 5 c.c. :—

Ordinary Water.	Oxygen-free Water.	N I.	SO_2
C.c.	C.c.	C.c.	Per Cent.
50	..	7.5	0.48
100	..	9.2	0.58
200	..	9.6	0.61
400	..	9.6	0.61
..	100	9.6	0.61

Giles and Shearer (this Journal, III., 197, and IV., 303) have shown that it is necessary to add the sulphite to excess of $\frac{N}{10}$ iodine if accurate results are to be obtained, and this is our uniform experience.

We believe we have found a process which enables us to determine sulphites, and even free sulphurous acid, readily and accurately, not only in a pure form but even when mixed with sulphides, thiosulphates, and sulphates.

It is well known that when iodine solutions react with solutions of neutral sulphides neutral sulphates, and an equivalent quantity of hydriodic acid are formed :—



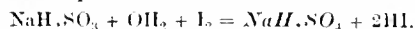
Thus a neutral sulphite of soda solution was added to three respective 20.0 c.c. of iodine until the reaction was complete; to neutralise the resulting colourless solutions were required :—

Phenolphthalein as indicator,	19.8 c.c.
Methyl orange	20.0 c.c.
Litmus	20.2 c.c.

Therefore the result with methyl orange was theoretically accurate.

We find that the best plan is to reduce all sulphites to the condition of bisulphite—that is, to the state of hydrogen-sulphite of the base; this is necessary because a sulphite may be alkaline, or it may be exclusively acid; indeed, a so-called "pure sulphite of soda" gave us, with phenolphthalein as indicator (knowing that bicarbonates of the alkalis are neutral to phenolphthalein), as much as $\frac{1}{10}$ per cent. of sodium carbonate. Sodium-hydrogen-sulphite is quite neutral to methyl orange, and by titrating the solution of a neutral sulphite with decinormal sulphuric acid, using methyl orange, we arrive exactly at a point

when all the sulphite is converted into the acid sulphite. This did not dawn upon us until we had obtained a number of results which gave the sulphite just half as large again as it should have been. The reason for this is patent when we consider the reaction which takes place when an acid sulphite acts upon iodine—



Here we have a new factor, inasmuch as the titration with alkali and with methyl orange as indicator is concerned; although the acid sulphite of soda is neutral to methyl orange, the acid sulphate of soda is acid to the full and exact extent of its combining power.

Thus one molecule of sodium-hydrogen-sulphite, on titration with $\frac{N}{10}$ iodine, liberates acid equivalent to three molecules of sodium or potassium hydrate.

A solution containing 1.62 per cent. of $\text{Na}_2\text{SO}_3 \cdot 7\text{Aq}$ was titrated upon. Iodine solution equivalent to 9.5 c.c. $\frac{N}{10}$ I; 29.9 c.c. were required; the mixture required 14.6 c.c. of $\frac{N}{10}$ NaHO. Now 9.5 c.c. $\frac{N}{10}$ I and 14.6 c.c. $\frac{N}{10}$ NaHO are in the ratio of 2 : 3 almost exactly; by using 0.0126 as the factor for the c.c. of $\frac{N}{10}$ I and 0.084 for the $\frac{N}{10}$ NaHO, both results give 1.64 per cent. of $\text{Na}_2\text{SO}_3 \cdot 7\text{Aq}$. (Of course the sulphite solution had been previously titrated with $\frac{N}{10}$ H_2SO_4 in the presence of methyl orange.)

As the details of calculation may be somewhat obscure to those who have not experimented in this direction, the working out of an actual analysis may be of interest. A solution containing 1.00 per cent. of pure thiosulphate of soda and 0.78 per cent. of sodium sulphite was titrated upon 20 c.c. of iodine; 19.3 c.c. were required to decolorise; to neutralise with methyl orange as indicator 17.9 c.c. were required; therefore 100 c.c. of the mixture required 103.6 c.c. iodine and 92.7 c.c. of $\frac{N}{10}$ soda respectively; the c.c. of soda $\times 0.0684$ give 0.7787 as the percentage of $\text{Na}_2\text{SO}_3 \cdot 7\text{Aq}$, and this figure $\div 0.0126$ (the factor for 1 c.c. iodine in $\text{Na}_2\text{SO}_3 \cdot 7\text{Aq}$) gives 61.8 c.c., and this subtracted from 103.6 c.c. of total iodine required gives 41.8 c.c., and this $\times 0.0248$ gives 1.036 instead of 1.00 per cent. of $\text{Na}_2\text{SO}_3 \cdot 5\text{Aq}$.

The immense advantage of this method is better seen in the case of a complex mixture, where one must remove sulphides or other bodies by the addition of an alkaline solution of zinc or other precipitating agent. The alkaline filtrate is speedily brought into a suitable condition for iodimetric and alkalimetric titration by the method proposed.

As a test case we give the following :—A solution of known amounts of thiosulphate of soda and sulphite of soda was treated with 10 c.c. of a strongly ammoniacal zinc-chloride solution, and the mixture was titrated with it until it gave a neutral reaction with methyl orange; it was now made to 1,000 c.c., and it was titrated upon a known volume of $\frac{N}{10}$ iodine, using starch to find the end reaction (which is otherwise somewhat obscured by the methyl orange). The disappearance of the blue colour and the appearance of the pinkish-purple of the acidified methyl orange is both interesting and striking. Titration with $\frac{N}{10}$ NaHO is now easily accomplished. The results were :—

	Present.	Found.
$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{Aq}$	0.31	0.31
$\text{Na}_2\text{SO}_3 \cdot 7\text{Aq}$	0.29	0.22

A more rapid and satisfactory method it would be difficult to find.

We had previously tried Lunge and Smith's combined permanganate and $\frac{N}{10}$ iodine process for the estimation of sulphites and thiosulphates in the presence of each other, but found that the method was not only more tedious, but

that it was, in our hands at least, incapable of giving reliable results.

The following figures express a few of our results from the application of this process:—

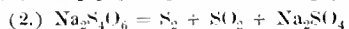
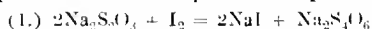
---	Present.	Found.	Present.	Found.	Present.	Found.
$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{Aq.}$	0.0583	0.0250	0.126	0.2058	0.126	0.2032
$\text{Na}_2\text{SO}_4 \cdot 7\text{Aq.}$	0.0254	0.0216	0.0209	0.0401	0.0209	0.0349

A far better method than this of Lunge and Smith (this Journal II., 463, and Sutton's Vol. Anal.) was arrived at ere the combined volumetric method above described was worked out.

After the sulphite and thiosulphate solution has been titrated upon a known volume of $\frac{N}{10}$ iodine, the sulphate formed is estimated by barium (any sulphate in the original solution is estimated by the tartaric acid method and deducted from the result), a little HCl being used in the boiling operation.

The results were on the whole very good.

We fully expected that the tetrathionate formed by the mutual reaction with the thiosulphate and the iodine would be decomposed in the boiling operation with the dilute HCl with the production of free sulphur and sulphate:—



But, strange to say, under the conditions of the analysis this never takes place.

True, we have obtained a very little BaSO_4 when thiosulphate was thus operated upon, but the amount has always been so small that it may have been easily due to a little impurity:—

(1.) 40 c.c. thiosulphate + 40 c.c. $\frac{N}{10}$ I thus gave 0.013 BaSO_4 .

(2.) 30 c.c. thiosulphate + 30 c.c. $\frac{N}{10}$ I thus gave 0.010 BaSO_4 .

(3.) 29.3 c.c. thiosulphate + 29.3 c.c. $\frac{N}{10}$ I thus gave 0.010 BaSO_4 .

These results were confirmed by many others, and we conclude that for every 10 c.c. of $\frac{N}{10}$ I in conjunction with 10 c.c. of $\frac{N}{10}$ thiosulphate, sulphate equal to 0.0025 gm. of BaSO_4 was produced. The following is an example of the application of our process to a mixture of known composition:—

	F.W.R. and H.E.A.		Lunge and Smith.
	Present.	Found.	Found.
$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{Aq.}$	1.0000	1.0292	0.498
$\text{Na}_2\text{SO}_4 \cdot 7\text{Aq.}$	0.7800	0.7704	1.064
$\text{Na}_2\text{SO}_4 \cdot 10\text{Aq.}$	1.2220	1.2530	..
$\text{Na}_2\text{S.}$	0.0420	0.0430	..
	3.0440	3.0956	..

We have tried to estimate thiosulphate by boiling with dilute HCl in an oxygen-free space in connection with a condenser, carrying the distillation to dryness.

If this last condition is not carried out, only some 90 per cent. of the thiosulphate will be decomposed. Proceeding thus we have obtained from 1 gm. of thiosulphate 0.126 gm. sulphur (theory = 0.129); in distillate 0.248 gm. $\text{SO}_2 = 0.9612 \text{ Na}_2\text{S}_2\text{O}_3 \cdot 5\text{Aq.}$ Unfortunately very much depends upon the accurate estimation of the sulphur, which partly distils or is carried over by capillarity and is somewhat difficult to separate from the apparatus. As 1 part of sulphur represents nearly 8 parts of thiosulphate of soda, a little loss may mean a serious error in the results. It is none the less certain that such a determination serves as a

valuable check to the other data, and may be of utmost importance when we have to deal with mixtures containing thiosulphates and thionates.

G. E. Davis (this Journal, I., p. 88, &c.), in a paper containing excellent suggestions and also processes which in his hands at least appear to have given good results, makes use of strontium chloride for removing the SO_3 , and cadmium carbonate for removing the sulphide; but we find that these reagents do not satisfactorily accomplish the task assigned to them. Davis found that all titrations made of mixtures of sulphides and sulphites in presence of acetic acid, or of any acid which displaces sulphurous acid, are incorrect; this is also our experience, and we are glad to have found a method which renders any such combination of circumstances unnecessary; indeed we object to Davis's plan of adding acetic acid to the filtrate from the precipitation of the sulphide with zinc for iodimetric titration, as we have shown that thiosulphates are soon decomposed in the presence of this acid.

At an early date we are to read a paper upon the subject of "Cachou-de-Laval"; indeed, the processes we have just described lie at the very threshold of any investigation into the complex composition of this compound.

Our best thanks are due to Mr. Frank Wood, and also to Mr. Adolf Jaffé, for carrying out some of the experiments necessitated by this inquiry.

DISCUSSION.

Mr. F. W. RICHARDSON stated, in reply to an inquiry from the chair, that the sulphate was determined in a separate portion of the solution, and that excess of ammonium tartrate had to be avoided owing to its solvent action on barium sulphate. Tartaric acid by itself had been repeatedly proved to dissolve no barium sulphate—a crystallised sodium sulphate, tested thus in small quantities, giving over 99 per cent. of $\text{Na}_2\text{SO}_4 \cdot 10\text{Aq.}$

Scottish Section.

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SESSION 1895-96.

April 7th.—Discussion on Mr. Stenart's paper, "The Standard of Minimum Flash-Point for Mineral Oil."

Meeting held in Glasgow on Tuesday, March 3rd, 1896.

DR. JOHN CLARK IN THE CHAIR.

THE STANDARD OF MINIMUM FLASH-POINT FOR MINERAL OIL.

BY D. R. STEUART.

1x November 1892, I read a paper before this Section on the flashing-point and heat of burning of mineral oils, and supplemented it, in December 1892, with a further paper at Edinburgh. In December 1893, some notes of mine were read at Manchester by Mr. Carter Bell. Many chemists

spoke in the discussions; and in both sections resolutions in favour of raising the standard to 100° were adopted. Strange to say, when Col. Majendie gave his evidence before the House of Commons Special Committee in 1894, he had never heard of these resolutions, nor of similar resolutions by the Chambers of Commerce of Manchester, Glasgow, Edinburgh, and Dundee.

I wish, in this paper, to recapitulate certain facts as to the relation between the Abel test and the point at which oil will explode in a lamp, or catch fire if spilled, and give new experiments; and in the light of present knowledge discuss how we and the Germans came to adopt such a low standard, and to compare that with the standards in America.

In the following experiments I tested the oil by trying to explode the mixture of air and vapour with spark from a pint bichrome battery and half-inch intensity coil. Explosive mixture, however, ignites more readily by the application of an ordinary light.

Exploding Oil at its Flash-Point.—I had an ordinary duplex lamp half filled with oil of 73° Abel test, heated for 1½ hours at 73°, and shook up gently before testing. The vapour flashed, blowing out the cork, with little report.

Dr. Thörner, of Osnabrück, with a very small lamp, 150 c.c. capacity and 100 c.c. of oil in it, of which 50 c.c. were drawn off before exploding, and trying, not to get point of severe explosion, but *lowest* point at which he could get explosion of any kind, found that the explosion took place sometimes a little under the flash-point Abel, but oftener a little above it. Of 30 experiments the average was 1·2 above the Abel flash-point, *two being violent*. With larger lamp, size of ordinary duplex, 800 c.c. capacity, 500 c.c. oil, and 100 c.c. drawn off, he found, average of four experiments each, with oil of 71·6° F. Abel, that the explosion took place at 72·5°, with oil of 82·4° Abel at 84·2°. *One explosion was severe*. So, as a demonstrated scientific fact, with some oils at any rate, *there is danger of severe explosion in a lamp even at its flash-point Abel*.

At a very few degrees above Abel flash-point, I often found explosion very severe. Oil of 792 sp. gr. and 80 flash-point, which was ordinary Royal Daylight petroleum, bought at random, heated in water-bath, reservoir of lamp 14,000 fl. gr. half-filled with oil, cork without hole, I got sharp explosions at 85°, 90°, 95°, and so on every 5°, up to 140°. All sharp explosions. We did not try higher temperature although the vapours had not got in excess. We heated in each case half an hour, beginning with oil cold. If we had heated longer, no doubt the vapours would have got in excess and ceased to be explosive. This shows that this kind of false safety can only be got by passing through point of severest explosion. Similar experiments with little hole in cork to let off pressure of vapour, heating 1½ hours at 120°, sharp explosion; 1½ hours at 140°, no explosion; with 3,500 fl. gr. oil, 1½ hours at 140°, no explosion; 1,000 fl. gr. oil, 1½ hours at 140°, no explosion. So, with longer heating the point beyond explosion from excess of vapour is got, if the temperature is high enough; but in these experiments the temperature required is far above the ordinary temperature of the common lamps of the people. So to trust for safety to excess of vapour is to deceive ourselves. Such safety, if safety it were, could only be depended on if oils were all guaranteed of low flash.

With an iron, single-burner lamp, fitted up with burner and ¾-in. wick, half-filled with oil of 73° flash, and heated 15° above the flash-point, the vapours exploded with violence, blowing the wick bodily out of the lamp some yards away. When heated 5° above flash-point, there was a flash or puff, not a sharp explosion, which blew the cork, which was not very tight, out. When tightly corked 5° above flash-point, there was no visible result. The oil for last two experiments had been used for several experiments and may have been somewhat exhausted of vapours.

The same lamp half-filled with fresh oil of 78° flash, heated 5° above flash-point, exploded violently, blowing out the cork, which was fixed in as firm as it could be

made, and at the same time blew the wick up three or four inches through the wick-tube. At 10°, 15°, and 20° above flash-point the results were similar; the explosions seemingly all alike severe.

I got oil reservoirs of tin made of definite sizes, and fitted with the Abel cap top, so as to test the flash-point in lamps of different sizes in comparison with the Abel flash-point.

Oil Flash Abel.	—	Different Experiments.
73°	Reservoir 2 ins. wide by 3 ins. deep, half-filled with oil.	Flashed at—69°, 70°
99°	Do. do. do.	98°, 102°
73°	Reservoir, 3 ins. wide by 3 ins. deep, half-filled with oil.	89°, 75°, 73°, 70°, 71°
99°	Do. do. do.	100°, 101°, 99°, 99°
122°	Do. do. do.	123°, 121½, 123°, 124°
78°	Reservoir 2 ins. wide by 4 ins. deep, half-filled with oil.	78°, 79°
78°	The same reservoir and oil filled to usual distance from top, 14 ins.	73°, 72°
99°	Reservoir 3 ins. wide by 2 ins. deep, half-filled.	95°, 96°
99°	Reservoir 3 ins. wide by 2 ins. deep, full to 14 ins. from top.	97°, 97°
99°	Reservoir 3 ins. wide by 4 ins. deep, half-filled.	93°, 94°
99°	Reservoir 3 ins. wide by 4 ins. deep, full to 14 ins. from top.	96°, 95°
78°	Reservoir 5 ins. wide by 4 ins. deep, half-full, gently shaken.	74°, 71°, large flash.
78°	Reservoir 5 ins. wide by 4 ins. deep, three-quarters full, gently shaken.	76°, 76° do.
99°	Reservoir 5 ins. wide by 4 ins. deep, full to 14 ins. from top, not shaken.	94°
73°	Do. do. do.	68°

So with ordinary lamps, the oil flashes under the Abel flash-point, and with large size of lamp, the oil flashes as much as 5° below the Abel test. When the reservoirs were tried half-full, as stated above, it was a little before the vapour mounted to the top of where the light was, but the flashes were very large, and the thermometer was suddenly sent up 2°. The reservoir 5 ins. by 4 ins., with top to fit the Abel top, had the Abel top removed, and the vessel with its 2-in. orifice used as an open tester. When full of oil of 73° Abel it flashed open at 72°; when half-full of oil at 71°; when full of oil of 99° Abel, it flashed open at 99°, and when half-full also at 99°. So for large lamp quantities of oil in certain circumstances the open flash-point is as low as or lower than the Abel flash-point.

Our opponents all dilate on the extreme fewness of lamp explosions, and put all the blame of lamps upset or broken on the lamps or the people. If a lamp is upset or broken with oil flashing above 100°, there are a thousand chances to one that the lamp goes out without doing harm. It may in the thousandth case cause a fire as any other light would; but the oil is not ignited at once; the burning wick would be some time on the pool of oil without igniting it, and if it ignited at all it would be slowly. Contrast this with a lamp with 73° oil upset or broken; the oil ignites so furiously that in common speech it is said to have exploded. Lamps upset are more numerous, no doubt, than explosions; but a lamp upset is perfectly innocent unless the flash is low. I see no need for the sharp discrimination of explosions and these sudden uncontrollable ignitions, for neither can take place except with dangerous low-flashing oil.

In Col. Majendie's 1890 report, Abel and Redwood gave details of 28 accidents happening between 30th July 1887 and 16th January 1890, and of these 23 were lamp explosions. In 1893, of the 36 accidents investigated by the London County Council officers, only 2 were acknowledged to be lamp explosions. How does it happen there were 82 per cent. of explosions in Abel and Redwood's cases, and only 6 per cent. in the London County Council inspectors' case? There was no change of oil or lamps in that time; but the facts as stated by the inspectors are influenced no doubt by their theoretical opinion that an explosion is nearly an impossibility.

With cheap lamps oil necessarily flows out when the lamps are overturned. Even if tight when new, they soon

get leaky, or else the burner is not screwed in tight. A safe oil makes any common lamp safe; but a good lamp cannot save accidents from low-flash oil. To depend on lamps, therefore, and designedly adopt oil of 73° on account of its giving off much vapour, and tends to become non-explosive, is a great mistake. The non-explosive condition, as I proved, is difficult to reach in practice often, and yet the oil, if set free, burns most fiercely. A year ago, through a friend in London, I got all the lamps then recommended by Mr. Spencer. Good new lamps, and carefully screwed home. On being lighted and overturned, all leaked, and, with one exception—a self-extinguisher—all took fire; and on attempting to extinguish the flame, one gave a serious explosion. The oil was ordinary American petroleum, 79° flash. In all cases, I tried to extinguish before the fire became so fierce as to spoil the lamps. The self-extinguishers cannot be depended on for continuous work unless in careful hands. I have known of several accidents with safety lamps. *There are few accidents with them, only because scarcely any are used.* Their safety depends on screws, and these soon get out of order, or are not screwed home, and then the safety lamp is an extra danger. Safety depends on safety tubes for the wicks, and these are a trouble in wicking the lamp, and will be left out without any thought of danger. Experiments with new lamps in good condition, like Mr. Spencer's, are worse than useless. Then the fount has to be of metal, and fount and safety tube cause heating of the oil, and increase the danger greatly, and entail many accidents that with glass would be free from danger. Safety lamps, to keep them safe, require intelligent treatment and care, and intelligence and care have to be provided against as necessarily absent; for it is only because they are necessarily absent that oil legislation is required at all. Metal lamps also tend to get filled too full, and when the heat comes with the burning, the expansion of the oil causes danger. To legislate as to lamps, and leave the oil of present standard, is necessarily to fail. I hear great things of new lamps Mr. Spencer has tried; but one thing is certain, that he cannot have discovered a lamp that makes the oil safe while still in barrels in the steamer, train, or shop, or in the oil-can in the house. Lamp legislation does not even attempt to cover one-hundredth of the danger of low-flash oil.

I tried the danger from upsetting cheap glass lamps, costing 9d. to 1s. each, flat-wicked single burners, half filled with the oil. I tried to get at the danger from burning, inherent in the oil itself, apart from the danger of over-setting on easily combustible materials—a danger common to all flames. After burning for some time, I tipped the lamp from the table on to an iron tray covered with broken bricks, so as to break it. The brick was to interpose a bad conductor between the oil and the iron, and prevent the oil being put out by the sudden chill from the cold iron. American petroleum, 73° flash, heated 5° above flash-point for half an hour, then tipped over: the lamp went out. Heated 10° above flash-point for half an hour: gave a flash, then went out. Heated 10° above flash-point for one hour: oil blazed up fiercely, no explosion. Heated 15° above flash-point for half an hour: oil caught fire, and continued to burn quietly; easily put out. Similar experiment with Russian petroleum of 87° flash-point, heated one hour 10° above flash-point: oil flashed, but went out. American petroleum of flash point 105°, heated 10° above flash-point: lamp did not break this time; some oil ran out, but lamp was only extinguished, and oil did not catch fire. Repeated the experiment: the lamp broke, but went out. Broxburn paraffin oil, 108° flash, heated 5° above flash-point for half an hour: went out. 10° above flash-point for one hour: oil gave a slight flash and went out. 15° above flash-point for half an hour: oil caught fire, burned two minutes, then went out of its own account.

Lamps at 9d. each smashed up wholesale soon come to money. I tried to gauge the same danger without breaking a lamp each experiment. I put a candle on the floor, covered with a hood to prevent the oil coming in contact with the flame, and I spilled quantities of oil equal to a lampful from a table on to the candle. If the oil caught fire readily, it must be from the vapours evolved. 100° flash-point oil, heated to 105°: light went out. Heated to

110°: did not catch fire, candle did not go out. Heated to 115°: oil caught fire, and burned very quietly. With oil of 73° flash, heated to 75°: much vapour rose from the oil, but it did not catch fire. Heated to 78°: did not catch fire. Heated to 83°: oil caught fire and burned quietly. Heated to 78°, and tipped over on to the floor while still hot from previous fire: the oil caught fire.

So high-flashing oils have very little danger in over-setting or breaking lamp, unless heated to, the altogether unusual temperatures of more than 10° above flash-point, while with ordinary low-flash oils danger begins 5° above flash-point, and therefore at ordinary temperatures of house and lamp. Any spraying of the oil by dashing on the floor, or from explosion of the lamp, will make the oil catch fire more readily. All these figures show that high-flashing oil is safer than low-flashing, even more than in proportion to the flash-point.

From these results we see that different oils of the same flash-point vary in their nature to some extent; and that for oil spilled by lamps over-setting, with oil of 73° serious danger begins at 78°, and with oil of 100° danger does not begin till 110° or 115°.

We come next to whether oils of 73°–85° or oils of 100°–120° develop most heat in burning. I have published several series of experiments on this point. One series of experiments gave a very slight increase with low-flashing oil over the temperature developed in the oil reservoir with high flashing, within the error of experiment almost, when the air-holes were quite clear; but when the air-holes were clogged, the temperatures with the low-flashing oils were distinctly the higher. In other experiments the general rule was an increase of heat with decrease of flash-point, although there were a few slight exceptions. In general, in my experience, the high-flashing oil, judging from temperature developed, is safer even, more than in proportion to the flash-point. I never in any case got with a high-flashing oil a temperature sufficient to neutralise its higher flash-point or anything approaching it. Abel and Redwood, in their 1890 Lamp Report, stated that "experiments have demonstrated that the burning of an oil of comparatively high flashing-point is *more likely* to cause heating of the lamp than the use of an oil of comparatively low flashing-point in consequence of the higher temperature developed by the former, and of the greater difficulty with which some oils of that description are conveyed to the flame of the wick." They did not say what temperature they found, and whether they ever got, *even in one case*, an increase of heat equivalent to the higher flash-point. They only gave the result as *more likely*, and built on it the warning that high flash-point was not alone to be trusted to, as "in certain cases such oils *may* give rise to dangers which are small, if not entirely absent, with oils of comparatively low flashing-point." They warn us, as it were, against the over-confidence in high flash-point; and they did not, as several thought, say that high-flashing oils were no safer than low-flashing ones and sometimes more dangerous.

The heat of burning developed in lamps is dependent on many little circumstances obscure to us. Atmospheric pressure and amount of vapour in the air probably tell on the result, and cause that one experiment is not exactly comparable with another. The amount of soda soap left in the oil by imperfect refining has great influence, and probably also the amount of sulphur in the oil. So that generalisations can only be made with confidence on the average of numerous experiments, or from samples carefully made comparable in manufacture. The German Government experiments found that lamps burned in cold chambers gave more heat than when burned in warm chambers, and the conclusion was that there was less heating in warm weather. The warm chamber was heated by many lamps being burned together in a small chamber, and the experiments continued for a fortnight, but this introduced unnatural circumstances quite different from plenty of warm summer air, and I would put the results aside as altogether worthless; as I know that what seems a very small matter sometimes has a great influence on the temperature developed. The interval between temperature of chamber and temperature of oil in reservoir is probably influenced by atmospheric temperature, but the same oil must

be tried in comparable natural circumstances. Scotch oil requires a little more air to burn it than American, and it is a matter of draught dependent on air-holes, chimney, &c., of lamp, whether the extra latent power in the oil appear in any particular case as extra white light with cool burner, or as extra heat with red light. So, oils of different nature, like American, Scotch, and Russian, cannot be properly compared by burning in the same lamp, as Mr. Spencer did. Each should have a lamp to suit it. In Scotland here, we probably have adopted types of lamps and chimneys to suit Scotch oil, while in London the lamps and chimneys, although to careless inspection the same,

may be expected to suit the American oil more. This may be the reason why I find the general rule to be that high-flash oil burns coolest, while Mr. Spencer is under the impression that it burns hottest. It may depend on a slight difference in length of Scottish and London chimneys to suit the prevailing oil, or something of that kind.

Instead of giving details of many experiments I will only give one. I took from a burning oil still samples at various points, so that all were comparable and each homogeneous in its nature, and tried the burning and took the temperatures after six hours.

Specific Gravity.	Flash.	Glass Lamp.				Metal Lamp.			
		Temperature			Increase of Oil over Room after 6 hours.	Temperature			Increase of Oil over Room after 6 hours.
		Of Burner.	Of Oil.	Of Room.		Of Burner.	Of Oil.	Of Room.	
790	118	104	57½	54½	3½	125½	66½	54½	12
805	165	100	55	52	3	131	67	52	15
820	205	96½	55	53	2	124½	68½	53	15½

The figures are in each case the *average* of three days' burning. With the glass lamps there is a gradual decrease of heat with increase of flash-point. With the iron lamp the results tend the other way; but the details of the different days differed much more than with glass. So that Mr. Spencer's working mostly with metal lamps may have helped to give him the impression that high-flash produces more heat. There is, however, nothing here to neutralise in the least degree the extra safety from the higher flash: only 4° difference of temperature for 87° difference of flash. With the metal lamps recommended by Mr. Spencer, I

found the Scotch high-flashing oil rather warmer than the low-flashing American petroleum, although nothing to neutralise the extra safety; but the lamps were no doubt adapted for petroleum and not Scotch oil.

Mr. Spencer, in his evidence before the Parliamentary Committee in 1894, gave figures which produced the impression that he had got more heat with the higher flashing oils, and talked as if this were a general law; and the committee in their conversation and questions took this law as granted. The figures he gave were as follows:—

	Scotch Oil, Flash 110°			Russian Oil, Flash 91			American Oil, Flash 82°		
	Temperature of Oil.		Increase of Temperature.	Temperature of Oil.		Increase of Temperature.	Temperature of Oil.		Increase of Temperature.
	On Lighting.	After 5 hours' Burning.		On Lighting.	After 5 hours' Burning.		On Lighting.	After 5 hours' Burning.	
1. Glass reservoir, without wick tube.	65	81	16	70	84	14	69	83	14
2. Metal reservoir, without wick tube.	65	87	22	70	92	22	69	89	20
3. Metal reservoir, with metal wick tube.	65	99	34	70	101	31	69	97	28

The temperature increase as given by Mr. Spencer was over the initial heat of the oil. Now that is a figure of no value nor interest. The oil soon warms up to the heat of the room from radiation, &c., and the room during the experiment may have been warmed from atmospheric influences or the fire more in one case than the other. The figures should have been, increase of temperature of oil at the end of experiment over the temperature of room at the end of the experiment. The figures then would have been—

Lamp.	Increase of Temperature of Oil over Room.		
	Scotch, 110 Flash.	Russian, 91 Flash.	American, 82 Flash.
1. Glass reservoir, no tube for wick.	6	6	8
2. Metal reservoir, no tube for wick.	12	14	14
3. Metal reservoir, with metal wick tube.	24	23	22

With both glass lamp and metal lamp without wick tube the Scotch oil with high flash developed even less heat than the American oil, and with metal lamp and metal wick tube

only 2° more. The Scotch oil was of 28° higher flash-point, and would have had to develop 28° of extra heat to have become as dangerous as the American oil. So even Mr. Spencer's own figures bear out the fact that there is no more heat with high-flash oil under ordinary circumstances in ordinary lamps.

As a matter of incontestable fact, then, the Abel flash-point may be reckoned the point of incipient danger for explosion in lamps, and at a very few degrees above it, varying with the nature of the oil, the explosion is or may be very severe. The larger the quantity of oil experimented with, the lower is the flashing-point. An oil which flashed at 78° F. Abel I tried in a 9-in. wide cup, covered over, and with circular holes to test by. I found the oil not only to flash, but to ignite permanently at 76° F., or 2° under the Abel test. In an open dish 9 in. wide, the oil permanently ignited at 87° F.

To test the danger of a large spill of oil on a floor, and the danger of a light applied to a large vessel of oil, I took a tray, 14 ins. by 10 ins., and put an inch of oil in it, and covered loosely with a sheet of tin. I put it in a larger tray of warm water, and heated the oil up slowly for 25 minutes. The flash-point (Abel) of the oil was 74½°, and when the temperature reached 79°—that is, 2° under the flash-point—the lid was lifted off and a light applied, and the oil took fire permanently. The firing-point of larger quantities of oil is the flash-point. I mean if the

vapour flashes it takes fire permanently. So the American firing-point is not the true firing-point, but sometimes 50° above it. For larger volumes of oil such as tin can, barrel, tank, or large spill on the floor, the firing-point is somewhat noder the Abel flash-point. This, at any rate, is the case with some oils.

I tested the diffusion of vapour into the air in this manner. I took a half-gallon tin can, shook up 4 oz. of shale naphtha, 730 sp. gr. in it, for five minutes, turned it upside down, and drained out with loosened cork, wiped the neck, and set it to stand on its bottom without a cork. I tried exploding after various intervals by pouring out the vapour on a lighted candle.

After 4 hours, very violent explosion.

" 6 "	" "
" 8 "	" "
" 10 "	not very violent explosion.
" 12 "	explosion still less violent.
" 14 "	very faint explosion.
" 15 "	no explosion.
" 16 "	" "

The Petroleum Committee of 1894 asked Col. Majendie, if he did not think 73° oil dangerous when the temperature of the air was above 73°. He answered that the close test was an artificial one, and that he did not think that with a barrel of oil of 73° flash and temperature 83° there was any danger of fire with bung half open. The open test is manifestly artificial and false, but the close test is an imitation of lamp and barrel on a very small scale, and therefore natural. I had not oil of 73°, but I tried a half-barrel of 82° flashing petroleum, heated to 92°, and drew off the mixture of air and vapour into bottles, and applied a light, and the bottles exploded readily. The vapour in the barrel was beyond the point of severest explosion from excess of vapour.

The Standard in America.—In Thorpe's Dictionary of Applied Chemistry, Mr. Boverton Redwood has the following remarks in an article on petroleum:—"The experience of many years has conclusively demonstrated that the transport and storage of kerosene of comparatively low flashing-point (say, 70° F., Abel test, or its equivalent), and its use in properly constructed lamps, is free from risk." The proportion of the total fires in London from petroleum, being over 19 per cent. of those of known origin in 1893, 23 per cent. in 1894, and 20 per cent. in 1895, after all the County Council's recommendation as to lamps, is a practical demonstration that the remark is contrary to fact and experience. He proceeds:—"This practical conclusion has been confirmed by recent experiments made in this country by Sir Frederick Abel and the writer, and in Germany by the officials of the Standard Office, and it has been found that some oils of high flashing-point may be actually less safe than others of low flashing-point. The tendency of modern legislation in the United States indicates a recognition of this fact." It would be a great pity if the legislation of a great nation like the United States, so much interested in petroleum, should recognise as fact such a tremendous error.

The Home Office, in the memorandum published on the Inflammable Liquids (1891) Bill, gave the flash-point of States and important cities in the States as they were some years ago, and Mr. Redwood gives in Thorpe's Dictionary, article petroleum, the more recent standards of the same places. I find that in five States, viz., Pennsylvania, Massachusetts, Vermont, New Jersey, and Minnesota, and also in the city of York itself, there has been a raising of the standard, and in not one case was there a lowering. The subject has been investigated by many State boards of health or other State official experts. Some States have no state law, but even of these some have efficient regulations and inspection in every town and village. Four or so have as low a standard as Britain, but these are producing States, and their low standard is used only for export. Order 73° oil from many refineries in Pennsylvania, and they would supply high-flash oil at a cheaper rate: they have no facilities for filling oil of low state standard in barrels; all that quality goes by pipe-line to New York. Some States have high standard but poor inspection; but many have high standard

and efficient inspection. There is a tendency to high standard and more efficient inspection everywhere.

The Standard in Germany by imperial statute is 21° C., or say, 70° F. But this is not recognised as a safety point. In this country cities or local authorities are by our imperial statutes prevented from taking any surveillance or precaution in regard to burning oil. In Germany the States and Cities were encouraged to regulate the oil trade, and did so. Shops are allowed to have 14 gallons of oil in stock, or 83 gallons with specified precautions; or if the shop is a dwelling-house, only 5½ gallons are allowed. This is the kind of trade we also will be obliged to adopt if we stick to our absurd standard. Germany has fewer accidents than England has, because Germany treats burning oil as we treat naphtha in law and in use, regarding it as a dangerous liquid.

It was shown to the German commission that England lost all its great Continental trade by raising the standard to 120° fire test (=73° Abel). The merchants argued quite rightly that 120° fire was practically no safer than 110°; that German ports and merchants had now 40 per cent. of the European trade; and that raising the standard even to the English standard would make them lose it all. This argument was conclusive. Prof. Hofmann, not knowing the question himself, was sure the English must have some reason for their standard, and made an appeal for 73° instead of 70°, but failed. He was in error. It would have lost their trade without gaining any safety. They were told, on Mr. Redwood's authority, that the English had made their standard so high for protection to the home manufacture. In their report they honestly state that the danger is in proportion to the lowness of the flash-point; that safety could only be attained by going far above 30° C. for standard; and they accepted the petroleum merchants' assertion that this would make oil too dear. They said: "The only question for us was whether oil of 23° C., as in England, or 21° should be adopted. This 2° was going to increase perceptibly the price of the oil, interfere with the German trade in foreign oils, and as proved by Dr. Weber's experiments, would have given practically no increased safety." So they conclude: "That with proper lamps, properly managed, at ordinary temperatures of the air, oil of 20° C. may be counted safe." They put it very carefully. They did not, as Mr. Redwood said, find 70° F. safe; but made the frank avowal that 70° oil was dangerous unless with special care and special lamps. So their conclusion was arrived at quite frankly in opposition to scientific requirements to conserve the Continental trade for German ports.

Legislation.—Paraffin oil from Boghead coal commenced to be made about 1851, and as long as true paraffin oil was the light of the people there was nothing heard of lamp accidents. When, after 10 years, petroleum commenced to be introduced in quantity, accidents and fatalities became numerous, and through scientific men writing in the newspapers, &c., a demand was made for legislation to protect the people. Our first Petroleum Act was passed in 1862. No method of testing was given, but "Petroleum for the purposes of this Act shall include any product thereof that gives off inflammable vapour at a temperature of less than 100° F." As we have seen, oil of 100° Abel test, gives off inflammable vapour in dangerous quantity at 100°, so that if our legislators had had our present knowledge, they would have fixed 100° close test as the standard, and it was, therefore, 100° close test that they meant. The words they used were a good enough definition of flash-point, but the Americans interpreted it as allowing 100° with their open firing test, which gives a point about 50° above the close test and the point of danger. The result was that oil was sent in more dangerous than before, and for awhile safe oil could no longer be got. The Act appointed no inspectors, and the law, although powerful for evil, was quite powerless for good. As a consequence, fatalities, instead of being fewer, were more numerous.

The next step was the investigation by the Select Committee of the House of Commons on Fire Protection, 1867. The evidence was printed, with a separate index. Science was faithfully represented by such men as Prof. Lyon Playfair and Dr. Atfield, and they advocated 120° open test as

the lowest standard that could with safety be adopted. Prof. Playfair represented that this standard could easily be attained in practice, and without harming the foreign petroleum trade, and this was supported by large refiners from America. The petroleum trade representatives, however, maintained that a high standard would practically shut out foreign petroleum, and declared that 100 firing-test was sufficient for safety. The Committee reported that explosions from mineral oil arose from a light being brought in contact with the vapours, and the lower the temperature at which vapours are given off, the greater the danger. So the Committee had caught quite clearly the scientific principles of the case. Trying to strike a medium between the conflicting demands as to standard, they recommended as a compromise that no coal, shale, or petroleum illuminating oils should be sold with an ignition point under 110° F., to be tested with an oil cup in a water-bath, and a light applied to the surface of the oil. Evidence had shown that Americans tested by applying the flame to the surface of the oil, but that the English petroleum tester applied the flame an inch above the surface of the oil, so the Committee evidently meant to fix us to the stricter American method.

When in 1868, these recommendations were attempted to be carried out in a Bill, the schedule descriptive of the apparatus and mode of testing was handed over to Prof. Abel, Dr. Letheby, and Prof. Atfield. They reported that the standard, instead of being 110 as recommended by the Parliamentary Committee, may be lowered to 100° if their test and method of testing be rigidly adhered to. The apparatus they recommended was to be of thin sheet iron, 3 ins. deep, $1\frac{1}{2}$ ins. diameter, with a rim at top to support it in water-bath which was $4\frac{1}{2}$ ins. deep and $4\frac{1}{2}$ ins. diameter. The petroleum is to fill the inner vessel about half full; the surface of the water in outer vessel to be at same level, and commence cold, and a small flame put below it. A thermometer in the oil is to be moved about occasionally, a small flame applied quickly close to the surface of the oil, at 90° , and tried every 5° until a flash is got; then the experiment repeated with fresh oil and cold water, beginning near the flash-point got, and applying the flame every 2° .

This apparatus will give a varying result, depending on whether in a quiet or a draughty room, whether the flame is skilfully put over the surface of the oil or put a good way above it. With oil of 73° Abel, beginning to test at 65° and testing every 5° , I get the flash at 70° , or 3° under the Abel test, every 2° it flashed at 73° . Other experimenters got results varying by 5° or so, according to skill. So this test is practically the same as the Abel test when the conditions laid down are rigidly adhered to, and all their remarks may be taken as applicable to Abel flash-point.

The old open test was put into the Bill contrary to Dr. Atfield's protest at the time; and that, without raising the standard to suit, the standard being left at 100 to suit the cup of the three chemists. The old open test gives a point 20° or 30° higher than that of the three chemists. So 100 standard crept into the Act through an egregious blunder, viz., the standard fixed with one test and a different test adopted. There has never been any scientific Government investigation which proved that 100 old open test was safe for the people, but only the investigation of the three chemists proving the very reverse.

100 old open test thus became the standard, the lowest possible point with the most unreliable instrument, and the standard has been kept at this point ever since. With the result that accidents have continued as before; but people were now satisfied that they were inevitable.

The old open test thus adopted is a very false and unscientific one. The cup is open, although oil is never burned or kept in an open vessel; and the vapours given off, instead of accumulating as in a lamp, are gradually dissipated into the atmosphere during the experiment, and the slower the temperature rises the falser is the result. Also, instead of getting the light applied to near the surface of the oil as the Americans do, the flame was not allowed to get within quarter or half-an-inch—often in practice a whole inch—a matter of considerable importance in an open test. But the test would have been passable if honestly

used, with proper stipulations as to screen, &c., if the standard had been made to suit it. The petroleum authorities, however, adopted a very low rate of heating and also a very low screen, thus "trying to get as far away from the truth as possible," as Mr. Keates, Metropolitan Inspector, boldly accused them of doing. Every time they applied the flame they passed it back and forward three times, thus cutting away the vapours, instead of quietly applying it at once. This is all distinctly brought out in the Report, Petroleum Bill, 1872. No conviction could be got under this test; a little manipulation of the breath could prove any oil safe, and there was constant conflict between the results of the Metropolitan Inspectors and the chemists employed by the Petroleum Association. It was seen at once that a close test must be adopted, and Mr. Keates's was proposed; but the question arose, what was the equivalent between the close and the open? In 1871 the Act still in operation was passed, but as no agreement could be come to between the conflicting parties as to the right point to put in for the close test, the old open test and 100° was again put in, and the Act passed for a year in the hope of an agreement. The Government did not refer the matter to any scientific authority, who could by experiment easily settle the matter for ever; they let the matter be fought out between the home trade and the foreign, neither of whom were by any means identified with the good of the people, but both had interests in common contrary to the people's. Moreover, the question was not as it should have been, what is the equivalent of 100° in the test of the three chemists? but, conserving the original blunder, what is the equivalent of 100° old open test?—a different question, and a very indefinite one. The petroleum chemists made the difference about 30° ; the home trade chemists made it about 15° . The old test had to be adopted from year to year, as no agreement was possible. It was settled in 1879 when the Abel test was adopted, when the petroleum authorities got all their own way.

In 1868 Parliamentary Committee recommended 110° open test. The three chemists recommended a test equal to 120° open test; and here we adopt 73°—not the equivalent of 100° open test, as originally intended by the Government, but even 10° under that at least.

The Government, however, saw that this was not all that was required, and they asked Prof. Abel "whether 100° F. (or its equivalent in any modified method of testing) is, in your opinion, calculated to afford adequate protection to the public without unduly interfering with or restricting the trade; if not, what alteration in this respect should be made? He answered, "There are not, in my judgment, well-established grounds for considering that the present flashing-point of 100° F. is not calculated to afford adequate protection to the public." Col. Majendie in 1894 said he wished to suspend his opinion on the flash-point and said the *onus probandi* lay with those who wish to disturb the present standard.

Before the old Parliamentary Committees there was mistaken evidence given, which was built on as facts by the Committees. For example, that, as most of the oil at present imported is under 100° flash-point, a standard of 100 would shut out practically all the oil of the people. Not one gallon of the oil would be shut out, but only the naphtha that was in it kept separate. Merchants in this country make the mistake of thinking that a low standard would be more easily kept up to by manufacturers than a high one, and that a high standard would cause constant rejection of oil and cause them trouble. The fact is, 100° flash is as easily made as 73°, and would be kept up to as certainly. American manufacturers themselves bore witness to the fact that high-flash oil could be produced easily at 1 cent. per gallon extra cost; but petroleum merchants of this country assured the Committee with confidence that if a high standard were adopted, not a barrel of oil would come in. The price then was 1s. 6d. to 3s. 6d. The cost has not been increased by 1 cent, but the price has been reduced by from 1s. to 3s., and yet the oil pours in. Events have proved a great deal of the evidence to be utterly mistaken.

Witnesses declared there was no danger at all until oil was heated to the temperature of the American firing-point,

which is 16° or 15° above the old open flash-point. Dr. Letheby (1872, p. 57) declared that he had proved that oil of 100° old open test (= 73° Abel test) could not be exploded in lamps under ordinary circumstances, by electric spark or otherwise. The evidence as to this fact was quite wrong, and no true evidence was given to rebut it.

The relationship of the Abel test to the points of danger is one easily determined by experiment, and this must be fixed once for all before the test can be of any use whatever. The Home Office, however, seem quite content to have a vague notion that the danger point for 73° oil is somewhat above 100° (Report, 1883, p. 21, § 99). Even yet they seem quite uninstructed (Report, "Petroleum," House of Commons, 1894, p. 23, § 251), and await information from interested parties (*Ibid.*, p. 13, § 93 and 96). What possible use can a test or standard be until its relationship to danger is fixed decisively from experiment by neutral scientific men or man? And whose duty is it to determine this if it is not the Home Office officials responsible for proposed Bills.

Then again, the nomenclature adopted by the Home Office leads inevitably to confusion. Petroleum is defined to mean, what is *not* petroleum in ordinary speech, but oil under 73° flash, which is generally known as spirit or naphtha, petroleum in our ordinary language being reserved for ordinary burning oil above 73° flash. Then again the term "high-test oil" is applied by the Home Office to very low-test oil, ordinary petroleum of 73° and above it. High-test oil in ordinary language is oil about a 100° flash and above it. The confusion caused by this is so great that Col. Majendie himself was confused, and in 1883 gave facts as for ordinary 73° oil, which were true only of true high-test oil above 100°; and when Captain Hope in 1894 asked a question about high-test oil he answered as for 73°, and confused Captain Hope entirely. This way of using language adds unnecessary confusion, and prevents the people and all concerned from seeing clearly the facts of the case.

There is no room for two opinions as to the fact that oil of flash-point, 73° to 83°, gives off explosive vapours at ordinary summer temperatures, and ordinary temperatures of lamps even in winter, and is therefore very dangerous, the danger approaching that of naphtha. There is no ghost or unexplained mystery about lamp explosions—vapour, air, and a flame are required. But the flash of the oil should be so high that filling the lamp when burning, carrying about, or extinguishing by blowing or turning down the wick, can be done with perfect safety. A lamp cannot explode unless the oil vapours are evolved, and the vapours are not evolved at all unless the oil is heated about the flash-point. So the standard flash-point should be fixed so high that under ordinary circumstances of climate, and lamp in passable order, the temperature of the flash-point is never reached in the lamp of the people. The standard should be as low as possible subject to this condition.

Probably every evening in London the dangerous explosive mixture is present in about a million lamps; but only in a few cases does the light get at it; and in only a few of these again is there any damage done. Only 2,000 lamp accidents that caused much harm were known of in London for 1893, only 456 fires, only 48 deaths. A very few accidents considering that the danger is so widespread. But again, all these accidents that do take place are easily preventable. With standard of 100°, no doubt the explosive mixture would occasionally be present, but in very few cases; and even of these the proportion that could get the light applied would be a very small percentage—a few cases in a million as at present—so that the danger would practically be reduced to *nil*. The argument, therefore, that so few accidents take place at present is not one that should produce contentment with the present state of matters, and the trade left burdened and hindered by danger, seeing it could be so easily cured. Accidents with high-flash oil are very rare indeed. Coal dust and wheaten flour have caused many serious explosions, yet common sense prevents us from classing coal or flour as dangerous explosives. In the same way high-flash oils that have caused three or four accidents in the last 30 years must not be classed along with dangerous low-flash petroleum that cause hundreds of

accidents every evening. And we must remember that the low quality of the oil in the market that causes the numerous deaths is not merely allowed, but is *directly created by our legislation*, because manufacturers make the oil to suit the standard, and it frees merchants and manufacturers from responsibility for the inevitable result. The object of our legislation is surely to save lives and property.

If you continue to allow oils under 100° flash, you allow oils that contain naphtha, and that could have been kept free from naphtha without any extra expense in refining.

It is as easy to keep the naphtha separate as to put it into the burning oil. Naphtha in burning oil should be counted an adulteration. We would not lose a gallon of oil by what I propose, only the household oil would be sent in safe, and would require only ordinary care, while the naphtha would come in separate, and be treated with the necessary precautions. Naphtha in this country is generally dearer than burning oil. I cannot conceive a state of matters in which it would be wise economy, either from the national or world-wide point of view, to deliberately mix naphtha with the burning oil as at present, for it makes all dangerous.

Have a truly safe standard, and let all above standard escape burdensome surveillance. It leaves the oil trade quite free, and also the trade in lamps. It causes also that the oil of the people be all safe. All that is required in the Bill is to raise the standard to 100° close test, where it was meant to be from the first, and give towns the power of regulating the storage of large quantities.

(See also pages 228 and 229.)

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Meeting held Monday, February 17th, 1896.

MR. A. H. MASON IN THE CHAIR.

METHOD OF ANALYSIS OF ALLOYS OF LEAD, TIN, ANTIMONY, AND COPPER.

BY C. W. THOMPSON.

ANALYSES of the alloys of lead, tin, antimony, and copper are frequently required, as these alloys enter into a great variety of uses in the arts. The classification of these alloys according to their uses may be made as follows:—

1. Low grade tinfolils, alloys of lead and tin in which the tin is less than 20 per cent.
2. Solders. Alloys of lead and tin, the tin being over 20 per cent, and the alloys frequently containing small percentages of antimony.
3. Babbitt and Britannia metals. Alloys of tin, antimony, and copper.
4. Bronzes. Alloys of tin and copper.
5. Certain kinds of bearing metals. Alloys of tin, lead, antimony, and copper.
6. Type and stereotype metals. Alloys of lead, tin, and antimony.
7. Antimonial leads. Alloys of lead and antimony containing traces of copper, arsenic, nickel, and cobalt.

It is very important that correct methods for the analysis of these alloys be used. Many of the methods now in use cannot be said to give correct results, or if correct results are obtained by their use, they are so long and tedious as to be unavailable for technical purposes. We know of one case in which chemists of repute asserted that alloys containing tin and antimony could not be analysed correctly; and we may add that in metal work there is hardly any class of analyses in which more divergent results are obtained by various chemists working on identical samples. In addition to the four metals mentioned, these alloys may contain small amounts of phosphorus, arsenic, iron, nickel, and cobalt. Phosphorus is used in phosphor-bronze and similar alloys. Arsenic, nickel, and cobalt occur as impurities in antimonial leads and in stock worked up from shot residues. Iron occurs as an impurity only to a small extent and cuts no figure in the analysis unless the sample be very dirty superficially, in which case it may be purified from iron by simple melting. An experienced eye can usually detect the principal constituents of alloys of these four metals; but if the percentage present of any one metal is small it is frequently advisable to resort to qualitative tests. We give here qualitative tests, not that the experienced chemist will have any difficulty in this regard but because these tests have proved very satisfactory and rapid in our hands.

For lead dissolve in aqua regia. If much lead is present it will separate on cooling as chloride; if only a small amount is present it will be detected by the addition of four volumes of 95 per cent. alcohol. Very small percentages, i.e., under 0.50 per cent. will not be shown by this test.

For tin dissolve in HCl conc. containing some KCl, and before the portion of alloy taken is completely dissolved, pour off supernatant solution, cool to separate lead as chloride, add four volumes of alcohol, filter and to the filtrate add a slight excess of bromine water to convert SnCl_2 to SnCl_4 , heat to expel free Br, dilute and pass H_2S when if tin is present it will be obtained as yellow stannic sulphide.

For antimony treat with HCl conc. Almost all the antimony is left undissolved, decant and wash residue well with water, after which dissolve in HCl with KClO_3 , boil to expel free Cl and pass H_2S obtaining precipitate of Sb_2S_3 if antimony is present. If copper is also present, it will be precipitated as CuS and may obscure the colour of Sb_2S_3 , if so filter and treat precipitate with KOH which will dissolve the Sb_2S_3 , filter and acidify filtrate, when the pure colour of the Sb_2S_3 will be observed if antimony is present.

For copper treat with dilute nitric acid in porcelain dish, evaporate to dryness, when, if copper is present, it will show as a green ring where it crystallises out of nitrate on edge of residue.

For arsenic dissolve in HCl with addition of KClO_3 in Erlenmeyer flask, boil to expel free Cl add more HCl conc. and two (2) grms. of sodium thiosulphate, connect flask with condenser and distil, following in principle the method first proposed by Fischer. Arsenic will be found in distillate by passing H_2S . The use of sodium thiosulphate as a reducing agent in this distillation of arsenic is very satisfactory, possessing as it does the great advantage of leaving a solution suitable for further analysis. If the boiling of residual solution is carried far enough, the thiosulphate is entirely decomposed with the liberation of sulphur which can be filtered off, the only contamination to the solution then being sodium sulphate.

We determine the metals as follows:—

Lead, by precipitation as chromate in acetic acid solution after Fresenius, filtering and weighing on Gooch crucible. We have found this method the most accurate we have used. No volumetric method has as yet commended itself to us. It is frequently convenient where lead only is to be determined to work on 0.64 grm. obtaining the percentage directly in centigrams of lead chromate found.

Tin we determine electrolytically in double oxalate solution after Classen. This solution is obtained in the course of regular analysis by the systematic method given further on. Very good results are obtained.

Antimony we determine volumetrically in a strong HCl solution by reduction of the Sb_2Cl_6 to Sb_2Cl_3 by addition of

KI in excess, titrating the liberated I with thiosulphate of sodium. The method of separation described below gives us a solution of antimonious sulphide in KOH entirely free from copper and iron, and containing a minimum amount of sulphur to be subsequently oxidised or separated by filtration. To this alkaline solution we add 1 grm. of KClO_3 and 50 c.c. HCl conc. and boil until the solution is colourless and the free Cl is driven out. The solution is then cooled, 1 grm. KI added and 1 c.c. CS_2 . The thiosulphate is run in until the aqueous solution is decolourised, then drop by drop with vigorous agitation until the CS_2 is decolourised. The trouble that others have had in using this method is probably due to the imperfect separation of the copper and iron from the antimony, and the presence of a large amount of free sulphur which in strong HCl coats over the sulphide of antimony and prevents its ready solution. We obtain our antimony sulphide in the first place containing very little free sulphur and then dissolve it in a solution of KOH obtaining a complete separation from copper. We then treat this KOH solution as above.

We determine copper in small amounts by titration with KCN and in large amounts electrolytically. Arsenic can be determined by precipitation as As_2S_3 and weighing on Gooch crucible, or by titration as with antimony.

The separation of the metals in the classes of alloys we have described is based on Clark's oxalic acid method. As, however, that method is for the separation of tin from antimony and arsenic, the first thing to be determined was how far it is applicable for the separation of tin from other metals. Bismuth, copper, and cadmium oxalates are soluble in aqueous solutions of oxalic acid containing oxalate of ammonium, and the respective sulphides are obtained by passing H_2S through such solutions boiling. Lead and zinc oxalates are nearly insoluble in similar solutions, but such oxalates are more or less converted to sulphides by the passage of H_2S through the solutions in which they are suspended. As, however, copper and lead are the principal metals which it is desired to separate from tin, our experiments were principally directed towards observing their respective reactions. Working upon alloys containing large percentages of tin and small percentages of antimony and copper, dissolving in aqua regia, adding some KCl to form double chlorides, evaporating to dryness on water-bath and taking up in solution of oxalic acid containing enough oxalate of ammonium to form double oxalate of copper soluble in water, the separation of the copper and antimony from the tin is readily effected by the passage of H_2S through the solution on boiling for a sufficient length of time. After filtering out the antimony and copper sulphides we proceed to their separation. We could have used sodium sulphide of course, but its use would have resulted unsatisfactorily in the determination of the antimony volumetrically. We found the use of a solution of caustic potash more satisfactory, that reagent dissolving antimony sulphide readily. The determination of the tin in the filtrate from the sulphides of antimony and copper could be made by rendering it alkaline with ammonia and acid with acetic acid and then passing H_2S , filtering, &c., igniting and weighing as SnO_2 ; but for large amounts of tin this method was not found sufficiently accurate. Classen's electrolytic method of determination was finally adopted as giving the best results. This method consists in obtaining the tin in solution as double oxalate of tin and ammonium, with enough free oxalic acid to prevent the precipitation of stannic hydrate, and electrolysis. The presence of chlorides does not interfere with the electrolysis of the tin, as whatever chlorine is liberated at the cathode does not act upon the platinum but upon the oxalates in solution, decomposing them. If we have only tin, copper, and antimony present, what we need do, therefore, is to add such an amount of oxalic acid, oxalate of ammonium, and water to the evaporated chlorides as will give the proper solution to electrolyse after passing H_2S to precipitate antimony and copper, filtering, &c. We found that working on 1 grm. of alloy, and using 10 grms. of oxalic acid, 10 grms. of oxalate of ammonium and 200 c.c. of water, a proper solution was obtained for electrolysis.

Working upon alloys containing lead the insolubility of

lead oxalate interfered with the use of the above method. The separation of lead from antimony, tin, and copper was finally effected by its precipitation as chloride from its HCl solution first by chilling and crystallisation and then by the addition of alcohol. We were pleased to discover that this precipitation is a practically complete one in the presence of KCl, and also that the chloride of lead thus precipitated is easily washed free from chlorides of tin, antimony, and copper by the use of alcohol containing HCl. Working on 1 gram of solder, for instance, after treatment in alcohol, filtering and washing, the filtrate was found to contain only 0.30 per cent. of lead. But the use of alcohol presented a new difficulty in that it could not be entirely evaporated off by heating on the water-bath. The combination apparently formed between the alcohol and the chlorides of tin and antimony was very stable. The evil effect of alcohol was that on passing H_2S to precipitate antimony and copper, a liberation of sulphur took place that was very objectionable in that it was filtered out with the antimony sulphide and dissolved with it by the KOH, interfering with the determination of the antimony. To overcome the separation of sulphur we had recourse to the treatment of the residue left on evaporation with KOH solution and H_2O_2 . This was attended with the desired result that in the subsequent treatment with H_2S in oxalic acid solution the separation of sulphur was very slight. At this point we would mention a very peculiar thing regarding the action of H_2S on solutions of oxalate of tin. It is that the H_2S is absorbed and what might be called a sulpho-stannate is formed. That this is the case was first suggested by the fact well known that in the separation of tin and antimony the precipitation of the antimony only takes place after the tin has been fully supplied with H_2S . The time necessary to secure the complete precipitation of the antimony is proportional to the amount of tin present. That there is a sulpho compound of tin formed is further proven by the fact that during the electrolysis of the oxalic acid solution there is a separation of sulphur, although the solution had been boiled for a long time to expel H_2S .

We have described the separation of lead as chloride from the tin, antimony, and copper. The conversion of the lead chloride into soluble acetate is easily effected by treatment with ammonium acetate, after which the lead is determined as chromate in the usual manner.

We will now describe the system we have adopted for the analysis of these alloys. One gram of the finely divided alloy is dissolved by boiling in from 70 to 100 c.c. of the following solution in a covered beaker. The solution is made by dissolving 20 grms. KCl in 500 c.c. H_2O , then adding 400 c.c. HCl conc., mixing, and then 100 c.c. HNO_3 1.40 specific gravity. No decomposition between HCl and HNO_3 takes place in this solution in the cold. If complete solution of the alloy is difficult in the amount of the solution taken, more is added as required. Continue boiling until solution is evaporated to about 50 c.c. Cool by placing beaker in cold water until the bulk of the lead has crystallised out as chloride, and then add slowly and with constant stirring 100 c.c. 95 per cent. alcohol; allowed to stand about 20 minutes, filter through 9 cm. paper into No. 4 beaker, wash by decantation three times with a mixture of 95 per cent. alcohol and HCl conc., 4-1, and wash paper twice with same mixture. Wash PbCl_2 on paper back into beaker and wash paper several times with hot water, allowing washings to flow into beaker with the rest of chloride. Finally, wash twice with a solution of ammonium acetate hot (the ammonium acetate solution is made by taking one volume of ammonia water 0.900 sp. gr., adding to it one volume of water and then 80 per cent. acetic acid until it is slightly acid to litmus), heat until lead chloride is all dissolved, add 15 c.c. saturated solution of $\text{K}_2\text{Cr}_2\text{O}_7$, heat until precipitate is of good orange colour, filter on weighed Gooch crucible, wash with water, alcohol, and ether, dry at 110°C , and weigh. Evaporate the filtrate from lead chloride by heating on hot plate and finally to dryness on water-bath. Add 10 c.c. solution of KOH (1 gm. to 5 c.c.) and after a few minutes 20 c.c. of 3 per cent. peroxide of hydrogen. Heat on water-bath for 20 minutes, add 10 grms. of ammonium oxalate, 10 grms. of oxalic acid, and 200 c.c. of water. Heat to boiling, pass H_2S with solution near boiling

for 45 minutes, filter at once, and wash precipitate with hot water. Boil filtrate to expel H_2S , concentrate if necessary, and electrolyse over night, using a current of about $\frac{1}{2}$ an ampère. Usually by morning the solution will have become alkaline, in which case it may be taken for granted that the tin is all precipitated on the cylinder. The cylinder is removed, washed twice with water, and then with 95 per cent. alcohol, dried in oven, and weighed. The precipitate of antimony and copper sulphides on the filter paper is washed back into beaker with the least amount of water possible and treated with 10 cc. KOH solution (1-5), heated on water-bath until undissolved matter is distinctly black, then filtered through same paper it was washed from into 12-oz. Erlenmeyer flask, washed, &c. On filter the copper is obtained as sulphide with a small amount of lead which failed to be precipitated as chloride (if it is desired to determine this lead it can be done by separation from the copper as usual), if not, dry and ignite precipitate in small casserole, dissolve in HNO_3 , boil to expel nitrous fumes, neutralise with Na_2CO_3 , add a few drops of ammonia, and determine volumetrically with cyanide of potassium standardised against pure copper.

The solution of antimony sulphide in KOH should not amount to over 40 c.c., add 1 gm. KClO_4 , 50 c.c. HCl conc., boil until solution is colourless and free Cl is driven off, filter through mineral wool if sulphur has separated into similar flask, wash out original flask with conc. HCl, cool, add 1 gm. of KI, 1 c.c. CS_2 , and titrate for antimony with N_{10} sodium thiosulphate, 1 c.c. of which equals 0.0060 gm. antimony. This systematic method assumes the absence of other metals than lead, tin, antimony, and copper; for the determination of other metals we offer the following suggestions. If arsenic is present it will be separated with the antimony and will liberate iodine as does antimony. One c.c. of N_{10} thiosulphate equals 0.00375 gm. of arsenic.

Arsenic is preferably determined on a separate portion by dissolving in HCl and KClO_4 boiling to expel free Cl, and distilling after the addition of sodium thiosulphate as a reducing agent, passing H_2S through the distillate and weighing As_2S_3 or dissolving it in KOH, and determining volumetrically as in the case of antimony.

Bismuth and cadmium sulphides would remain with copper sulphide after treatment with KOH solution. This renders this method very suitable for the analysis of fusible metals. Zinc would interfere with this method, but as it does not alloy with the lead to any extent we will not speak of it further. Nickel and cobalt alloy but slightly with tin, and if present should be sought for both in precipitate left by KOH and in tin precipitated on cylinder. Iron will also be precipitated with tin electrolytically if present in an oxalic acid solution. Phosphorus is best determined by Dudley's method. In alloys containing only lead and tin, with the tin under 20 per cent., the two constituents can best be determined by treatment with dilute HNO_3 in porcelain dish, evaporating to dryness on water-bath, &c., and determining lead as chromate and tin as SnO_2 . In samples free from iron and copper, antimony may be determined directly by solution in HCl and KClO_4 , boiling to expel free Cl and titrating as with pure antimony. Antimony in solders may be determined very accurately by dissolving in HCl away from access of air and filtering out the undissolved antimony on weighed Gooch crucible. I have not found a weighable amount of antimony was lost as stibine by this treatment. In the analysis of alloys of lead and tin, Richards' scales, which are accurate within 1 per cent., may be used. In the examination of the various classes of alloys described at the beginning of this paper, various steps in their analysis may be left out with the absence of the respective metals.

Thus, in the absence of lead, the addition of alcohol may be omitted, and the evaporation can proceed directly to dryness after the sample is dissolved. In such a case the treatment with KOH and H_2O_2 is also omitted. In the analysis of samples high in copper, as bronzes for instance, it is not well to let the evaporation proceed quite to dryness, as in that case compounds are formed insoluble in oxalic acid and ammonium oxalate.

I give the following examples of the accuracy of this method:—

I.	Taken.	Found.
	Grms.	Grms.
Lead	0.8000	0.8045
Tin	0.0320	0.0313
Antimony	0.1000	0.0990
Copper	0.0080	0.0073

II.	Taken.	Found.
	Grms.	Grms.
Lead	0.1000	0.0988
Tin	0.0007	0.0010
Antimony	0.1000	0.0987
Copper	0.0503	0.0507

There are a few points still to be mentioned. To clean the platinum cylinders of the tin precipitated on them by electrolysis, we have found strong hydrochloric acid in the cold very satisfactory. The cylinders change very little in weight if properly cleaned. In the precipitation of the chloride of lead the acid solution should not be evaporated much below 59 c.c., and the addition of the alcohol should be very gradual, otherwise the chloride of lead precipitated will not be pure, and inaccurate results will be obtained. If a very small percentage of lead is present it is not advisable to attempt its precipitation with alcohol, but rather to let the analysis proceed as in the absence of lead, separating it subsequently from the copper by the usual methods.

LABORATORY TESTING IN CONNECTION WITH GOLD EXTRACTION.

BY A. W. WARWICK, F.R.S.

SYSTEMATIC laboratory testing as an adjunct to the miling of gold ores ought to be of supreme importance. In many gold ores which are being worked successfully the valuable portion is only 1/60,000th of the total rock handled, and but a very slight variation in the character may cause enormous losses. It is therefore obvious that a system of laboratory tests which will show with a fair degree of accuracy the conditions in which the gold is disseminated through gold-bearing rocks, can render many useful services to the metallurgist.

Laboratory metallurgy has an evil name amongst practical and business men; it is in fact impossible to express in writing the contempt which is manifested towards laboratory tests by such men. Results which are obtained by ill-conceived methods of examination and which are further degraded by reckless use, are, to be sure, of little value. It is, however, unnecessary to tell a society of technical chemists that laboratory tests used correctly and worked by methods strictly applicable to the case under consideration can be of the greatest use. For example, there are many cases in the history of gold mining in which a great deal of money and time would have been saved, if, before proceeding to work the ores, they had been subjected to a proper system of laboratory tests. It is a self-evident truism, yet, however, to be learned by many superintendents of gold mills, that information may in many cases be obtained more quickly, cheaply, and accurately in the laboratory than in the mill. It is pointed out here that the tests to be described do not aim at showing the yields that may be obtained by practical working, but rather to show defects and the remedies to be applied, and as a collateral to act as guides in designing a plant for an ore hitherto unworked and of which little is known.

Some time ago, whilst chemist in a metallurgical testing works in London, a great many parcels of gold ore passed through my hands, and in dealing with a great variety of ores a system of trustworthy laboratory tests was absolutely essential. There is to be found scattered through metallurgical literature a number of rough-and-ready tests,* but nothing which would satisfactorily answer the purpose. An account of the method of examination may therefore be of value to managers and metallurgical chemists in general.

In order to ascertain the precise character of each parcel of ore, a series of tests was drawn up to come at the following facts:—(1) The degree of crushing required to unlock the gold and gold-bearing minerals from the gangue; (2) the physical character of the wet pulp and its action upon mercury; (3) the amount of "free" readily amalgamable gold; (4) the amount of free gold incrustated with oxides, &c., i.e., rusty; (5) the amount of gold locked up in the heavy minerals and the percentage of the latter; (6) the amount of "float" gold; (7) the general character and size of the gold particles. Most if not all of these facts can be obtained by direct experiment, but it is better in the cases of rusty and float gold to obtain them indirectly.

Having come to a conclusion on these points it is possible to work out a scheme for the treatment of the ore under examination or to locate the defects in treatment if it is being worked already. It is, however, very necessary to check the results obtained in the laboratory by working a fairly large parcel of ore according to the mode of treatment shown by them to be appropriate. The results given, however, by the mill tests show a surprising concordance with the laboratory results.

The procedure adopted for any particular ore will naturally vary somewhat according to the needs of the case, but the tests described in this paper may be so varied as to meet nearly all requirements. In any case, however, it was the writer's practice to commence work on a parcel of ore by determining the facts scheduled above.

Sampling.—A little care in sampling is well repaid. "Grab" samples should be absolutely barred. More errors result from inaccurate samples than all the rest of the work put together. A sample should be made sufficiently large to suffice for all the tests to be made, so as to ensure uniformity among the results. Ten to twenty pounds is amply large enough.

Crushing.—The first point to be ascertained is the degree of fineness to which the rock should be crushed in order to unlock the gold and gold-bearing minerals. About two pounds of the rock are crushed by hand in a mortar to go through a 30-mesh screen, care being taken to prevent the formation of very fine dust. About 400 grms. of the crushed stuff are screened successively through 60- and 90-mesh screens. The percentages of each grade of ore thus made are determined. Each grade is now assayed and the amount of "free" amalgamable gold determined by the test to be described later; if the coarser sizes show a high assay value and a low amalgamation extraction, it may be safely concluded that the degree of crushing is not fine enough. In most cases it is only necessary to examine the coarsest size for amalgamable gold, as the finer sizes show usually a high amalgamation assay. An ore containing 0.639 oz. gold per ton and about 3 per cent. iron pyrites was treated in this manner, with the following results:—

Stuff passing through h	Remain- ing on.	Per- centage.	Assay Value, Ozs. per Ton.	Per Cent. of Total Ore Value.	Free Amalga- mable Gold, Ozs. per Ton.	Per Cent. of Total Ore Value.
30 screen	60 screen	29.2	0.11	3.4	0.051	1.61
60 "	90 "	50.5	0.39	30.8	0.239	18.88
90 "	"	29.3	1.42	65.6	0.563	25.81
100.0			99.8		48.30	

In this case the grade of ore between 30 and 60 screen contains but 3½ per cent. of the total value of the ore, and of that nearly one-half is recoverable by amalgamation. The balance is left in the heavy minerals and coarse particles of ore, and as it only amounts to 0.059 oz. per ton it is obvious that the crushing is fine enough for this

* These are summarised by A. G. Charlton in a paper read before the Federated Inst. Mining Engineers, Eng., in 1893.

ore, especially as some of this value is recoverable by concentration. In stating the screen required in practice some judgment is necessary, as account must be taken of the type of machine used. Rolls would require a 30 screen, and stamps 18 to 24, according to the type of the mortar; however, considerations such as these are beyond the scope of this paper. The ore just referred to was received as an example of a refractory ore, inasmuch as only about 47 per cent. was recoverable by amalgamation. On inquiry it was found that the plant consisted only of stamps and plates, as it was considered unnecessary to save the heavy minerals on account of the small percentage. The excessive loss was attributed to "float" and "rusty" gold by the management. The addition of a concentrating plant effectually cured the low extraction. This is a very good example of the need of laboratory testing in the mill; the little bill run up by the company would have purchased all the fittings and apparatus for a decent assay office.

Examination of the Pulp.—The character of the wet pulp may not only influence the laboratory tests, but it has an effect upon the milling. Thus, if it is slimy, an excessive amount of gold may be carried off by flotation. Most limonite ores have this character; on crushing such ores and moistening with water for the amalgamation assay the wet pulp has an unctuous feel; on amalgamating, the mercury is generally covered with a film resembling oil, but no sickening, properly speaking, took place. As an example an ore from Costa Rica may be given. The ore was free milling, it contained absolutely no heavy minerals, and consisted of about 30 per cent. limonite, the remaining 70 per cent. being quartz. On crushing and direct amalgamation, 25 per cent. of the gold was obtained as "free amalgamable gold." On heating to about 300° C. the ore lost 5 per cent. of moisture, and changed in colour to a dark red. On mixing with water it had lost its greasy feel and became sharp and gritty. Amalgamating now gave 73 per cent., thus showing the evil influence of slimes in preventing good contact between the mercury and gold. The character of the mineral particles should be examined. I have repeatedly noticed that when iron pyrites is hard, compact, and distinctly cubical in a gold pulp, then the amalgamating plates keep bright, and the vanner concentrates are clean and the tailings free from savable mineral. On the other hand, when the pyrites is soft and honeycombed, then the plates sicken readily, and the vanner concentrates are dirty, or the tailings contain much mineral.

Examination of Soluble Matters.—Most ores that find their way to a testing works are more or less refractory. In a great many cases the refractory nature of the ore has been traced to the soluble matters. In one case in particular an ore from the island of Borneo contained no less than 13 per cent. of soluble matters, consisting chiefly of ferrous sulphate, sulphate of alumina, and free sulphuric acid. Needless to say, the ore absolutely refused to amalgamate. Most gossan ores contain from a trace to 2 per cent. of solubles. If the ore contains more than 0.2 to 0.3 per cent. solubles, trouble may be anticipated. A qualitative analysis at least should always be made of the soluble bodies.

Amalgamation Assay.—This assay is made in order to determine the free, readily amalgamable gold—that is to say, gold which can be and should be saved by copper-plate amalgamation. The amalgamation assay as usually performed, and as described in most text-books on assaying, is useless for the purpose of a systematic examination of a gold ore, as it not only gives the free amalgamable gold, but also some of the float, rusty, and gold in heavy minerals. The simplest way to perform this test is to weigh out into a porcelain mortar 4 assay tons of ore crushed to the screen found to be the right one by the test given above. Sufficient water is added to form a very thin paste, thin enough—in fact, to prevent the mercury being broken up into small globules. An accurately weighed amount of mercury (50 to 75 grms.) is now added. The contents of the mortar are then stirred for an hour to an hour and a half with a light, hard wood pestle, care being taken not to rub the ore or break up the mercury. The paste is then further thinned with water and poured into a large basin. The mercury left behind is collected into one globule and washed. The

tailings are twice washed in a horn spoon in order to collect any mercury that may have gone with them. The tailings are kept for additional testing.

The mercury after being thoroughly washed is dried carefully, first with blotting-paper and then for a short time at 80° to 100° C. The mercury is now weighed; the loss of mercury is an excellent guide as to the degree of sickening of the amalgamated plates in mill work. According to my experience the following table gives a fair indication of the sickening likely to occur, although it may differ slightly according to the experimenter:—

Loss of Mercury.

Per Cent.	
0.1 to 0.3	Sickening inconsiderable.
0.3 to 0.5	" appreciable.
0.5 to 1.0	" excessive.
Over 1.0	Impossible to amalgamate.

The amalgam is placed in a scorifier and another scorifier is placed mouth downwards over it; they are then heated at a very low heat in a muffle until the mercury has entirely volatilised, care being taken of course that the fumes are carried off up the chimney. The covering scorifier is removed, about $\frac{3}{4}$ A.T.* granulated is sprinkled over the bottom of the lower scorifier and $\frac{1}{2}$ A.T. over the bottom of the covering scorifier; scorification is allowed to proceed for a short time, the lead run into one button and cupelled. The bead of precious metals is treated as usual. The gold obtained in this way is the free amalgamable gold, which should be caught on copper plates. Ores that sicken mercury to any considerable extent, however, require a preliminary treatment. In such a case the ore is thoroughly washed with warm water followed by a very dilute solution of $\text{NaHO}(\text{NaHO}, 100\text{OH}_2)$ to decompose basic sulphates, &c. The wash liquors are passed through a filter, and, after washing, the filter paper is burned and added to the bulk of the ore, which is then amalgamated in the manner described.

Gold in Heavy Minerals.—The tailings from the amalgamation assay are concentrated on a batea or on a vanning shovel. The heavy minerals are dried, weighed, and assayed for gold and silver. The gold and silver obtained will be the contents of the heavy minerals *plus* the "rusty" gold; it is therefore necessary, in order to determine the gold in the heavy minerals, to determine the "rusty" gold. In order to do this, 3 A.T. of ore are taken and concentrated in the same manner as the tailings. The heavy minerals are washed into a porcelain basin and treated with dilute hydrochloric acid free from chlorine; the acid is filtered off, the residue washed with water two or three times and finally with a 1 per cent. solution of KCN, the solution of KCN remaining on the residue for only a minute or two. All these wash liquors are filtered, and at the end of the operation the filter paper is burned and added to the mineral residue. The residue is amalgamated by shaking up in a bottle with mercury for half an hour, the mercury collected and treated as in the amalgamation assay. The gold obtained is the free amalgamable *plus* the rusty. Now let—

A = gold in heavy minerals *plus* rusty gold : B = free amalgamable gold : C = free amalgamable gold *plus* rusty gold : D = rusty gold : E = gold in minerals : then $D = C - B$, and $E = A - D$, all stated in ounces per ton of the original ore. Thus a sample of Transvaal bauket contained 0.83 oz. gold per ton; the free amalgamable gold was 0.57 oz.; the gold in the minerals and rusty gold together was 0.23 oz.; the free amalgamable gold and rusty together amounted to 0.61 oz.; then the rusty gold $D = 0.61 - 0.57 = 0.04$ oz. per ton, and the gold in the heavy minerals $E = 0.23 - 0.04 = 0.19$ oz. per ton of ore. In the ore in question the minerals amounted to $3\frac{1}{2}$ per cent., and if all were saved the concentrates should assay 5.42 oz. per ton.

Estimation of Float Gold.—The determination of float gold is of considerable importance, inasmuch as the word

* A.T. = assay ton.

"float" looms large in the vocabulary of the average millman. It is fairly safe to attribute losses to "float," as, so far as I am aware, no means are available for testing the amount of such gold. The amount of float gold is largely dependent upon the character of the wet pulp. Slimy pulps will carry off fine particles of gold more readily than clear gritty pulps. The amount of float is not altogether dependent upon the size of the gold particles. Several methods have been tried to obtain the amount of float gold directly, but without success; the results are in all cases too high. The only satisfactory method is to deduct from the total assay value of the ore the combined values of free amalgamable, rusty, and ore in heavy minerals. Thus in the Transvaal basket cited above the float gold would be $0.83 - (0.57 + 0.04 + 0.19) = 0.03$ oz. per ton, or 2.4 per cent. of the total value.

Attempts made to estimate the float gold by means of the elutriating apparatus used to determine sand in clays, &c., gave unsatisfactory results; in all cases the results were 10 to 20 per cent. too high when compared with the method just described.

Microscopic examination of the gold particles is sometimes of great assistance. The minerals panned out from the tailings from the amalgamation assay should always be examined under a low-power objective. Particles of gold may be frequently observed quite bright, and should have apparently been amalgamated. A little cyanide added to the minerals while yet under the microscope will generally cause the small globules of mercury, which are invariably present in the tailings from the amalgamation assay, to almost immediately coat such particles of gold with mercury. The reason for this may possibly be explained by the observation of Skey, that gold is rendered unamalgamable by treating with sulphide solutions.

All the information which can be obtained from the ore itself, and which can be of metallurgical importance, is now at hand. The application of such matter is so obvious that it will not be dealt with in this paper; yet one may be pardoned for saying that although the results obtained by these tests may be highly satisfactory, yet the local circumstances in which the ore is found may forbid the working of it. Business capacity combined with a knowledge of the locality in which the ore is found, are absolutely essential before the laboratory results can be utilised metallurgically.

The mode of procedure for testing the efficiency of a mill may vary considerably from the foregoing, although it is undoubtedly of importance to run through such a scheme whenever there is a change in the character of the ore milled. Systematic checking of the mill results should be regularly made. In order to do so, good average samples should be obtained: (1) of the rock sent to the mill; (2) from each distinct part of the mill, such as (a) from immediately below the mortar, (b) from the end of the amalgamating plates, (c) concentrates from the vanners, (d) from the mill tailings. These samples are examined according to the needs of the case by such of the foregoing tests as are applicable: for example, the tailings should be examined for loss of gold due to insufficient crushing; the loss due to "float"; the loss due to uncaught heavy minerals, and so forth. These tests, combined with good mill statistics, would result in bringing to light and locating many losses hitherto unsuspected, and would suggest the necessary remedies. More, such a system of testing would act as a detector of theft, and assist in putting down one of the most troublesome annoyances of the mill manager.

In the many cases where I have had occasion to use this system of tests, the results have been confirmed in every possible way, and left no doubt of their accuracy.

In every case where a divergence from the laboratory results was noticed, the error was due, not to the laboratory tests, but to the mill work. The figures obtained from the assay for the "free amalgamable" gold described above agree in a very remarkable manner with the amount of gold actually saved by copper plates in the mill; a divergence of 25 per cent. was obtained in one case, but on examination of the concentrates made on fine vanners, quite large flakes of gold were found, which were thoroughly coated with mercury; it was evident that either the plates had too much pitch or too much water was used; in fact, both too

much water and too much pitch were the disturbing influences.

These tests have been described chiefly from the point of view of the treatment of the so-called free milling ores, but the writer is of opinion that they can be of service in a great many cases outside of this view, by making necessary modifications.

In most mills of the West there is a good deal of unnecessary hurry to get the ore through the mill into the tailing dump. Systematic tests are rarely, if ever, performed. Hence it is that every now and again parties buy up mill dumps and get profitable returns. This is, to a large extent, due to the cent-wise dollar-foolish policy of mill proprietors who begrudge decent accommodation to the assayer. In one of the largest mills of the West, splendidly equipped with work-shops, &c., the assay office is small, inconvenient, and worse fitted up for its purpose than the blacksmith's shop. In another fine mill which is kept in a trim in every way creditable to its superintendent, there is actually no assay office at all. There is little or no doubt that with proper appliances and a system of test, as outlined in this paper, a great deal of waste and loss that now goes on can be very largely obviated.

DISCUSSION.

The CHAIRMAN said that in the Bulletin No. 3 of the California States Mining Bureau, Mr. Ed. B. Preston called attention to the old practice of relying upon rule of thumb tests. The mill manager by the horn spoon test was supposed to know how much the ore would mill to the ton, and if the horn spoon tests of the tailings showed no amalgam, he thought all was being saved. It was not sufficient to know that a certain loss had been sustained, but one must know at what particular part of the operation the loss had been incurred, hence the necessity of constant sampling and assaying by an expert.

Mr. MURRAY EDWARDS said that the best evidence as to the necessity of employing skilled chemists was to be found in the results obtained at the mines in South Africa. After many years working in a crude way without expert aid, skilled chemists were engaged, and the cyanide process adopted, so that in 1893 gold to the value of 6,610,000 dols. was extracted from refuse which had been thrown away. In August 1894, 1,160,000 dols. resulted from one month's work, 60 per cent. from current work, and 40 per cent. from refuse. The cyanide process had been previously tried without success, because there was no chemist to work it. When the chemist set to work he found the tailings had been lying so long that the pyrites had decomposed, and presented difficulties which he was able to overcome.

Mr. H. VAN HOEVENBERGH exhibited and explained a new petroleum lamp with automatic lighting arrangement.

Dr. R. C. SCHIFFRINUS exhibited and explained a modified separating funnel and an extracting apparatus adapted for the analysis of smokeless powder. In the various connections corks had to be used, which solvents such as alcohol, ether, and chloroform destroyed. Soaking the corks in a solution of gelatine mixed with formaldehyde resisted these solvents, but not acetone, which apparently dissolved everything.

The CHAIRMAN introduced the subject of Röntgen's rays. Drs. Stebbins, Wainwright, McKenna, and Schweitzer took part in the discussion. It was suggested that the investigation of these phenomena might utilise the services of chemists in the preparation of special plates to receive the shadows, and that it would open up new fields of research to the metallurgist and to the engineer.

London Section.

SESSION 1895-96.

April 15th 1896:—

Election of Officers and Five Members of the Local Committee.
Mr. R. W. Sindall. "Moisture in Wood Pulps."
Mr. Watson Smith. "Some Reactions of Ammonium Salts," concluded.

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I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

PATENTS.

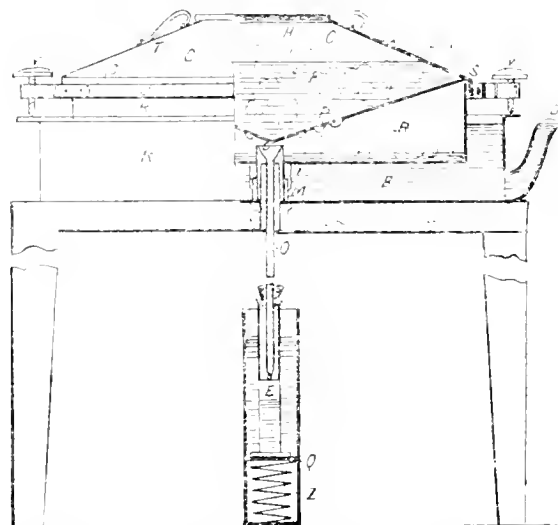
Revolving Retorts for Furnaces, Improvements in. J. A. Yeaton and W. Adgie, both of Leeds. Eng. Pat. 104, Jan. 2, 1895.

THE improvement claimed relates to patents (Eng. Pat. 19,183, 1889; this Journal, 1890, 797; and Eng. Pat. 5239, 1892; this Journal, 1893, 439) previously granted to the same inventors, and consists in corrugating the revolving body of the retort. The corrugations may be either parallel to the axis of rotation, or helical.—R. B. P.

Evaporating and Distilling Liquids, Improvements in Apparatus for. A. A. Robin, Paris. Eng. Pat. 2424, Feb. 4, 1895.

THIS invention relates to the construction and arrangement of a low-pressure still for the distillation of volatile compounds, and more particularly of such as are inflammable, a number of applications being quoted. It may also be used for the extraction of oils or fatty substances. It consists essentially of four parts: a water-bath in a tank K, an evaporating pan, a condenser C, and a receiver E. The water-bath is heated to a constant temperature by gas or other suitable means, and is provided with an overflow D. The evaporator, or in a modification, the water-bath carrying the evaporator, is levelled by screws V. The condenser, having a conical bottom and a conical top, is provided with a rim at S, which dips into a mercury or plastic seal, with handles A, and with a central opening H for introducing fresh cold water. Through the bottoms of the tank and the evaporator passes a tube O, which leads the distillate into the receiver E. The tube O is surrounded by two lengths of tube M, between which is placed mercury or other non-volatile liquid, or some plastic material, as putty or wax, so as to form a seal into which dips the tube O, projecting downwards from the bell-mouth of the tube O. The surface of the bath-liquid B is covered

with an insoluble light non-volatile liquid, as petroleum. The graduated gauge or receiver E is surrounded with ice



or a current of cold water, and rests upon a disc Q, supported upon a spring Z, so that by depressing the receiver, the pipe O may be withdrawn therefrom.—R. S.

Evaporating Apparatus [Multiple-Effect], Improvements in and relating to. J. Foster, Glasgow. Eng. Pat. 3118, Feb. 13, 1895.

THIS invention relates particularly to multiple-effect apparatus of the vertical type for evaporating sugar juice and like liquors, in which the evaporators are arranged in steps. Each evaporator consists of a chamber provided with two cross plates, one near the bottom, the other nearly half-way up, connected by tubes through which the juice passes, delivered over the top plate and flowing downwards, while the steam is admitted to the space surrounding the tubes. The improvements consist of the following:—1st. The ports for admitting steam consist of a number of openings arranged in two or more horizontal rows, or, in a modification of a series of single vertical parallel slotted branches. 2nd. The juice is delivered on to the top plate by means of a main trunk tube passing across the evaporator, from which proceeds on each side a series of parallel horizontal tubes immediately over the rows of vertical evaporating tubes, and are provided with short vertical branch tubes leading into the latter. 3rd. Each vertical evaporating tube is provided with two juice or liquor spreaders or distributors, one at the top of each tube and one between the upper and lower tube plates, so as to direct the juice to the surface of the tubes. 4th. Instead of the spreader between the tube plates, a zinc tube may be fitted within each tube concentric therewith, such zinc tube having a series of conoidal or tapering annular shields, and openings through which the vapour from the juice escapes, and passing upwards assists in evaporating the juices, thus producing a double evaporating effect. 5th. When the inner tubes are used, a special tapering shield is arranged at the top of each tube for directing and regulating the flow of juice and permitting the escape of vapour. These shields are carried by rods which pass downwards through the tubes and all rest upon a plate which can be raised or lowered, so as to regulate the shields, by means of external screws.—R. S.

Double-Tube Boilers, Evaporators, and other Heat Exchangers, Improvements in. K. D. Noble, Helensburgh, and J. Irving, Cardross. Eng. Pat. 4831, March 7, 1895.

THE boilers, evaporators, and other heat exchangers are provided with a stack of inclined double tubes. The inner and longer tube of each pair is secured to outer tube plates, whilst the outer and shorter tube of each pair is secured to inner tube plates, the space at each end between the two

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Lack, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

tube plates forming a water chest. These water chests are connected by the annular spaces between the inner and outer tubes of each pair, and are also put into connection with a highly-placed steam drum or cylinder from which downward circulating tubes lead to a low-placed horizontal tube or cylinder connected to the lower water chest, thereby completing the circulation. The furnace is below the stack, and the fire gases, after passing around the outsides of the tubes, pass to a space above, and thence to the back of the lower water chest, through the inner tube of each pair, and out to the stack.

Evaporating Apparatus [Multiple-Effect], Improvements in. J. B. Elliott, Nottingham. Eng. Pat. 5496, March 15, 1895.

One or more preliminary evaporators are employed, which are heated by high-pressure steam, and are used in connection with one evaporator, or with a battery of multiple-effect evaporators heated by low-pressure exhaust steam. The preliminary evaporator is provided with a reducing valve so adjusted as to feed the steam to the main evaporator, or to the first vessel of the battery, at the same pressure as that of the exhaust steam with which it mingles. It has also a safety valve.—R. S.

Furnaces [Carbon Pencils] for Continuous Use, Improvements in. H. Niewerth and R. Niewerth, Berlin. Eng. Pat. 3559, Feb. 19, 1895.

Two furnaces are described and illustrated: first, a multiple arrangement, and second, a single furnace. The multiple arrangement consists of four chambers or ovens placed one above the other, and connected to a common grate, with suitable flues and dampers, so that the fire can be passed into the different chambers at will, thereby allowing continuous work to be done. Such a battery of furnaces is particularly suitable for baking or burning carbon pencils for arc lamps. For some articles it is desirable to gradually allow them to cool in the oven before removing them; for this purpose, air passages having dampers are provided. The single furnace shown is also specially designed for baking carbon pencils, but without using crucibles as at present. The improvement consists in the shape of the hearth, which is formed as a shallow receptacle in which the rods may be embedded in carbon dust or other material to prevent them sticking to one another.—R. S.

Mica and Mica-Ore Purifying and Pulverising, Improvements in or relating to Methods of and Apparatus for. A. J. Boulton, London. From T. J. Lovett, Chicago, U.S. Eng. Pat. 19,892, Oct. 22, 1895.

FINELY-DIVIDED mica is a valuable ingredient of axle-grease and other lubricating materials, but hitherto the difficulty of producing fine division of this tough and lamellar substance, and of separating it from gritty matter, have restricted its use, and have prevented the use of the commoner kinds. In the present invention, the commoner kinds of mica are first reduced to a state of moderately fine division, which gives the mica in flakes and the impurities in fine grit. A blast of air, assisted in its action by the swirl or eddy caused by a diaphragm, is then directed upon the material, with the result that the grit is blown through the meshes of a sieve. The flakes of mica, which remain, are then allowed to slide down a screen which acts as a shoot to these flakes, but allows any grit that may be left to drop through the meshes. The further reduction of the purified flakes of mica to a sufficiently fine state of division is effected by a machine which acts by cutting and tearing rather than by grinding and pounding.—V. C.

Furnaces [Metallurgical, Glass, &c.], Improvements in. E. Powell, Pittsburgh, U.S.A. Eng. Pat. 24,214, Dec. 17, 1895.

This invention is applicable to furnaces for the evolution of heat from fuel in the various descriptions of heating apparatus employed in manufacturing or mechanical operations, and for the generation of steam. It consists in providing the fuel chamber, which is closed above and below to access of air, with an adjustable air-supply

passage at one side above the firebed, and on the opposite side with (a) an exit throat or passage at or near its firebed, and (b) one or more gas conduits above the layer of fuel. The passages lead the gases to a combustion chamber, either meeting one another before reaching such chamber or discharging thereinto one above the other, but in either case the gases evolved from the incandescent portion of the fuel of a downward-draught furnace, and the smoke and partially consumed gases from the top of the fuel of such a furnace, meet at a point wholly exterior to the fuel chamber, thereby producing a flame of great intensity in the combustion chamber. The invention is illustrated as applied to a metallurgical furnace and to a glass furnace.—R. S.

II.—FUEL, GAS, AND LIGHT.

Coals, The Caking Power of. L. Campredon. Rev. Chim. Indust. 1896, 7, 8.

To determine the caking power of a coal, the sample is ground sufficiently fine to pass through a sieve of 400 holes per square centimetre. It is then diluted with varying proportions of fine dry sand and the mixture ignited in a covered crucible, the character of the resulting coke being noted. The weight of the coal being taken as unity, the largest amount of sand that the sample will bear and yet give a coherent coke represents the caking power of the coal. In the case of some Welsh coals, the coke takes the form of a powder without the addition of any diluent; therefore the number found on examining different samples may vary from 0 to 17.

It should be noted that mere exposure to the atmosphere affects this property of coal; at elevated temperatures the loss of caking power is still more rapid. There does not, however, seem to be any connection between the quantity of volatile matter in the sample and its caking power—as is shown in the following table:—

Sample.	Volatile Matter.	Ash.	Coke.	Caking Power.
Welsh coal (Aberdare)	10.90	6.20	82.90	0
Newcastle coal	34.25	10.89	54.95	2
Scotch coal	34.72	8.35	56.93	4
Welsh coal (Cardiff)	19.80	7.70	72.50	6
Lens coal (Pas-de-Calais)	27.20	8.70	64.10	13
Lens coal heated to 110° C. for one year.	28.12	8.55	63.33	0
Gas coal (Newcastle)	27.83	8.75	63.42	14
.....	29.50	8.50	62.00	17
Pitch (Beckton)	44.82	0.60	54.58	20

—F. H. L.

Coals, Determination of their Heating Effects. W. A. Noyes, J. R. McTaggart, and H. W. Craven. J. Amer. Chem. Soc. 1895, 17, 843—849.

REFERENCES are given to the recorded discrepancies found by Schenck-Kestner and others to exist between the calculated and the determined calorific powers of coals. The authors have tested six specimens of representative Indiana coals by the Hempel calorimeter, by Berthier's test, and by analysis; two of these coals (Brazil and Lancaster) are non-caking, and are known as block coals, whilst the other four are bituminous caking coals. Anthracite could not be compressed into cylinders for the calorimeter, and could not be burned as a powder; it was therefore not tested. The moisture was found by drying at 105° C. for an hour in a toluene bath, and the fixed carbon by heating 1 grm. of the coal in a covered platinum crucible with the full flame of a Bunsen burner for seven minutes; the oxygen was estimated by difference, after adding to the weight of ash found, five-eighths of the weight of sulphur present, as the sulphur generally occurs in the form of pyrites, which is assumed to be burned to Fe_2O_3 and SO_2 . The calorific power is calculated from the formula $8080\text{C} + 28,800(\text{H} - \frac{1}{8}\text{O}) + 1582\text{Fe} + 2168\text{S}$, the symbols standing for the weight of the corresponding elements present, and hydrogen being supposed burnt to vapour of water. In the Hempel calorimeter the thermometer was

read by means of a telescope, and the rise of temperature was only 5° in each experiment, so that the error due to radiation was minimised; the error produced by the condensation of the water vapour formed during combustion is corrected in the results recorded, by deducting 610 calories per gram. of water formed, assuming the calorimeter temperature to be 26° C. The Berthier test was made by mixing 1 gram. of coal with 40 grms. of litharge in a Battersa C crucible, and there covering it with a layer of salt. The covered crucible was placed in a hot gas furnace for

15 or 20 minutes; it was then removed, tapped to collect the lead, cooled, and broken, and the lead was cleaned and weighed. Theoretically 1 gram. of lead should correspond to a heating effect of 234 calories in the coal, but the average of the results obtained gave an empirical factor of 268·3 calories per gram. of lead, and this number is used in stating the results. In all cases the results are the means of at least three concordant experiments. The methods employed in the tests are fully described in the paper; the results are as follows:—

	Non-caking "Block" Coal.		Bituminous Caking Coal.			
	Lancaster.	Brazil.	New Pittsburg.		Shelburn.	Mine Screenings.
			A.	B.		
Moisture	12·66	8·98	6·83	5·89	8·63	2·36
Volatile combustible matter	37·44	34·49	39·92	42·23	38·82	31·11
Fixed carbon	47·22	50·30	39·93	40·40	43·45	42·44
Ash	2·68	6·23	13·31	11·18	9·05	24·00
Carbon	71·31	70·50	62·83	65·26	66·86	57·32
Hydrogen	5·56	4·76	5·07	5·17	5·30	4·59
Nitrogen	1·51	1·36	1·01	1·17	1·50	1·44
Oxygen	18·42	16·29	13·06	13·25	15·69	9·93
Ash (corrected)	3·07	7·09	17·98	15·15	10·65	26·75
Sulphur	0·62	1·39	7·46	5·88	2·57	4·25
Iron (calculated)	0·54	1·22	6·53	5·14	2·25	3·72
Calories per gram. calculated. Total	6731	6529	6336	6491	6455	5739
Difference, per cent.	+ 0·4	- 4·6	+ 2·6	+ 1·2	- 1·2	- 1·2
Calories per gram. (Berthier)	6831	6689	6367	6471	6461	5726
Difference, per cent.	+ 1·9	- 2·3	+ 2·1	+ 0·9	- 1·1	- 1·4
Calories per gram. (calorimeter)	6793	6846	6175	6415	6532	5806

The calorimeter results represent most accurately the relative heating value of the coals; but the results calculated from analysis and those found by Berthier's test agree better with each other than either agrees with the calorimeter results; but the Berthier results on the average are the better of the two. Attempts to use the calorimeter of Barrus failed, owing to a deposit of carbon being always formed.—W. G. M.

Waste of Heat in the Generation and Use of Steam, Some Preventable. W. Kent. Journ. Franklin Inst. 1895, 140, 406—419.

THEORETICALLY, 1 lb. of good anthracite coal should be capable of evaporating about 15 lb. of water from and at 212°, whilst a good bituminous coal should evaporate about 15·5 lb. of water under like conditions. The maximum efficiency obtained with a good boiler, well set, and well stoked with good anthracite coal is about 80 per cent. of the theoretical, whilst the efficiency is less with bituminous coal, owing to the difficulty of burning the gases generated at a low temperature when fresh coal is put on the fire. The unpreventable loss when using anthracite coal is principally due to the fact that it is not practicable to reduce the temperature in the flues to less than about 100° F. above the steam temperature, or below 400°, to 450°, though probably some of this loss might be saved by utilising this waste heat to heat the feed water. But in very many boilers far more than this 20 per cent. of theoretical heat is lost, and this further loss is preventable. The sources of this preventable waste are many, of which the following are the chief:—

Improper Burning of the Coal.—The bed of coal may be too thick for the draught available, when there is incomplete combustion, and unburned carbonic oxide escapes and is lost or on the other hand, the bed of coal may be too shallow for the draught, when excess of air passes through, with consequent chilling. The use of generators and separate combustion chambers with superheated secondary air supplies, much economises the coal.

Waste in the Boiler.—The heating surface may be too small—at least 1 sq. ft. of heating surface should be allowed for every 3 lb. of water to be evaporated per hour—or the surface may be inefficiently placed for receiving the heating gases. The unclean condition of the inside or outside of the boiler is, also often the cause of loss. Leaky blow-off valves, excess of pressure and consequent blowing

off of steam at safety valve are also frequent causes of loss.

Waste in Steam Pipes.—Uncovered piping causes great loss by radiation of heat. Experiments have shown a loss of one horse-power for 132 ft. length of uncovered 2-in. pipe, for 46 ft. of 6-in. pipe, and for 26 ft. of 12-in. pipe.

Waste in Engine.—The following table gives the approximate amounts of water consumed per horse-power per hour in various types of engines:—

Common direct-acting pump.....	100 lb. and upwards.
Old style slow-speed throttling engine, non-condensing.....	45 "
Modern high-speed, automatic cut-off	30 "
Compound	22 "
Corliss single-cylinder high-pressure	20 "
Corliss single-cylinder, high-pressure condensing	18 "
Corliss compound high-pressure	14 "
" triple-expansion condensing.....	12½ "

These losses are due to (i.) condensation of the steam as it enters the cylinder; (ii.) waste of steam in engines which are overloaded, due to exhausting the steam at too high terminal pressure; (iii.) waste of steam in high-pressure engines which are not sufficiently loaded, by exhausting the steam below atmospheric pressure. The last two sources of waste can be reduced to a minimum only by properly proportioning the engine to the work to be done. The waste from cylinder condensation is best saved by triple-expansion engines, and the position of the cut-off is very important. In single-cylinder high-pressure engines the maximum efficiency is obtained when the cut-off is between one-quarter and one-fifth of the stroke. The best engines use about 12½ lb. steam per horse-power per hour, or give only about 18·7 per cent. of the theoretical efficiency, and taking the boiler efficiency as 80 per cent., we get the maximum efficiency of the boiler and engine as 15 per cent., or about one-seventh of the heating value of the coal used.

—L. T. T.

Coal-Gas, Relative Proportions of Sulphurous and Sulphuric Acids formed during and after Combustion of. M. Dennstedt and C. Ahrens. Zeits. anal. Chem. 1896, 35, 1—10.

COLLAX has described a process for determining SO₂ and SO₃ in the combustion products of coal-gas (this Journal, 1895, 771), and concludes that almost the whole of the

sulphur is converted during combustion into SO_2 , and remains as such in the atmosphere. This conclusion the authors cannot confirm. According to their experiments, the proportion of SO_2 produced in the flame itself is, indeed, comparatively small (7–8 per cent.), although it varies to some extent with the rate of air supply during combustion. However, this point is of no particular importance, since it is shown that the SO_2 , after leaving the flame, suffers, in presence of atmospheric oxygen and moisture, continual further oxidation to sulphuric acid; and the authors believe that under favourable conditions (such as obtain when gas burns in the open air) this oxidation would be completed in a very short space of time. This conclusion, which is opposed to the generally accepted belief, makes additionally evident the necessity of removing as completely as possible all sulphur compounds from coal-gas. As regards Collan's analytical process (absorption in standard chromic acid and final titration of the unreduced portion), it appears that it yields erroneous results owing to the presence of other reducing bodies besides SO_2 .

—H. T. P.

Acetylene from Calcium Carbide, Separation of Phosphoretted Hydrogen from; the Preparation of Pure Silver Acetylide, Silver Nitrate, &c. C. Willgerodt. Ber. 1895, 28, 2107–2115.

CALCIUM phosphide is present as an impurity in calcium carbide when this substance is prepared from material containing calcium phosphate, and the decomposition of such carbide with water gives an acetylene containing phosphoretted hydrogen. The presence of this latter may be detected by the odour of the evolved gas and the precipitation of dark-coloured silver phosphide when the gas is conducted into silver nitrate solution. To estimate the phosphoretted hydrogen the author decomposed 10 grms. of the carbide and led the evolved gas through a series of three flasks containing bromine water, by which means the phosphorus compounds were converted to phosphoric acid, which was estimated. 10 grms. calcium carbide gave 0.0065 gm. Mg_3P_2 ; this is equivalent to 65 c.c. P_2H_4 per 1 kilo. of carbide.

Acetylene silver, silver nitrate, $\text{HC}\equiv\text{C}\cdot\text{Ag}\cdot\text{AgNO}_3$.—This compound is prepared by conducting the gas, evolved from carbide, into a series of flasks containing a solution of silver nitrate in water. All phosphorus compounds are removed in the first flask and the acetylide separates in the succeeding vessels as a pure white powder, which, if dried in the dark, remains white for a considerable time. Heated in a melting-point tube (in quantities not exceeding 5 mgrms.) the appearance changes visibly at 170°C , and the colour becomes darker and darker with increasing temperature up to 230°C , when explosion occurs.

By friction or concussion the substance explodes violently, with separation of carbon, silver, and silver oxide, and great care is required in handling it.

Analysis gave 70.86 per cent. Ag (theory = 71.28 per cent.). The compound is stable in the air and becomes perfectly dry when left exposed to the atmosphere. Treatment with hydrochloric acid liberates acetylene gas, and on boiling, the silver is completely removed as chloride.

—J. T. C.

Acetylene, Combustion of. H. Le Chatelier. Comptes rend. 1895, 121, 1144–1147.

MIXTURES of acetylene with air are explosive when they contain more than 2.8 and less than 65 per cent. of acetylene, mixtures of acetylene and oxygen when they contain more than 2.8 and less than 93 per cent. of acetylene. In tubes of less diameter than about 40 mm., these limits are gradually narrowed, until in tubes of 0.5 mm. the propagation of the flame ceases altogether. In mixtures of air and acetylene, when the acetylene is less than 7.7 per cent. the flame is yellowish-brown and feebly luminous, and the products of combustion are carbonic anhydride and water. When the acetylene amounts to from 7.7 to 17.4 per cent., the flame is pale blue with a yellowish-brown edge, and carbonic anhydride, carbonic oxide, and water are formed. Between 17.4 and 20 per cent. of acetylene cause very imperfect combustion, carbonic oxide, hydrogen, carbon, and

acetylene being amongst the products, whilst when the hydrocarbon exceeds 20 per cent., the deposition of soot is very marked, and the flame, though strongly luminous, is of a reddish colour.

The rate of propagation of the flame is 0.1 metre per second with 2.9 per cent. of acetylene, increases rapidly to 5 metres with 8 per cent., still increases slowly to 6 metres with 9–19 per cent., and then decreases rapidly to 0.4 metre with 22 per cent., and slowly to 0.05 metre with 64 per cent. The temperature of ignition is very low, viz., about 480°C , most other combustible gases requiring a temperature of 600°C for ignition. The temperature of the flame is very high, owing to the endothermic character of acetylene. Burned with its own volume of oxygen, acetylene gives a temperature of about $4,000^\circ\text{C}$, or nearly $1,000^\circ\text{C}$ more than that given by the oxyhydrogen flame.—L. T. T.

Luminosity, Acetylene Theory of. Vivian B. Lewes.

Proc. Chem. Soc. 1895, [159], 1–8.

THE author considers that the criticism offered against the acetylene theory by Smithells (Trans. Chem. Soc. 1895, 67, 1049, and this Journal, 1895, 1037) in no way affects the considerations upon which the theory is based, which are—

1. That the unsaturated hydrocarbons in the inner region of the flame are largely converted into acetylene before luminosity commences.

2. That acetylene develops luminosity when heated whilst flowing through a hard glass tube, no air being present.

3. That the temperature necessary to decompose acetylene with evolution of light does not raise to incandescence the carbon liberated by the decomposition.

4. That in luminous hydrocarbon flames of sufficiently high temperature the luminosity varies directly with the amount of acetylene present at the point where luminosity commences.

The objections raised by Smithells against the determination of absolute temperatures in flames by means of the Le Chatelier thermo-couple are warmly endorsed by the author as far as those portions are concerned in which combustion is taking place, and these objections were pointed out in his former paper (this Journal, 1895, 738), but he contends that the results obtained in the inner non-luminous portion of a hydrocarbon flame are probably fairly accurate, and the results obtained by Smithells confirm the statement that the temperature in the inner zone rises from a comparatively low temperature close to the burner to over $1,000^\circ\text{C}$ at the apex of the cone.

The author describes experiments showing that although the heat of combustion of acetylene is very high, so small a proportion has to be burnt in order to develop the remaining energy as light and radiant heat, that it by no means follows that the acetylene flame is hotter, or even as hot, as a coal-gas or ethylene flame of the same size.

Smithells concludes that the statement that cyanogen could be made to undergo luminous combustion has arisen from a yellow ammonia flame having been mistaken for one containing solid carbon; the author shows that by surrounding the cyanogen flame by nitric oxide, intense luminosity and a copious deposit of soot can be obtained.

The author contends that the flame is in reality divided into two zones—

1. The outer sheath of combustion,
2. The inner region of non-combustion,

and that the latter consists of an internal portion in which radiant heat is converting the hydrocarbons into acetylene; a luminous envelope which caps it, and in which more intense heat is decomposing the acetylene with emission of light, and the blue calyx at the bottom of the inner zone where the hydrocarbons are undergoing decomposition by water vapour and carbon dioxide without previous separation of carbon.

The author also contends that the incandescent carbon particles in the upper portion of the flame are acted upon by carbon dioxide and water vapour, forming carbon monoxide and hydrogen, and that this action tends far more than combustion by the air, to prevent their escape from the flame.

Prof. Smithells, in reply, said the question was not whether the explanation of luminosity afforded by the acetylene

theory was conceivable, but whether the theory was really in harmony with ascertained facts, and this question, he still thought, was to be answered decidedly in the negative.

He wished that Lewes would state explicitly what view he had as to the structure of an ordinary gas flame. Did he, or did he not accept the old and generally accepted view, that the flame consisted of three distinct parts—a luminous region, a mantle, and a blue calyx at the base? Lewes had attempted to define the parts of flame by reference to temperatures; and whereas at one time he indicated the mantle as the region of lowest temperature, he now appeared to agree that it was the hottest part. Did he still maintain temperature measurements to be a reasonable basis for defining the anatomy of the flame?

He did not consider that Lewes had explained the extraordinary discrepancies that had been pointed out in his measurements of temperature, and he should like to know whether Lewes had used the thermo-couple, as shown in the apparatus before them, or whether he had not, as implied in his previous papers, inserted the twist of the thermo-couple in a manner now admitted to be improper.

He still thought that it was misleading to speak of 80 per cent. of the unsaturated hydrocarbons as being converted into acetylene within the flame. If acetylene were the source of light, and if the light depended on the almost explosive character of its decomposition, there surely was some reason to ask for evidence that a mixture of gases containing 1·4 per cent. of acetylene, 0·5 per cent. of other unsaturated hydrocarbons, and 98 per cent. of other gases (four-fifths of which were incombustible) could afford light in the manner stated.

There was no getting over the fact that the acetylene flame was surrounded by a mantle of extremely high temperature, and that a platinum wire introduced into it glowed at least as brightly as the carbon within the flame. That being the case, there was no occasion to explain that, hypothetically, the flame might be cool.

With regard to the cyanogen flame, he had nothing to withdraw from what he had said on a previous occasion, though he gladly congratulated Lewes on having now made a new and interesting observation. He had entirely failed to obtain evidence of carbon being separated in a cyanogen flame surrounded by burning hydrogen, and Lewes had not shown that it was separated. The use of nitric oxide (which would in its luminous result remind them of the behaviour of that gas towards carbon bisulphide) undoubtedly led to the separation of carbon, and supplied a piece of evidence which Lewes was now entitled to claim.

There was a calculation which was intended to give the theoretical illuminating value of ethane, ethylene, and acetylene respectively, on the supposition that in giving light after passing through the state of acetylene they were resolved into carbon and hydrogen, and this calculation gave results in tolerable agreement with the illuminating value of the gases as determined by the photometer. The calculation was, he thought, unintelligible from a scientific point of view, but, even if the principle were admitted, seemed not only incorrectly made, but capable of affording a set of numbers entirely at variance with practical measurements, just as easily as numbers in harmony with them. He thought some explanation of this was due from Lewes.

In reply in the discussion Prof. Lewes said that his views as to the structure of an ordinary gas flame were that it contained four parts, but that three of these, namely, the non-luminous inner zone, the luminous sheath, and the blue calyx were portions of the region in which no combustion, in the ordinary acceptance of the term, took place; whilst the outer mantle of the flame was the region of intense combustion, and is undoubtedly the hottest part of the flame. In a paper read in 1892, he had given a description of a gas flame, but, in criticising this, Smithells had evidently overlooked the fact that the portion of the paper following the description was devoted to an investigation as to the causes which led to the non-luminosity of hydrocarbon flames, which showed that the outer envelope must be the hottest portion of the flame, but it is also manifest that the outer side of this mantle must be rapidly cooled by admixture with air and products of combustion, so that the maximum temperature will be near the inner side of this region, and it

was the extreme outer portion of this zone which he had described in the words criticised by Smithells.

He thoroughly agreed in condemning any temperature measurements of those portions of the flame in which active combustion was going on, but still believed in the measurements obtained in the area of non-combustion.

The statement he had made was that 80 per cent. of the unsaturated hydrocarbons at the point just before luminosity commenced, consisted of acetylene.

If a mixture of 1·5 per cent. of acetylene and any gas which had a non-luminous flame was burnt, no luminosity would be generated, and no trace of acetylene would be detected at the top of the inner zone, it having been consumed before the temperature necessary for its decomposition was reached; but if 1·5 per cent. of acetylene were led into the top of the inner zone of a flame of coal-gas, from which the unsaturated hydrocarbons had been absorbed, then this addition would make the flame as luminous as if the unsaturated hydrocarbons had not been withdrawn.

Smithells concludes that because a platinum wire held in the outer sheath of a flame glows with the same incandescence as the carbon particles in the flame itself, therefore there is no need to assume any other source of heat than that given by the combustion going on in the flame walls.

It had been shown that metals at high temperatures reflect light, and he thought it quite possible that some of the apparent brightness of the platinum wire might be due to light reflected from the luminous veil in front of which the wire was placed.

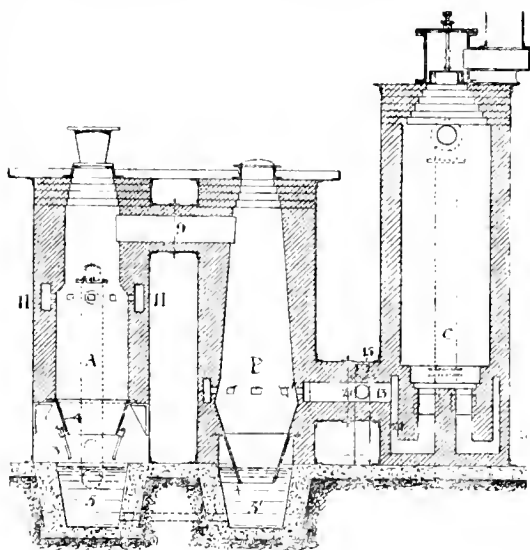
Megass and Refuse Furnaces. W. P. Abell. Proc. Inst. Civil Eng. 1895, 123, 3.

See under XVI., page 210.

PATENTS.

Oil-enriched and Illuminating Water-Gas, and Apparatus therefor, Improved Process for Generating. B. H. Thwaite, London. Eng. Pat. 949, Jan. 15, 1895.

The invention consists substantially in employing two fuel-fed chambers A and B, in conjunction with a third fixing chamber filled with refractory material and built in such a way as to obtain the maximum amount of heating surface and heat-absorbing capacity in the space available. In the first



chamber the base of the fuel rests in a water-bath 5, the fuel being supported by hanging fire-bars 3, suspended from the inverted cone 4, whereby the steam and air can readily enter. The base of the fuel in the second chamber rests in the water-bath 5', the inverted cone at the base of the chamber dipping 8 to 12 ins. under the water, and so making a water-joint. These water-baths extend beyond the chambers

and enable the elinkers to be easily raked away from time to time without interfering with the gas production. The first chamber is connected at the top with the top of the second chamber by means of the conduit 9, and the bottom of the second chamber is connected with the fixing chamber C, by conduit 21. During the blow-up, primary air is admitted by the fire-bars 5, secondary and superheated air being admitted at 11, and, if desirable, in the conduit 21 at 13. When the heating is sufficient, the air supplies are cut off, steam is admitted at 5 and 11 (or a small current of air may be continued at 11 to aid in maintaining the heat), and oil is injected under pressure through finely perforated pipes either in the conduit 9 or into the upper layer of fuel in B. Special and detailed arrangements are made for feeding in the coal, injecting and regulating the oil, opening and closing the valves automatically, &c.—L. T. T.

Distilling, Cracking, or Gasifying Oils, Tars, or any Liquid Hydrocarbons, Improvement in Plant for. R. V. Horsfall, Skidwaite, Yorkshire. Eng. Pat. 2188, Jan. 31, 1895.

This consists in the use of sloping or horizontal retorts so arranged in separate chambers—or two or more in a chamber—and so connected with one another that the heating of the different retorts may be regulated to the temperatures required for the gasifying of the hydrocarbons therein. The upper retorts containing the fresh oils are least heated, the next lower, containing the residuals from the first and some of the condensation products from the mains, are more heated, and so on.—L. T. T.

Generating Gas, such as Acetylene, Improvements in Apparatus for. D. B. Morison. Eng. Pat. 2437, Feb. 4, 1895.

This apparatus consists of a portable lamp (constructed on the Kipp or Doeberlein system) for generating illuminating gas, such as acetylene, by the action of a liquid on a solid. It consists of an outer vessel containing water, and an inner vessel open at the bottom. The inner vessel is fitted with a perforated tray to carry the blocks of calcium carbide, and this tray is preferably supported on springs. Thus, as the carbide is decomposed and the lime falls through the perforations into the outer vessel and so raises the water-level, the springs raise the lightened tray, and thus keep the carbide at the right level.—L. T. T.

Retorts for the Manufacture of Gas and for other Purposes, Improvements in. J. J. Green and W. Oates, Claremount, Halifax, Yorkshire. Eng. Pat. 4282, Feb. 28, 1895.

The improvement consists in making a part or the whole of the surface of fixed fireclay retorts fluted or corrugated, thereby increasing the heating surface. The corrugations may be formed either within the retort, on the outer surface, or both together.—L. T. T.

The Injection or Ejection of Mineral Oils [for feeding Flare Lamps and Furnaces] or other Inflammable Fluids not Miscible with Water, and Apparatus therefor, An Improved Method of safely applying Compressed Air or Vapour under Pressure for. R. S. O. Bramwell, Grange-over-Sands. Eng. Pat. 4579, March 1, 1895.

This apparatus is for feeding inflammable fluids—which float upon water but do not mix with it—to flare lamps, furnaces, &c. It consists of two closed receptacles, one fixed inside the other. The outer vessel is partly filled with water, on top of which compressed air or steam can be admitted. The inner vessel, which contains the oil, has a port at its lower end communicating with the outer vessel, and a pipe leading from its upper end to the apparatus in which the oil is to be consumed. When pressure is applied to the upper surface of the water in the outer vessel by compressed air or steam, it is transmitted to the oil, which is thereby forced out.

—R. B. P.

Coke Ovens for the Manufacture of Metallurgic Coke, Improvements in Constructing and Working. W. Ure, Workington, and S. T. Croasdel, Whitehaven. Eng. Pat. 4760, March 6, 1895.

The coke ovens are provided with a lowering floor, which is also tilted at the proper moment to discharge the coke formed, the latter being afterwards quenched. The lowering and subsequent raising of the floor is performed by a lever operated by worm or other gearing. The charging-hopper is provided with two dampers, one above the other, the outer one being of iron and the inner one of firebrick or fireclay lump. An annular space is arranged around the oven, into which openings for the gaseous products enter, and from which they pass to the main flue. Tuyères are also provided to facilitate combustion.—R. S.

Artificial Fuel [Briquettes], Improvements relating to the Manufacture of. G. Hayeraft, Pontardulais. Eng. Pat. 4879, March 7, 1895.

Any suitable binding material, in the form of a film, is added to powdered coal for the formation of briquettes. In the plant designed for this purpose, the binding agent, as liquid or semi-liquid distillates of coal, is placed in two tanks, which are heated by a furnace to keep the contents in a liquid state. Into these tanks dip two rotating rolls, which deliver the binding agent to two other horizontal and parallel rolls, between which the powdered coal is fed. The mixture passes between a lower pair of rolls, and then falls, thoroughly incorporated together, out of the machine. The rollers are provided with scrapers for removing the mixture therefrom, and the first mixing pair has also an extra pair of scrapers for regulating the supply of the binding material.—R. S.

Burners for Incandescence Gas Light, Improvements in. R. Violet, Berlin. Eng. Pat. 5213, March 12, 1895.

Above the nozzle through which the gas issues from the supply-pipe and around which the air-apertures are arranged, is mounted a box or casing having a perforated bottom and a sieve top, while within it is a fan wheel which is carried by a pin so as to rotate rapidly as the air and gas pass upwards. Two or more such fans may be used, the wings of which are set alternately in opposite directions. By this arrangement the air and gas are thoroughly mixed, and also burn at a higher pressure than exists in the gas-pipe. The lower end of the mantle is secured against movement in a lateral direction, by a hinged or closed ring.—R. S.

Treatment of Coal-Dust to adapt it for Use as Fuel and for the Manufacture of Gas, Improvements in. A. McDougall, Birkdale. Eng. Pat. 6300, March 27, 1895.

Dry coal-dust is mixed with about 10 per cent. of tar, paraffin, or petroleum oil, whereby its heating and gas-yielding properties are improved.—R. S.

Flaming Lights used for Marine Purposes and the like, Improvements in. J. S. Comrie, London. Eng. Pat. 8720, May 2, 1895.

In that class of lights which are ignited by the action of water upon certain substances, calcium phosphide has hitherto been used.

The improvement claimed in this invention is the addition of calcium carbide. In some cases the two substances are simply mixed together, but it is preferred to enclose them in separate chambers, so arranged that the vapours mingle as they issue and burn together. The calcium phosphide provides the means of ignition, whilst the calcium carbide provides a vapour which when ignited yields a brilliant and steady light.—R. B. P.

Combustible Gas, Improvements in Processes and Apparatus for the Production of. H. H. Lake, London. From E. N. Dickerson, New York. Eng. Pat. 11,848, June 18, 1895.

The apparatus is for the automatic generation of combustible gases, especially acetylene gas, by the interaction of a solid and a liquid—especially of calcium carbide and water—for the supply of houses, &c. The carbide is contained in the upper half of an hour-glass shaped vessel, the

lower, open end of which stands in a large tank of water. Just below the most constricted part of the vessel is placed a grate on which the blocks of carbide rest. The water in the outer tank stands at such a level as to enable it to rise in the carbide vessel to a short distance above the grate. The lime formed during the decomposition of the carbide falls through the grate into a removable tray. Special valves and systems of pipes are arranged to minimise the escape of acetylene, and the whole apparatus is enclosed in a chamber which may be efficiently ventilated, and also both the chamber and the water may, if desirable, be warmed.

—L. T. T.

Combustible Gas for Illuminating Purposes, An Improved Method and Apparatus for Supplying. H. H. Lake, London. From E. N. Dickerson, New York. Eng. Pat. 11,848v, June 18, 1895.

THE patentee claims the discovery that acetylene gas can be liquefied, under suitable conditions, at reasonable pressures, and subsequently utilised for illuminating purposes. The invention consists in using cylinders of liquid acetylene fitted with suitable reducing valves, governors, &c. The patentee burns the gas alone, or preferably with a certain admixture of air effected in a mixing chamber.

—L. T. T.

Enriching Illuminating Gas, Improvements in Apparatus for. W. Ewing, Hamilton, Lanarkshire, and J. Meikle, Glasgow. Eng. Pat. 19,916, Oct. 23, 1895.

THIS consists of a constant-level carburetter, consisting of two parts, the one being a closed receiver containing the main body of the carburetting liquid, the only outlet of which terminates near the base of the lower or carburetting vessel. In this way a constant level of the carburetting liquid is maintained, and by means of a diaphragm over the surface of this liquid and fitted with circular plates dipping into the liquid, the gas to be carburetted is made to take a circuitous course over the surface of and finally through the carburetting liquid, and is thus more evenly and efficiently carburetted than in the usual carburetters. The upper storage vessel is fitted with taps, screw-joints, &c., so that it may be detached and refilled.—L. T. T.

Petroleum, An Improved Method of Increasing the Lighting Power of. N. Baroa, Budapesth. Eng. Pat. 21,927, Nov. 18, 1895.

THE addition of paraffin to petroleum increases its lighting power, but increases the rate of consumption at the same time.

According to the present invention, this objection is obviated by also adding spermaceti.

Two parts of the purest hard white paraffin may be used to one part of pure hard spermaceti, and 0.3 gram. of the mixture will last for four days in a lamp holding half a litre, the petroleum being replenished from time to time as required. The addition of this mixture, it is stated, also does away with the objectionable smell of certain petroleum.—R. B. P.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum, Elementary Composition of. C. Engler and L. Jezioranski. Ber. 1895, 28, 2501—2505.

THE attention of investigators has hitherto been mainly directed to the fractions boiling between 150° and 160°, or less frequently 200°, whereas the composition of the higher boiling fractions has been but little studied, and it has been taken for granted that, apart from the small quantities of acetylene, benzene, naphthalene, &c., isolated from the latter, their nature corresponds with that of the light fractions. This is, however, not the case, the ratio of carbon to hydrogen (and therefore the proportion of unsaturated hydrocarbons) increasing with the boiling point, till in the higher fractions the unsaturated compounds greatly predominate. This is shown by their behaviour

towards sulphuric acid, and by the comparatively small amount of solid paraffin that separates out.

The analytical tables given show a larger percentage of carbon than is present in bodies of the methane series with boiling points corresponding to those given; this percentage also exceeds that of the ethylene series, thus leading to the conclusion that whilst the lighter fractions consist chiefly of saturated hydrocarbons, the fractions above 200° contain a predominating proportion of unsaturated bodies.

The authors' attention was first called to this matter by the formation of water in the preparation of petroleum by distilling train oil under pressure. If petroleum has been formed from fats or fatty acids, the general formula for crude oil (C_nH_{2n} rather than C_nH_{2n+2}) indicates that a good deal of water must have been driven off during the process of conversion.—C. S.

Asphalts, Analysis of. S. P. Sadtler. J. Franklin Inst. 1895, 5, 383.

See under XXIII., page 222.

PATENT.

Distilling, Cracking, or Gasifying Oils, Tars, or any Liquid Hydrocarbons, Improvements in Plant for. R. V. Horsfall, Skithwaite, Yorkshire. Eng. Pat. 2188, Jan. 31, 1895.

See under II., page 190.

Retort for Distilling Heavy Bodies in General, and Particularly Gum and Resin. V. J. Kuess, Paris. Eng. Pat. 4882, March 7, 1895.

THIS invention renders it possible to extract spirits of turpentine and oil of resin in one retort, and to introduce steam into the same without effervescence, and thus obtain results in a shorter time, whilst the unpleasant taste and disagreeable odour, which at present accompany hydrocarbons of the turpentine series, are eliminated. The distilling apparatus consists of a jacketed still, heated by means of superheated steam. The top of the still is provided with the ordinary head and neck; the latter, instead of being directly connected with the condenser, is arranged to enter a short distance within a tube of larger diameter, communicating with the condenser in such a manner as to form a hollow annular ring, through which superheated steam passes. A pipe is led through the head and descends vertically nearly to the bottom of the inner bath, where it branches off in different directions, and is joined to and carries an annular pipe, perforated with small holes and concentric with it. This pipe carries two perforated discs, preferably of aluminium, which are connected to the electrodes of a dynamo. If desired, an electrical superheater may be placed at the bottom of the inner bath for the purpose of simplifying the distillation and also improving the quality of the products. The gum or other substances having been introduced into the inner bath, steam is admitted into the pipes and an electrical current passed through the wires. Electrolysis is set up and the gum in the bath is decomposed. The distillation proceeding, the steam, which issues with some force into the neck of the retort, surrounds the vapour and steam issuing from the inner bath, and carries it along with it to the condenser.—D. B.

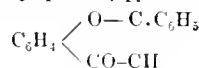
Wood, Treatment of, with a View to Preserving and Colouring the Same. R. Aitken, London. Eng. Pat. 2710, Feb. 7, 1895.

See under IX., page 199.

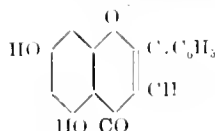
IV.—COLOURING MATTERS AND DYES.

Fisetin, Constitution of. St. von Kostanecki and J. Tambor. Ber. 1895, 28, 2302—2309.

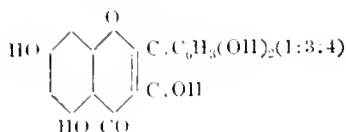
ALL the three dyestuffs, chrysin, quercetin, and fisetin, are derivatives of β -phenyl-pheno- γ -pyrone—



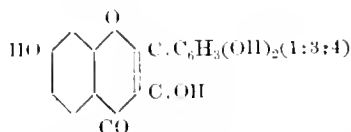
chrysin being—



quercetin—



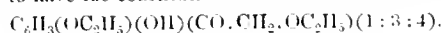
and fisetin—



The products of decomposition by fusion with potash of fisetin are resorcinol, protocatechuic acid, and glycollic acid.

There are two formulae possible for the resorcinol nucleus of fisetin. The accuracy of that ascribed as above is proved by the ready convertibility of fisetin into its tetra-alkyl derivatives, compounds containing hydroxyl-groups in the resorcinol nucleus in the other position possible, namely, ortho to the carbonyl-group, as chrysin and quercetin, for instance, not being susceptible of complete etherification.

Moreover, the diethylfisetol ether which, as Herzig has shown, is produced along with diethylprotocatechuic acid when tetra-ethylfisetin is boiled with alcoholic potash, is found to have the constitution—



—E. B.

Triphenyl Carbinol, New Methods of Formation of.

Hg. Frey. Ber. 28, 2514—2521.

ATTEMPTS to introduce the CO group into an organic radicle by decomposing ethyl oxalate with sodium in presence of an organic halogen compound, led to the discovery that ethyl oxalate when treated with sodium in ether, is decomposed into carbonic oxide and ethyl carbonate at ordinary temperatures. By acting on a mixture of ethyl oxalate and bromobenzene in ether with sodium, carbonic oxide and hydrogen are given off, and in place of the benzophenone expected, triphenylcarbinol, together with a not inconsiderable quantity of benzoic acid, is produced. Benzaldehyde appears to be formed as an intermediate product, and both this substance and benzophenone, when treated together with bromobenzene in dry ether with sodium, yield triphenyl carbinol, and in the case of benzophenone the yield is almost quantitative. It was not, however, possible to obtain pararosaniline by the action of sodium on a mixture of oxalic ether and *p*-bromaniline, although two different stable nitrogen compounds of high melting point are produced. Experimenting in the aliphatic series, the author attempted to prepare trimethyl carbinol by the action of sodium on a mixture of acetone and methyl iodide. Although a small quantity is formed, the principal product is isopropyl alcohol.—T. A. L.

Naphthazarin from δ-Tetranitronaphthalene, Formation of.

W. Will. Ber. 1895, 28, 2231—2235.

δ-TETRANITRONAPHTHALENE (1:2:1':1') (Ber. 28, 369) yields, on reduction with tin and hydrochloric acid, the tin double salt of the corresponding tetramide compound. This is decomposed by an excess of sodium hydroxide with separation of crystals of the base, which have a bronze reflex. The base is converted by the addition of hydrochloric acid in alcoholic solution into the hydrochloride of amidodimido-naphthol, which separates as a granular blue precipitate. From this, naphthazarin is obtained by boiling with dilute hydrochloric acid, the solution changing in colour from blue to red, and when sufficiently concentrated, depositing, on

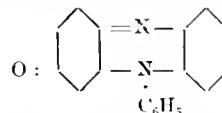
cooling, naphthazarin in red-brown flocks, the yield amounting to 50—60 per cent. of the theoretical. The formation of naphthazarin appears to be assisted by the addition to the acidified solution of a small quantity of ferric chloride.

—E. B.

Indulines to Safranines, Relations of. O. Fischer and E. Hepp. Ber. 1895, 28, 2283—2289.

THE authors, as a result of further investigation of the safranines and indulines, conclude that these colouring matters belong to the same group.

The close connection of these two series of colouring matters is exhibited by the formation of anilido-aposafranine (formerly named benzene-indone; Ann. 266, 254) from aposafranine—



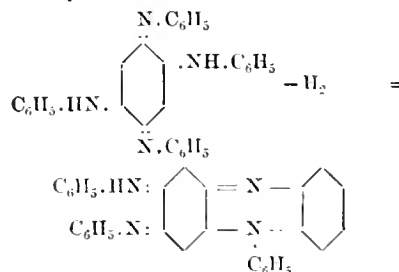
by heating with aniline and aniline hydrochloride.

In accordance with this relation, the formula of the anilido-compound must be expressed as $C_{24}H_{17}N_3O$.

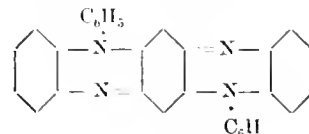
Anilido-aposafranine gives, on heating with 7.5 per cent. sulphuric acid, hydroxyaposafranine (Nietzki and Otto's safranin), a compound which may also be directly obtained from aposafranine by boiling with alcoholic potash.

Aposafranine is reproduced from anilido-aposafranine when the latter is treated in 60 per cent. boiling acetic acid with zinc dust, and the leuco-compound formed is oxidised. In a similar manner, the simplest induline, anilido-aposafranine, prepared by Kehrman (this Journal, 1895, 858), is converted into aposafranine (this Journal, 1894, 30).

Phenylinduline is derived from anilido-aposafranine by the substitution of a phenylimido-group for the oxygen atom, and must therefore have the formula, $C_{30}H_{23}N_3$, instead of that formerly assigned to it, namely, $C_{24}H_{17}N_3$. Its formation from azophenine is explained on the assumption that two atoms of hydrogen are withdrawn from this compound, thus:—



further condensation in the same way giving diphenyl-fluorindine—



The indulines must, therefore, be regarded as anilido-safranines. The mauveines (phenylsafranines), indazines, rosindulines, naphthyl red and blue, Magdala red and its homologues, phenosafranine and its homologues, and the indulines thus, all belong to the same group.

Two of the objections made to the grouping of the safranines with the indulines—namely, that phenosafranine contains a hydroxyl-group or combined water, and that the safranines in certain of their properties resemble ammonium compounds—are based on misconceptions. Hydroxy-aposafranine contains only one hydroxyl-group, and phenosafranine at 100°, if not at the ordinary temperature, is anhydrous. Aposafranine was not obtained by the authors free from water (less than $\frac{1}{2}$ mol.), but its benzoyl derivative was obtained entirely free. Further, the safranin bases are precipitated from solutions of their salts by alkali

hydroxides, free from carbonates, and are extractable by ether, thus differing from ammonium derivatives of closed chain compounds.—E. B.

Azo Colouring Matters, Observations on. E. Bamberger and F. Meimberg. Ber. 28, 1887—1897.

BAMBERGER brings forward further evidence in support of the views, as already stated (Ber. 28, 837), that both normal and isodiazobenzene compounds, when combined, yield identical azo compounds, and finds that this is also the case with the products from ethyl- and methylaniline when combined with normal or with iso-*p*-nitrodiazobenzene. Hantzsch's results as to the constitution of the isomeric *p*-nitrophenyl-azo- α -naphthols obtained by the action of *p*-nitrodiazobenzene hydrate with α -naphthol are confirmed by the authors, who also agree that the two compounds are *p*- and *o*-derivatives of naphthalene, and they adduce further evidence to show that, even with a free para position, certain phenols are substituted in the position ortho to the hydroxyl. Thus from diazotised *o*-nitraniline and α -naphthol they obtain *o*-nitrophenyl-*p*-azo- α -naphthol (1.4)OH. $C_{10}H_7.N_2.C_6H_4.NO_2(1.2)$, which crystallises in bronzy dark-red needles, melts at 244° — 245° C., and dissolves easily in hot xylene and amyl alcohol. On reduction it gives *o*-phenylene diamine and (1.4)-amidonaphthol, the latter when oxidised yielding α -naphthoquinone. The isomeric compound *o*-nitrophenyl-*o*-azo- α -naphthol (1.2)OH. $C_{10}H_7.N_2.C_6H_4.NO_2(1.2)$, is produced, together with the para compound, by the action of α -naphthol on *o*-nitrodiazobenzene methyl ether (obtained from the silver salt of *o*-nitro-isodiazobenzene and methyl iodide). On reduction and oxidation with ferric chloride no α -naphthoquinone is obtained, the reduction product being 2.1-amidonaphthol. Both the ortho- and the para-compounds are soluble in alkalis, but whilst the solution of the former is almost completely precipitated by water, that of the latter requires the addition of an acid, when it is precipitated in yellow flocks. The authors confirm Bamberger's previous statement that dialkylated *o*-toluidines will combine with diazo-compounds to form colouring matters, and describe the preparation of *p*-nitrophenyl-azo-diethyl-*o*-toluidine from diazotised *p*-nitraniline and diethyl-*o*-toluidine in presence of sodium acetate. On the other hand, no dyestuff is formed from *p*-nitro-isodiazobenzene and diethyl- or dimethyl-*o*-toluidine.

Experiments have also been made as to the replacement of one component in an azo dyestuff by another, a reaction which can be brought about in certain cases. Thus, for example, when α -naphthylamine dissolved in acetic acid is added to *p*-nitrophenylazomethylaniline and the mixture is allowed to stand, there results Meldola's *p*-nitrophenyl-azo- α -naphthylamine, and in a similar manner methyl- and ethyl-aniline can be replaced by α - and β -naphthol in the compounds resulting from the combination of these substances with *p*-nitrodiazobenzene.

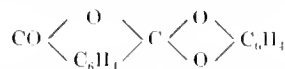
In conclusion the authors call attention to the formation of certain disazo colouring matters which have been overlooked in the preparation of some azo dyestuffs. When diazobenzene chloride is combined with alkaline α -naphthol, 33 per cent. of the product consists of bis-phenylazo- α -naphthol, $C_{10}H_7(OH)(N_2.C_6H_5)_2$, which crystallises in bronzy greenish-black matted needles melting at 190° — 191° C. (cf. Krohn, Ber. 21, 3240; this Journal, 1889, 116). Bis-*p*-tolylazo- α -naphthol, $(OH)(C_{10}H_7(N_2.C_6H_4.CH_3)_2)$, crystallising in dark violet-brown matted needles melting at 205° — 206° C., insoluble in alkalis, is formed, together with *p*-tolyl-azo- α -naphthol (m.p. 209° — 210° C.), by the action of diazotised *p*-toluidine on α -naphthol. Bis-*p*-bromophenyl-azo- α -naphthol, $HO.C_{10}H_7(N_2.C_6H_4.Br)_2$, from diazotised *p*-bromaniline and α -naphthol in an alkaline solution, crystallises in green needles melting at 233° — 235° C., is formed together with *p*-bromophenyl-azo- α -naphthol which melts at 237° — 238° C., and not, as Margary (Gazz. Chim. Ital. 14, 271) states, at 185° or 195° — 196° C. The bisazo compound is very sparingly soluble in warm dilute alkali, but dissolves easily in benzene or toluene, whilst concentrated sulphuric acid dissolves it with a greyish-green colour.—T. A. L.

Nitranilines, Preparation of the Three. E. Bruns. Ber. 28, 1954—1955.

THE method consists in nitrating aniline in presence of sulphuric acid and subsequently separating the three isomers by means of their different basicities. Aniline dissolved in 6—8 times its weight of concentrated sulphuric acid is nitrated with the theoretical amount of nitric acid mixed with an equal volume of sulphuric acid. The operation must be performed below 9° C., and after the nitration is complete, the melt is poured on to ice, and ice-water is added as long as a precipitate of *o*-nitraniline is produced. After one crystallisation from alcohol the product has the correct melting-point. The filtrate from the *o*-nitraniline is neutralised with powdered sodium carbonate, any tar which separates being first filtered off. On further neutralisation, *p*-nitraniline separates as a yellowish-brown precipitate, whilst finally, *m*-nitraniline is precipitated as a pure yellow precipitate. The change from brown to yellow is said to be very sharp, and after one crystallisation the nitranilines are pure, having the melting-points 147° and 110° C. respectively. With regard to the yields, 10—15 per cent. of *o*-nitraniline is obtained, whilst about 45—50 per cent. of *m*- and *p*-nitraniline are formed in approximately equal quantities.—T. A. L.

Allofluorescein. B. Pawlewski. Ber. 28, 2360—2362.

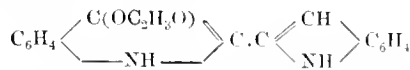
WHEN phthalyl chloride and resorcinol are heated on the water-bath, either alone or in solution, a yellowish amorphous mass is obtained, which fluoresces strongly in an alkaline solution. The melt is purified by treatment with acetic anhydride for several hours at 150° — 170° C., and after evaporating the liquid, the residue is repeatedly extracted with alcohol and acetic acid, a slightly yellowish amorphous substance being obtained. The pure substance is white, melts at 140° C., fluoresces strongly in an alkaline solution, and is nearly insoluble in all solvents. It has the formula—



and is termed allofluorescein. The author in conclusion compares this modification with ordinary fluorescein, from which it would appear that although in solutions of equal strengths allofluorescein shows a greener and denser fluorescence, when diluted it disappears sooner, and solutions containing 0.000001866 per cent. are colourless, whereas ordinary fluorescein of this strength shows a distinct fluorescence on a dark background.—T. A. L.

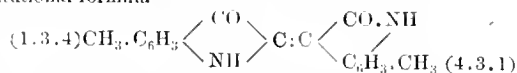
Indigotin, The Red Isomeride of, and some Derivatives of Isatin. E. Schunck and L. Marchlewski. Ber. 28, 2325—2331.

THE authors have already shown (Ber. 28, 539) that the three compounds described as red isomerides of indigotin are identical, and this identity is further proved by the fact that when treated with zinc dust and acetic anhydride in presence of fused sodium acetate they all yield acetylindilencin—



which crystallises in pink shining needles melting at 204° C., and by treatment with alkalis can be converted into indilencin.

Dimethylindirubin, prepared by reducing in a similar manner *p*-methyl isatin chloride, has probably the constitutional formula—

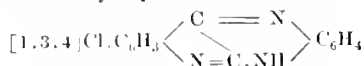


It crystallises from aniline in chocolate-brown needles, and has similar properties to indirubin.

Isatin-methyl-phenylhydrazine, obtained by boiling an alcoholic solution of isatin with methyl-phenylhydrazine, together with some acetic acid, is a true hydrazone, and crystallises from alcohol in orange needles melting at 172° — 173° C.

Isatin-β-naphthylhydrazine, crystallising in dark yellow needles melting at 231° C., is obtained by boiling an alcoholic solution of isatin with β-naphthylhydrazine hydrochloride in presence of sodium acetate.

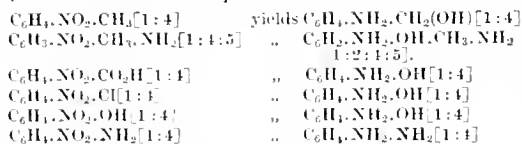
By acting on isatin with *o*-phenylene diamine, isatohydrophenazine, C₁₁H₇N₃, is obtained, which crystallises from alcohol or sublimes in yellow needles melting at 285°–287° C. The substance is stable to acids and alkalis, and gives an acetyl compound melting at 202° C. When *o*-phenylene diamine is condensed with *m*-chlorisatin, *m*-chlor-isatohydrophenazine—



is obtained.—T. A. L.

Paranitro Compounds, Electrolytic Reduction of, in Sulphuric Acid Solution. A. A. Noyes and J. T. Dorrance. J. Amer. Chem. Soc. 1895, 17, 855–859.

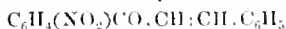
THE authors have investigated the action of electrolytic hydrogen on paranitraniline, paranitrophenol, and parachloronitrobenzene. All the paranitro compounds which have now been investigated are included in the following list, each with its reaction product:—



In the case of paranitrobenzoic acid and parachloronitrobenzene, the residue para to the nitro group is in each case driven out; this action may be characteristic of nitro-compounds with negative para groups, but further investigation is necessary to warrant any generalisation on this point. In only one case (that of nitrotoluidine) does the oxygen show any tendency to migrate to any other than the para-position. The experiments were made by dissolving 20 to 30 grms. of the substance in 2½ to 3 times that weight of strong sulphuric acid, and electrolysing with a large platinum electrode in a vessel containing a porous cup with sulphuric acid and a small platinum electrode. A current of from 1 to 2 ampères was employed for from 40 to 50 hours.—W. G. M.

Indigo, Formation of, by the Action of Sunlight. Engler and Dorant. Ber. 28, 2497–2501.

BENZYLIDENE-ortho-nitro-acetophenone—



is formed by the condensation of ortho-nitro-acetophenone and benzyl-aldehyde in alcoholic solution. When recrystallised from alcohol or ether it forms colourless long silky needles. When these crystals are exposed to sunlight for an hour or so, they begin to darken, and finally become dark blue; this is due to the formation of indigo-blue, which is caused by inter-molecular oxidation. No action takes place in the dark, very little in red light, more in yellow and green, and most in blue light.—A. L. S.

Luteol (Hydroxychlorodiphenylquinoxalin), New Indicator. W. Antenrieth. Archiv. d. Pharm. 233, 43.

See under XXIII., page 216.

PATENTS.

Dyestuffs [Azine Reds and Blues], the Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 4880, March 7, 1895.

THE symmetrical and mixed dialkylated 1,3-naphthylene diamines and their sulphonic acids, obtained according to Eng. Pats. 8898, 16,780, and 19,623 of 1893 (this Journal, 1894, 511, 801, and 912), can be converted into hitherto unknown mordant azine dyestuffs. The process consists in heating these products with nitroso or azo compounds of the benzene or naphthalene series—such, for example, as those

derived from *o*-hydroxy-carboxylic acids (salicylic acid, hydroxynaphthoic acid, &c.) and from *o*- or peri-dihydroxy compounds of the benzene or naphthalene series. If necessary, the resulting azine compounds may be sulphonated to render them soluble. A mixture of 7.8 kilos. of 1,3,1'-diphenyl-naphthylene diamine sulphonic acid, 8 kilos. of benzene-azo-dihydroxynaphthalene [4.1.1'], 2.7 kilos. of sodium acetate, and 20 kilos. of glacial acetic acid, is heated for six hours, until the solution is blue, and when cold it is poured into alcohol. After filtering and washing, the monosulphonic acid obtained is preferably converted into a polysulphonic acid by sulphonation with fuming sulphuric acid (containing 25 per cent. SO₃) at 50° C. On pouring the melt into water, the sulphonic acid separates out, and after conversion into its sodium salt, is soluble in hot water. It gives blue shades on chrome-mordanted wool, fast to alkalis and acids. The above is a typical example, but any other processes for the production of azines may be employed for the purposes of this invention.—T. A. L.

Hydroxyanthraquinones [Anthracene Dyestuffs], The Manufacture or Production of Derivatives of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 4951, March 8, 1895.

THE derivatives referred to are obtained by the action of primary aromatic amines and diamines (aniline, *o*- and *p*-toluidine, xylydine, *α*- and *β*-naphthylamine, *m*- and *p*-phenylene diamine, *m*-tolylene diamine, benzidine, and *p*-diamidodiphenylmethane) on hydroxyanthraquinones, such as quinizarin, purpurin, hydroxyanthra- and flavo-purpurin, anthrachrysone, alizarin bordeaux, pentacyanine and hexacyanine, and hexahydroxyanthraquinone. The condensation is carried out in presence of a condensing agent, such as boric, hydrochloric, hydrobromic, hydrofluoric, sulphuric, phosphoric, acetic, or benzoic acid, or zinc chloride. The resulting disubstituted products can, after sulphonation, be employed as valuable dyestuffs. A mixture of 10 kilos. of dry Alizarin blue (dihydroxy-anthraquinone quinoline), 200 kilos. of aniline, and 10 kilos. of crystallised boric acid, is heated for three hours to 130° C. After removing the excess of aniline and boric acid, the residue, after drying, is dissolved in 10 times its weight of sulphuric acid, and this solution is poured into a large quantity of water. The precipitated dyestuff, after filtering off, when boiled for a certain time with dilute acids or alkalis, is decomposed into Alizarin blue and aniline. It gives bluish-green shades on chromed wool. The production of a sulphonic acid by direct condensation is illustrated in the following example:—10 kilos. of quinizarin sulphonic acid, 100 kilos. of *p*-toluidine, and 10 kilos. of boric acid are heated at 130° C., until the greenish colour of the melt no longer increases. After steaming, to remove the excess of *p*-toluidine, the residue, which is the sulphonated dyestuff, is crystallised from dilute hydrochloric acid. It dissolves readily in pure water, and gives green shades on unmordanted and on chromed wool. In some cases no condensing agent is required, but under these circumstances a higher temperature must generally be employed. Thus, by cohobating 10 kilos. of purpurin with 100 kilos. of *p*-toluidine until the purpurin has disappeared, the new product formed can be isolated in the usual manner and employed for the production of dyestuffs.—T. A. L.

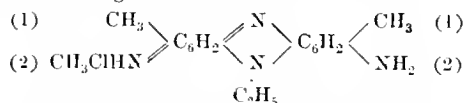
Alpha₁ Beta₂-dihydroxynaphthalene, The Manufacture or Production of, a New Alpha₁ Beta₂-dihydroxynaphthalene Sulphonic Acid, and of Colouring Matters derived from Alpha₁ Beta₂-dihydroxynaphthalene Sulphonic Acids. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 1962, March 8, 1895.

THE dihydroxynaphthalene disulphonic acid Y of Eng. Pat. 23,074 of 1893 (this Journal, 1894, 1191), when heated with water or dilute mineral acids at high temperatures, loses one sulphonic acid group and is converted into naphtharesoreinol sulphonic acid (1,3,2'-dihydroxynaphthalene sulphonic acid). When this acid is heated at still higher temperatures under the same conditions, it yields naphtharesoreinol (1,3-dihydroxynaphthalene), melting at

124° C. (Eng. Pat. 3580 of 1895; this Journal, 1896, 110). The new sulphonic acid will combine with tetrazo compounds, and the product derived from dianisidine and 1,3,2'-dihydroxynaphthalene sulphonic acid dyes reddish-violet shades on unmordanted cotton, fast to light, from a bath alkaline with potassium carbonate.—T. A. L.

Basic Azine Dyestuffs, The Manufacture or Production of, and of New Derivatives thereof. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5042, March 9, 1895.

According to Eng. Pat. 16,815 of 1892 (this Journal, 1893, 755) a process was described for producing basic colouring matters by condensing with amido azo compounds, alkyl-*m*-tolylene diamines ($\text{NH}_2 : \text{CH}_3 : \text{NHR} = 1 : 2 : 5$). Similar colouring matters and analogues thereof—for instance, those derived from benzyl-*m*-tolylene diamine—can now be obtained by any of the known methods for the production of similar azine dyestuffs. The various methods are: (1.) Condensing methyl, ethyl, or benzyl tolylene diamine with the nitroso-derivatives of secondary or tertiary aromatic amines or substituted amines. (2.) Joint oxidation of any of the preceding diamines with the *p*-diamines obtained by reducing the afore-mentioned nitroso-derivatives. (3.) Condensing primary, secondary, or tertiary aromatic amido compounds with azo compounds derived from alkyl-*m*-tolylene diamines and a diazotised amine. (4.) Joint oxidation of the alkyltriamido toluenes, obtained by reduction of the azo compounds in (3), together with primary, secondary, and tertiary amines. The dyestuffs produced according to these methods are similar to the safranines, from which they differ in containing a fatty radicle attached to an azine nitrogen, whereas in the safranines the substituting group is a phenyl or tolyl radicle. The following example gives the quantities employed:—A mixture of 28 kilos. of nitrosomethyl-*o*-toluidine hydrochloride, 15 kilos. of ethyl-*m*-tolylene diamine, and 100 to 200 kilos. of alcohol is heated on a water-bath until a clear red solution is obtained, when the whole is poured into water made slightly alkaline with ammonia, and filtered. After making acid with hydrochloric acid, the dyestuff is precipitated with salt, and after filter-pressing, is dried. It has the following constitution:—



and gives yellowish-red shades on tanned cotton. A further colouring matter can be produced from it by dissolving 3.1 kilos. in water and diazotising the solution with 3–4 kilos. of hydrochloric acid and 0.7 kilo. of sodium nitrite at a temperature below 5° C. When the solution has become a clear blue, 1.5 kilo. of β -naphthol in the calculated amount of soda-lye is added, and subsequently dilute soda-lye or sodium carbonate is stirred in until, on salting out and filtering a sample, a neutral filtrate is obtained. The dyestuff is then salted out, filter-pressed, and dried. It can be purified by crystallisation, and gives blue shades on tanned cotton.—T. A. L.

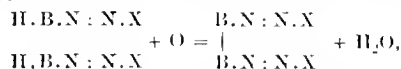
Dyestuffs [Safranines], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 6328, March 27, 1895.

THESE dyestuffs are obtained by condensing the nitroso-compounds of alkyl-*o*-toluidines with two molecular proportions of a primary aromatic amine having a free para position, or else with one molecular proportion of any primary monamine and one molecular proportion of a monamine unsubstituted in the para position. The following is a typical example of the method employed:—11 kilos. of *p*-toluidine, and 12 kilos. of methyl-*o*-toluidine are dissolved in 100 kilos. of alcohol, 18.6 kilos. of nitro-*o*-methyl-*o*-toluidine hydrochloride being subsequently added to the resulting solution, heated on a water-bath. The reaction soon commences, forming a deep red-coloured

solution, and after heating about an hour, the liquid is acidulated with acetic acid, and the oxidation is completed by gradually adding 20 kilos. of potassium bichromate as a 5 per cent. solution. After distilling off the alcohol, the residue is acidulated with hydrochloric acid, and extracted with hot water, the dyestuff being finally salted out from the filtrate. It is identical with that previously obtained by the patentees from equimolecular proportions of *p*-amidomethyl-*o*-toluidine, methyl-*o*-toluidine, and *p*-toluidine. (See also Eng. Pat. 2900 of 1895; this Journal, 1896, 109.)—T. A. L.

Azo Dyes of the Benzidine and Analogous Series, The Manufacture and Production of. J. Y. Johnson, London. From "The Badische Anilin and Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 6697, April 1, 1895.

THE method hitherto employed for the production of the benzidine and homologous series of dyestuffs has consisted in the combination of the tetrazotised bases with amines and phenols and their derivatives. According to the present invention, these colouring matters can be obtained by oxidising certain azo dyestuffs, according to the following scheme:—



where B is an aniline radicle or other amido compound with a free para position, and X is an azo-dye component. The production of Congo red is carried out as follows:—About 35 kilos. of the azo dye, aniline-azo-naphthionic acid, are dissolved in 300 kilos. of 92 per cent. sulphuric acid, and oxidised with about 20 kilos. of 50 per cent. manganese peroxide at a temperature not exceeding 20°–25° C. When no further formation of disazo dyestuff is observable, the melt is poured on to ice, preferably in presence of sulphurous acid. After filtering and washing, the acid is converted into the sodium salt and purified either by means of the calcium salt or else by redissolving and again salting out. Ammonium persulphate or lead peroxide may also be used as oxidising agents.—T. A. L.

Extracting the Colouring Matter from Dyewoods, Process and Apparatus for. F. E. Mafat, Paris, France. Eng. Pat. 6967, April 4, 1895.

THE apparatus, of which a drawing is given, consists of a series of air-tight vessels connected by suitable communicating pipes and fitted with steam coils and exhaust. After charging each vessel, which has the shape of a truncated cone, with fragments of the dyewood, the first vessel is exhausted of air, and water, kept hot by the steam coil, is admitted, which extracts the dyewood therein. The second vessel is then exhausted, and the liquor from the first admitted to it, fresh water being drawn into the first vessel. The liquor in this manner passes through the series of vessels (generally 5), and the spent wood having been discharged from the first vessel, and this recharged with fresh, the concentrated liquor is drawn on to it and then discharged. It is claimed that by this means a very complete exhaustion of the dyewood is effected.—T. A. L.

Orange Colouring Matters by Electro-Chemical Process, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 22,482, Nov. 25, 1895.

By reducing the yellow alkaline condensation products of *p*-nitrotoluene sulphonic acid in an alkaline solution by means of the electric current, the yellow colouring matters are converted into orange dyestuffs. A mercury cathode is preferably employed, as the reduction then proceeds at a lower temperature. The best strength of current is 5–15 ampères per square decimetre of cathode area. About 10 kilos. of *p*-nitrotoluene sodium sulphonate are condensed in the usual manner in an aqueous solution with 30 kilos. of soda lye of 30° B. After dilution with 70 litres of water, the whole is reduced at 45° C. in an electrolytic cell with a mercury cathode until a sample spotted on paper shows a red spot free from yellow. The solution is then neutralised and the dyestuff salted out. After filtering and drying, it

forms a dark brown powder easily soluble in water with a yellowish-red colour, and in concentrated sulphuric acid with a dark violet-blue colour. It dyes unmordanted cotton orange from a neutral or alkaline bath, fast to air, chlorine, and acids.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

PATENTS.

Oiling or Waxing of Animal Fibres or Yarns, and Mixed Animal and Vegetable Fibres or Yarns, and Fabrics made from such Materials, Improvements relating to. R. Aitken, London. Eng. Pat. 2711, Feb. 7, 1895.

The materials (for instance, rags destined for use in the manufacture of shoddy) are placed inside a cylinder and impregnated with the oil, which it is desired to apply to them, in solution in an appropriate volatile solvent. The excess of the solution is withdrawn, and the solvent retained by the materials is expelled by heating, and condensed for use again.—E. B.

Stalk Fibres, An Improved Method of Degumming or Separating the Filaments of. K. T. Sutherland and G. Esdaile, Manchester. Eng. Pat. 3011, Feb. 12, 1895.

The degumming is effected by means of a hot, "neutral" solution of resin soap, prepared by dissolving colophony-resin in caustic soda, followed by treatment with a dilute solution of alkali.—E. B.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Wool, Lactic Acid for Mordanting. E. Hoffmann. *Färber Zeit.* 7, 65. (See also this Journal, 1882, 363; 1883, 176; 1885, 116; 1886, 677; 1891, 362. *J. Soc. Dyers and Col.* 1895, 98.)

For most alizarin colours lactic acid is to be preferred for wool-chroming to tartar, and particularly to oxalic acid.

Alizarin red, alizarin blue, anthracene blue, and anthracene brown yield on chrome and lactic acid mordant darker shades than on chrome and tartar, the difference being still more pronounced when compared with dyeings on chrome and oxalic acid. 14 per cent. of Alizarin blue SRW or WX gave with lactic acid the same depth of shade as 15 per cent. with tartar, and 16.5 per cent. with oxalic acid. Wool chromed with the aid of lactic acid is darker, and the exhausted bath of a lighter colour than with tartar, and more so than with oxalic acid. From this the author concludes

that with lactic acid more chrome is fixed on the fibre. Fuller and brighter shades are obtained both with alizarin and dyewoods, and less of colouring matter is required. The softness of the fibre is equal to that of fibre mordanted with tartar, whilst oxalic acid imparts harshness to the wool.—I. S.

Slubbing Dyeing, Suitable Dyes and New Apparatus for. J. Berger. *Färber Zeit.* 1895, 7, 81—82.

Such colouring matters only should be selected which, besides possessing the necessary fastness, penetrate well and dye evenly. Only few of the fast dyes possess these qualities. The chief of these are:—Alizarin reds, Milling orange, and Milling yellow (Dahl), Alizarin greens G and B (Dahl), all brands of Anthracene blue, Brilliant alizarin blues G and R, Brilliant alizarin cyanines G and 3 G, Alizarin cyanine R extra, Gallen, Galloeyanine (Duraud), Wool violet (Bayer), Diamond brown (Bayer), Chrome brown (Hoechst and Bayer), Diamond black (Bayer, single-bath method), Alizarin black (Badische), and Alizarin cyanine black (Bayer). Anthracene brown, though indispensable for brown shades, is not to be classed among these; but with care may yield good results.

Two modifications of a new apparatus are described. It consists of a wooden tub, about 3 ch. m. capacity, to the bottom of which is fitted from the inside a hollow copper plate with five round sleeves 10 cm. high. In the centre of this plate is an injector of special construction to convey either hot or cold liquids. The injector has an elongation tube terminating in a hood from 10 to 15 cm. above the perforated copper cylinders containing the bobbins (spools of 5 kilos.), which fit into the sleeves. The dye-liquor is sucked upwards and through the bobbins by the injector, which also acts as heater, is sent up to the hood, and is thus kept in circulation. A number of these vessels are employed side by side for wetting out, mordanting, and dyeing; the copper cylinders being transferred from one into the other by an overhead travelling crane.

The other modification is adapted for dyeing by the hyposulphite (thiosulphate) vat, and differs from the former in having the injector outside the vessel, returning into the latter by a bent tube which dips into the liquor to about 10 cm. to prevent air being sucked through the indigo solution. The injector is also surrounded by a counter-current cooler to maintain a temperature below 62° C.—I. S.

Alizarin-dyed Cotton Fabrics, Results of Analysis of. C. Liebermann and P. Michaelis. *Ber.* 1895, 28, 2264—2265.

A CONTINUATION of the author's examination of the alizarin lakes on cotton (this Journal, 1895, 514).

The following additional results have been obtained:—

Per 2,000 Sq. Cm. of Tissue.

Dark Red Lake.		Dark Purple Lake.		Chocolate Lake.	
	Grms.		Grms.		Grms.
Alizarin ("For Red")	0.2791	("For Purple")	1.0718	("For Purple")	0.6210
Al ₂ O ₃	0.0557	Fe ₂ O ₃	0.2377	Fe ₂ O ₃ +Al ₂ O ₃ ..	0.0638
SnO ₂	0.0108	" ..	" ..	Cr ₂ O ₃	0.3449
CaO	0.0626	" ..	0.1298	" ..	0.0639
Fatty acid, combined	0.0795	" ..	0.0571	" ..	0.0614
" free	0.0819	" ..	0.0514	" ..	0.1156

For the purpose of this investigation, in order to obtain a colour lake of a simpler character than the Turkey-red lake, the alizarin red was dyed upon a mordant free from fatty matters and tin. The presence of these substances in it, is accounted for by the fact of the colour lake having been cleared in a soap-bath to which an addition of a tin salt had been made.

The mordants were in each case fully dyed and the dyed tissues slightly souped.—E. B.

Dyestuffs, Artificial, for Dyeing Silk Fast, Systematic Review of. H. Werner. *Leipziger Färber Zeit.* 1895, 44, 453—454 and 469—474.

The dyestuffs available for dyeing fast colours on silk—*i.e.*, fairly fast on washing or fulling, or at any rate fast to water—may be classed in three groups, *viz.*:—

1. Mordant-dyeing dyestuffs, *i.e.*, such as give fast colours upon silk mordanted with metallic salts.
2. Dyestuffs developed upon the fibre.

3. Direct dyestuffs, which either by themselves alone give sufficiently fast dyes, or can be made faster by a suitable after-treatment.

For the classification of the different dyestuffs into their respective groups:

1. The mordants used are—

As chromium mordant, chromium chloride, sometimes the fluoride or acetate. As iron mordant, nitro-sulphate of iron. Chromium and alumina mordants are applied at 2°–4° B., iron mordants at 8°–12° B. Fixing agents, e.g., soap or soda, are sometimes added to the mordanting bath. The dyeing is performed in the usual manner.

2. The diazotising is effected with 4 per cent. of sodium nitrate and 8 per cent. hydrochloric acid. The developing is effected according to the colour required, with the different developers. In all cases the dyed material is soaped hot before dyeing and brightened with acetic acid.

3. Treatment with tannin, after dyeing, consists in entering the silk into a cold up to a hot aqueous solution of 40° C., containing 20 grms. of tannin in 1 litre, with an addition of 0.5 gm. of sulphuric acid, wringing or drying, and, without rinsing, entering a bath at 40° C., containing 10 grms. of tartar emetic per litre, turning for one hour in it, rinsing, soaping, and brightening if required.

Tabulated results are given, in which the dyestuffs are arranged in three groups, and at a glance the mordants or developers used, colours produced, and fastness respectively to water, washing and fulling, and boiling soap, are stated. (See also *Textile Colorist*, 18, [206], 33–35.)—T. W.

Chlorine Water, Photo-Chemical Decomposition of, Influence of Hydrochloric Acid and Chlorides on the. E. Klimenko. Ber. 28, 2558–2564.

Equal volumes of chlorine water and normal solutions of various metallic chlorides or hydrochloric acid were mixed and exposed to sunlight in sealed glass tubes; at the same time comparative exposures were made with tubes containing chlorine water only. When the chlorine in the latter tubes had disappeared, the whole of the tubes were opened and the free chlorine which remained was determined.

Very little chlorine had disappeared from the tube containing hydrochloric acid, and the presence of the chlorides also had a retarding effect on the decomposition. In any group of metals, arranged according to the periodic law, the retarding effect of any one metallic chloride was proportional to its position in the group—sodium chloride having a greater retarding effect than potassium chloride, and calcium chloride than strontium chloride.—A. L. S.

PATENTS.

Printing Woven Fabrics or Yarns in Skeins, Improvements in or relating to Processes and Apparatus for. G. Markus, M. Baender, and F. Sicker, Warschau, Poland. Eng. Pat. 1691, Jan. 24, 1895.

A METHOD of block printing with bars mechanically carried on endless bands.—E. B.

Printing Calico and other Woven Fabrics of Cotton and Cotton Warps (Prepared with Beta-Naphthol), Improvements in. L. Rivett, Stockport, and R. H. Scott, Littleborough. Eng. Pat. 3905, Feb. 23, 1895.

BLUE, yellow, green, and black colours are printed, along with, for example, the red colour produced from diazotised *p*-nitraniline, on calico prepared with sodium β -naphtholate.

The blue is obtained with Prussian blue in admixture with oxalic or tartaric acid; yellow, with lead acetate or nitrate, and citric and tartaric acids; green, with a mixture of the blue and yellow colours; and black, with logwood liquor, gall-nut liquor, potassium ferrocyanide, and "nitrate of iron."

After being printed, the cloth is passed through a solution of potassium or sodium bichromate, and then washed "and otherwise treated as may be desirable."

Instead of β -naphthol and *p*-nitraniline, analogous compounds may be employed.—E. B.

Dyeing Apparatus, Improvements in. J. G. Haslam, Philadelphia, U.S.A. Eng. Pat. 4671, March 5, 1895.

AN invention which principally relates to apparatus forming the subject of Eng. Pat. 18,517 of 1893 (this Journal, 1894, 391).

The efficiency of the apparatus is increased by the addition to it of a third set of yarn-sticks intermediate between the upper and lower sets.

The construction and arrangement of the devices for raising and lowering the yarn-frame are modified, and an automatic valve is provided for the regulation of the supply of steam to the vat.—E. B.

“Potting or ‘Spungeing,’ Process for rendering Wool-Dyeings Fast to.” S. Pitt, Sutton. From L. Cassella and Co., Frankfurt-on-Main, Germany. Eng. Pat. 23,592, Dec. 9, 1895.

CERTAIN azo colouring matters (Naphthylamine black D, Naphthyl blue-black N, Anthracite black, Jet black, Sulphone black, and others) on dyed wool, change colour when subjected to heat, molecular scission of their azo groups taking place. With the polyazo colouring matters, this occurs step by step, amido-azo compounds being first formed and the wool showing the colours characteristic of these; thus, the black azo colouring matters derived from the amido-azonaphthalenesulphonic acids first change colour to red.

The change is prevented from occurring by applying to the wool, either during the process of dyeing or afterwards, 3–1 per cent. of its weight of copper sulphate, or, after dyeing, 5–8 per cent. of sodium chlorate.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Manufacture of Hydrochloric Acid [from NH_4Cl of Solvay Process], Note on a Process for. O. N. Witt. Bull. de la Soc. Ind. de Mulhouse, Dec. 1895, 321.

It is pointed out that, while the ammonia process for manufacturing soda has advantages over the Leblanc process, it is yet necessary, in part, to use the latter in order to obtain the hydrochloric acid required in industry. The author proposes to obviate this objection to the Solvay process by a special treatment of the residual ammoniacal liquor, which contains also undecomposed sodium chloride. This liquid, from which sodium bicarbonate has been separated, instead of being decomposed by lime to recover ammonia, with loss of the chlorine present as useless calcium chloride, as well as of the remaining sodium chloride, is evaporated nearly to dryness, the escaping carbonic acid being collected for application in the main process. The partially dried salts are then heated in a suitable apparatus until the ammonium chloride has sublimed, leaving a residue of available sodium chloride. The ammonium salt recovered is gently heated in an apparatus, such as a Leblanc sodium sulphate furnace, with sufficient syrupy phosphoric acid to form a bi-basic ammonium phosphate, and the hydrochloric acid evolved is collected in the usual way. The heat is then sufficiently raised to set free ammonia, which is condensed, and the residue of phosphoric acid is dissolved in water for re-use. Thus, it is claimed that phosphoric acid plays the same part in the author's process as ammonia in the Solvay process; and that, as it is constantly regenerated, its cost need not be considered in view of the hydrochloric acid recovered by its means, at a cost enabling it to compete with that obtained in the Leblanc soda process.—E. S.

PATENTS.

Sulphuric Acid, Manufacture of, Improvements in the [Economy of Nitre]. U. F. Benker, Clichy, France. Eng. Pat. 1168, Jan. 17, 1895.

THE liability to the escape of yellow vapours from Gay Lussac towers in the manufacture of sulphuric acid is attributed to the presence in the gases of too much "hyponitrous acid," for which the absorbing capacity of sulphuric acid at 60° B. is feeble. The loss thus occurring is prevented, under this invention, by injecting moist sulphurous

acid into the last chamber of the series of chambers used in such manufacture, or into the portion of a large chamber serving as the last chamber of the series. The injecting apparatus is preferably made of an alloy of lead with 10 per cent. of antimony, and contains two injector cones, the outlet to which faces the aperture for discharge of the sulphurous acid (moistened by admission of steam through a fine platinum jet) into the chamber to the side of which the apparatus is attached. The flow of both sulphurous acid and of steam are duly regulated, according to the coloration of the gases issuing from the Gay-Lussac tower. It is stated that, in a large apparatus, 150 to 250 kilos. of nitrate may be saved daily by use of the described process.—E. S.

Cyanogen Compounds, Improvements in the Production of.
A. E. Morgans, London. Eng. Pat. 2660, Feb. 6, 1895.

CYANOGEN, or compounds of cyanogen with chlorine, bromine, iodine, or fluorine, are produced for the purpose of extracting precious metals from their ores. One method of obtaining cyanogen consists in electrolyzing potassium cyanide solution, using a carbon anode and an iron cathode. Or, a cyanide is treated with sulphuric acid in presence of manganese dioxide, and the hydrocyanic acid gas is led over manganese dioxide heated to about 250° F. Chlorocyanogen is produced by electrolyzing a mixture of sodium chloride and a cyanide; or by treating a mixture of sodium chloride, sodium cyanide, and manganese dioxide with sulphuric acid; or a mixture of bleaching powder and an alkali cyanide is acted upon by a suitable acid, such as hydrochloric acid. The compounds of cyanogen with bromine, iodine, or fluorine are similarly prepared by electrolyzing a solution of the respective salts, or by their decomposition by means of acid in presence of an oxidising agent. The cyanogen, or cyanogen compound, may be used direct, or be compressed into a liquid state for transport.—E. S.

Chlorine, Manufacture of, by means of Magnesium Chloride, Improvements in. T. H. Bell, Middlesbrough.
From T. Schloesing, Paris. Eng. Pat. 3489, Feb. 18, 1895.

THE inventor has already described in Eng. Pat. 11,821, 1887 (this Journal, 1888, 626), the conditions necessary for dehydrating magnesium chloride obtained in a granular state, and in the present invention he describes the apparatus required for carrying out this and related processes. The "grains" of hydrated magnesium chloride are heated in a series of superposed cast-iron cylinders through which a current of dry hydrochloric acid gas is passed. Each cylinder is traversed by a steel shaft carrying spiral blades, which in rotating, impel the grains in the uppermost cylinder towards an outlet, through which they pass into the cylinder next below, and so on until they are discharged into a receptacle. The partially dried grains are then heated to low redness in the fireclay grid of a muffle furnace of brickwork, through which dry HCl is passed. The same furnace may be used in effecting the decomposition of the anhydrous magnesium chloride by air, to obtain chlorine. Details of the construction are given and shown.

The hot and moist hydrochloric acid issuing from the torrefiers is passed through a series of carbons in which strong acid condenses. The remaining gaseous acid is led through coke-packed towers down which sulphuric acid is run, to render it anhydrous for re-use. A chamber is shown containing a series of heated pans in which the sulphuric acid from the towers is concentrated, the strong acid passing from the last of the pans into a leaden box set over a flue, to which is also admitted the strong liquid hydrochloric acid previously recovered by condensation. The gaseous HCl given off may be completely dried by passage through a sulphuric acid tower, ready for application in the process.—E. S.

Zinc Chlorides, Improvements in the Production of.
C. Hoepfner, Giessen, Germany. Eng. Pat. 5062, March 28, 1895.

Zinc oxide, such as that derived from the roasting of calamine and zinc blende, is digested with solution of

magnesium chloride or zinc chloride, and carbonic acid is passed in to throw down zinc carbonate, which may then be converted into zinc chloride by digestion with calcium chloride, as described in Eng. Pat. 11,724, 1891 (this Journal, 1895, 581). Zinc oxide may be treated with calcium chloride solution and at the same time with carbonic acid to obtain zinc chloride in solution and a precipitate of calcium carbonate. Residual liquors of the manufacture of sodium and potassium salts, and such as occur in the treatment of copper and nickel ores, containing calcium and magnesium salts, with or without iron salts, may be used in the process. Metals more electro-negative than zinc may be separated from solutions of zinc salts by electrolysis in the manner directed in Eng. Pat. 13,336, 1893 (this Journal, 1894, 741). Zinc oxide may also be dissolved by solution of a caustic alkali, and be precipitated as described, for conversion into chloride. The alkaline solutions may be used again and again. Sulphates of iron, magnesium, and other metals may be caused to react with sodium or potassium chloride at a low temperature, to obtain chlorides suitable for use in dissolving zinc oxide.—E. S.

Alkali-Chlorates, Improvements in the Electrolytic Manufacture of. J. Wetter, London. From The Elektrizitäts-Aktiengesellschaft vormals Schuckert and Co., Nürnberg, Bavaria. Eng. Pat. 7364, April 10, 1895.

IT is proposed to dispense with porous divisions between the electrodes, and to employ a solution of the alkali chloride saturated at ordinary temperatures. The electrolyte is worked at a temperature preferably from 40° to 100° C., with a current density of 500 to 1,000 amperes per square metre. 2 to 3 per cent. of potassium bicarbonate is added to the electrolyte to maintain alkalinity next the anode (free caustic is to be avoided), and periodically, carbon dioxide is admitted. Instead of carbonates, organic compounds (fatty acids, or oxy-fatty acids, especially acetic and oxalic acid or carbohydrates, such as saccharose, dextrose, or dextrin) may be added to the bath, yielding carbonic acid on their further oxidation at the anode. "The yield of chlorate is a maximum at the beginning of the process, and drops as the contents of chlorate increase. The process should therefore be interrupted as soon as the consumption of current for the further production of chlorate exceeds a limit determined by the cost of the motive power."—J. C. R.

Caustic Soda, Hydrogen, and Chlorine, Improved Process for Obtaining, by Electrolysis of Sea Water, and in Treating the By-Products obtained during such Process.
G. B. Baldo, Trieste, Austria. Eng. Pat. 18,406, Oct. 2, 1895.

SEA-WATER is evaporated to a specific gravity of 1.060, and then electrolysed. The anode is placed in a porous pot. The cathode is in the form of a pot surrounding it. These two are filled with the electrolyte. A third pot encloses these again, and forms a water or cooling jacket. The soda liquor produced in the cathode compartment is drawn off from time to time. The hydrogen is eliminated. The chlorine may be collected for use. "The residue in the porous pot contains chloride of sodium . . . and free sulphuric acid." This residue is subjected to distillation. The last quarter coming over contains dilute hydrochloric acid produced by the action of the sulphuric acid on the chloride of sodium. The dry residue is heated to redness and the acid vapours passed through barium chloride solution, and then through the weak solution previously obtained by distillation, to bring it up to the desired strength.—J. C. R.

VIII.—GLASS, POTTERY, ENAMELS.

PATENT.

Translucent Enamel, Improvements in. W. Lutwyche and W. B. Lutwyche, London. Eng. Pat. 5934, March 21, 1895.

THE inventors claim the use of the following materials in the proportions named for the production of translucent

enamel:—Boric acid, 80 to 100; zinc oxide, 50 to 80; stannic acid, 30 to 40; powdered flint, 50 to 60; fel-par, 5 to 10; pearl ash, 2 to 5; carbonate of soda (*Sel de St. Gobain*), 20 to 30; bone ash, 5 to 9; calcined borax, 8 to 12; nitre, 2 to 5; chloride of sodium, 5 to 9 parts.

For colouring the enamel blue, hydrate of alumina and hydrated protoxide of cobalt (*Bleu de Sèvres*) may be used; for black, the preparation of oxide of manganese known as *oxyde noir de Dubois*; for yellow, oxide of antimony or oxide of uranium; for pink, carmine.—V. C.

IX.—BUILDING MATERIALS. CLAYS, MORTARS, AND CEMENTS.

Cement Mortar, Influence of Character of Sand on. A. S. Cooper. *J. Franklin Inst.* 1895, 8, 321—339.

THE author has made numerous experiments on the influence of sands of varying fineness and character of grain on the tensile strength of cement-mortar briquettes prepared with them. He arrives at the following conclusions:—(1.) Other things being equal, a fairly coarse sand, *e.g.*, one passing through a 12 sieve (12 wires to the inch) and caught on a 16 sieve, gives mortars of higher tensile strength than do finer sands. (2.) This effect of size of grain disappears with sands fine enough to pass a 40-mesh sieve and caught on a 60-mesh sieve; sands finer than this give similar results. (3.) The character of the surface of the grains is of moment. Mere sharpness of grain is not the only point to be considered, for an extremely sharp sand may have a smooth surface on each facet, and a moderately rough surface is preferable.—B. B.

PATENTS.

Wood, Treatment of, with a View to Preserving and Colouring the same. R. Aitken, London. Eng. Pat. 2710, Feb. 7, 1895.

ALTHOUGH the lighter paraffin oils are said to protect timber, they disappear after a time through rain and climatic influences, leaving only the heavier oils in the wood, and these are sufficient to protect the timber from decay. The invention consists in taking the heavier oils or waxes of the distillation of mineral, animal, or vegetable oils and mixing them under pressure and at an elevated temperature with naphtha or other solvent. The solution is then forced into the wood in the same way as when creosoting is adopted, after which the naphtha is recovered from the wood by distillation, leaving the heavy oil in the timber to protect it from decay. By this means a small amount of heavy oil will thoroughly preserve wood, whilst the latter will be clean to work and handle, and remain light and elastic. It is claimed that only one-fifth the weight of heavy oil is required compared with creosote. For colouring the wood, such dyes are used as are soluble in the solvent employed to dissolve the oils, with which the wood is being treated.

—D. B.

Portland and other Similar Cement, New or Improved Process and Apparatus for the Manufacture of. E. H. Hurry, New Brighton, U.S., and H. J. Seaman, Catasauqua, Pennsylvania, U.S. Eng. Pat. 23,145, Dec. 3, 1895.

IN ordinary practice, the hot clinker is spread on floors to cool, a process which is wasteful of time and space, and also requires that a large amount of material shall always be undergoing treatment in the works, even for a moderate output. In the present invention, the hot clinker is broken into small pieces, then wetted by a stream of water, and passed through a rotating conduit, where it is subjected to a strong draught of air, which cools the material; so that by the time it reaches the end of the conduit, it is in a condition for immediate handling.—V. C.

Cement and Cement-Mortar, An Improved Process for the Manufacture of. M. Nahsen, Schönebeck, Prussia. Eng. Pat. 24,898, Dec. 28, 1895.

THE waste residues of the manufacture of sulphate of alumina are washed and partly dried by the aid of gentle heating,

about 25 per cent. of water remaining, and quicklime is added. In general, equal quantities of the dried residues and of quicklime, are used, but for hydraulic cement, the quantity of lime is less.—V. C.

X.—METALLURGY.

Certain Metals, Solution and Diffusion of, in Mercury. W. J. Humphreys. *Proc. Chem. Soc.* 1896, [159], 9.

THE author has examined quantitatively the solution and diffusion of tin, lead, bismuth, zinc, copper, and silver in mercury with a view to determining the extent to which these phenomena differ, if at all, from the solution and diffusion of non-metallic solids in liquids. Pieces of metal were placed on the upper surface of a column of pure mercury, and samples of the liquid were taken at definite depths below the surface, and the amount of foreign metal estimated. As far as the experiments go, the author concludes that the solution and diffusion of metals in mercury do not essentially differ from those of non-metallic solids in liquids. Copper and silver dissolve in mercury to a very small extent at ordinary temperatures, but diffuse very rapidly.

Nickel Carbonyl, A Method for Preparing. H. Fiey. *Ber.* 1895, 28, 2512—2514.

THE author has made the interesting observation that nickel carbonyl (together with carbon monoxide) is formed when metallic sodium acts on ethyl oxalate in presence of a haloid salt of nickel. The following process is adopted:—A mixture of finely powdered anhydrous nickel chloride, and sodium cut in small pieces, contained in a gas-evolution flask, is covered with petroleum ether, and heated on a water-bath at 90° C. Dry ethyl oxalate is then added drop by drop through a tap-funnel, and the gas evolved passed through a flask placed in cold water in order to separate volatilised ether, &c. The proportion of nickel carbonyl formed is small (less than 5 per cent.), but it is readily detected in the gas by its odour, and by the greenish tinge it imparts to the flame when burnt. Passed through a red-hot tube, the gas deposits a brilliant filix of metallic nickel. Attempts to prepare carbonyl compounds of other metals in this way failed signally, even in the case of iron.

—H. T. P.

Chromium Amalgam and some Properties of Metallic Chromium. J. Féré. *Comptes rend.* 121, 822—824.

THE author has obtained the amalgam of chromium by an electrolytic method which has not been previously employed. When a solution of chromium chloride is electrolysed, without special precautions, with a negative electrode of mercury, the mercury takes up but little chromium, and a brownish-black chromium oxide is formed in the liquor. The author used 160 grms. of crystallised chromium chloride with 100 grms. of concentrated hydrochloric acid and 740 grms. of water, with a current of 22 amperes. In this way it was possible to obtain 1½ kilo. of solid chromium amalgam in a very short time. The amalgam was washed with water, and the mercury pressed out by squeezing in chamois leather. For analysis the amalgam was heated in a current of oxygen, and the chromium estimated in the resulting oxide. This showed that the amalgam has the formula Hg₂Cr. On pressing it for some minutes between filter-paper, at a pressure of 200 kilos. per sq. centimetre, the amalgam lost mercury, and a fresh amalgam of the formula HgCr was obtained. This amalgam is harder than the first, but it changes in the air more readily, and its surface soon becomes covered with little drops of mercury. By distillation *in vacuo* at 300°, one of these amalgams yields a chromium of different properties to that obtained by Deville and Fremy. It fires spontaneously in the air, and absorbs at the same time both oxygen and nitrogen, the heat disengaged raising the whole mass to a red heat. In this respect it resembles manganese obtained in the same way. Heated in a current of nitrogen it becomes incandescent and forms chromium nitride. It absorbs sulphur dioxide in the cold, becoming incandescent,

and if heated very lightly in a current of either carbon monoxide or dioxide, it becomes red-hot by the reaction. The author proposes to further study the products of these reactions.—A. W.

Aluminium Solders. J. Richards. J. Franklin Inst. 1895, 5, 351—355.

AFTER many trials the author has found that an alloy composed of aluminium 1, phosphor tin (10 per cent.) 1, zinc 11, tin 23 parts by weight, is effective as a solder for aluminium. The zinc and tin in this solder approximate to the proportions required by the formula Sn_2Zn_3 . The solder is said to be capable of use with a soldering iron, and not to disintegrate after exposure to air, as is often the case with tin-aluminium alloys.—B. B.

Zinc, Sulphur and Carbon in. R. Funk. Ber. 1895, 28, 3129—3132.

THE proportion of sulphur in purified zinc is found to range from 0 to $2\frac{1}{2}$ parts per 10 million; and the last traces may be extracted by continually remelting the metal and passing it through an asbestos filter. From this it would appear that sulphur is not appreciably soluble in molten zinc, but that when present in the metal it exists as sulphide. The test for traces of sulphur may conveniently be made by treating about 20 grms. of zinc with hydrochloric acid in a 200-c.c. flask, and collecting the hydrogen sulphide in the escaping gases by means of a sloping Pettenkofer's tube containing 12.5 c.c. of a 2 per cent. zinc sulphate solution mixed with an equal volume of 0.5 per cent. ammonia solution, and protected from the hydrogen sulphide of the air by a caustic soda guard-tube. When the zinc is quite dissolved (which may require a long time if the metal be pure, unless platinum wire is wound around it), the contents of the tube are transferred to a glass cylinder of 40 c.c. capacity, and the tube is rinsed with 2 c.c. of dilute hydrochloric acid; this is added to the now acid liquid in the cylinder, which is then diluted to 30 c.c. Finally there is added 1 c.c. of a solution of *p*-amido dimethylaniline in hydrochloric acid (1:500) and a drop of a 10 per cent. ferric chloride solution. In the presence of hydrogen sulphide a blue colour appears within a few minutes, which is quite permanent, and may be colorimetrically compared with other solutions of known strength. This colorimetric process, due to Fischer (Zeits. f. anorg. Chem. 9, 144), is accurate, and will detect 0.001 mgrm. of H_2S in 30 c.c. of solution. Commercial hydrochloric acid is never quite free from sulphur dioxide or hydrogen sulphide, and should therefore be boiled before use with a trace of potassium chlorate, the excess of chlorine being afterwards removed by the addition of pure zinc or of alcohol.

Traces of carbon were also found in zinc, but like sulphur, the carbon can be removed from the zinc by filtration of the fluid metal.—W. G. M.

Zinc-Fume Condenser, Explosion in. C. F. McKenna. Sch. of Mines Quart. 1895, 17, 171—174.

THE explosion referred to occurred in the condensers attached to a blast-furnace making spiegeleisen at the Passaic Zinc Company's works in Newark (N.J.). The blast-furnace in question was re-erected in 1893, and is 37 ft. to the stock line, with 6 ft. 9 in. hearth and 10 ft. bosh; it is water-cooled to the mantle, and has six tuyères with 3.5-in. nozzles placed 5 ft. 6 in. above the hearth. The capacity of the furnace is 2,323 cb. ft., and its daily output 20 to 21 tons of spiegel. It is charged through a bell and hopper, and is provided with a blast of 2,200 cb. ft. per minute at a pressure of 5 lb. and a temperature of 882° F. The zinc-iron-manganese ores of Franklin (N.J.) are used after the removal of a portion of the zinc. The zinc is reduced mainly in the lower part of the furnace, and is partly reoxidized, and escapes, together with much reduced zinc, in the form of the impalpable "blue powder," which sometimes contains 90 per cent. of finely-divided metallic zinc; a small portion is deposited in the form of concretions at the throat of the furnace, where a sudden lowering of temperature takes place.

The condensers are in duplicate, and are used alternately. Each set consists of eight clusters of nine vertical sheet-steel

pipes, connected at top and bottom with separate rectangular cast-iron chambers. The bottom boxes are 4 ft. 10 in. square, and 7 ft. 3 in. in height, but had been filled up to the extent of one-third by brickwork, as the capacity was too great, the brickwork sloping towards discharging-doors, 2 ft. by 3 ft., hung from the top in such a way that when the furnace is stopped they are free to blow open. At the top there are nine circular openings 11 in. in diameter closed by lids weighing about 50 lb. each, and also free to open outwards. From the last box in the set a gas flue 36 in. in diameter leads to the stove and boilers. On the morning of the accident, the furnace was stopped, and the downcomer-valve changed so that the set of condensers, which had been in use for some days, was cut off. A door in the lower boxes was then propped open, and some of the lids on the upper boxes were opened, when a slight explosion occurred, which blew away the block from the lower door, so that this became closed. At once a tremendous explosion occurred, wrecking one end of the set, scattering broken castings, and covering the workmen with pyrophoric zinc fume in active combustion. No explosion of similar magnitude has been recorded before, but slight puffs of explosion have occurred in the horizontal pipes when air has leaked in through valves or cleaning-holes. The combustion of zinc-powder, however, is not continuous. The air on the morning in question was humid, but the condensers had often been changed previously without accident under quite similar conditions. It would seem probable that the composition of the gases in the condensers was just suitable for forming an explosive mixture with the air introduced, and that the mixture was fired by the first particle of zinc which was pyrophoric, whilst the presence of moisture, leading to the formation of hydrogen by contact with the zinc dust, may have aggravated the disaster. Since the accident the condensers have been cooled before opening, but slight explosions have occurred even then. At present the doors and lids are operated mechanically from a safe distance, and the residual gases are swept from the condensers as quickly as possible after the set has been shut off. A pressure of 20 tons consolidates the blue powder (fume) to a metal-like material which oxidises with difficulty; otherwise the blue zinc powder may fire spontaneously, even in the cold.

—W. G. M.

Dust and Fume, Metallurgic, Methods for Collecting. M. W. Hes. Sch. of Mines Quart. 1895, 17, 97—118.

THE author classifies the methods employed in collecting fume in five classes:—

(1.) *Those in which it is deposited by its own weight in long flues, with or without enlarged settling chambers placed near to, or distant from, the furnace.*—Such chambers may collect dust, which consists merely of fine broken particles, but are never completely successful with fume, which is infinitely finer than dust, and is produced through the agency of heat. The collection is most perfect with long flues which have a large surface, and as many angles and turns as possible; the changes of direction are frequently made by the introduction of baffles, but the resulting interference with the draught of the furnace may seriously affect the output, and may even occasion a greater loss than the sacrifice of all the dust and fume produced; this is especially the case in roasting furnaces, in which dependence is placed upon chimney draught. The most elaborate system of dust chambers in the world is probably at Mecklenburg (Germany), and although much fume containing 70 per cent. of lead is recovered, yet even here the loss is very great. It may be said that almost all flues in metallurgical works should be higher and wider than they at present are; for the velocity of the gases containing metalliferous particles is nearly always too great; whilst almost universally in such works, economy would result from the substitution of fan draught for chimney draught. The Dee Bank Lead Works (N. Wales) had flues two miles in length; in Germany the flues are in one instance three miles long; all the lead smelters in Utah employ long dust chambers, whilst the Pueblo smelters, treating argentiferous lead ores, use simple cast chambers, and the lead smelters in Leadville (Colorado) and the copper smelters at Butte (Montana)

have short flues, few and simple. The system adopted by Enrich, of the Chicago and Aurora Smelting and Refining Company (Illinois), is specially commended: the smoke from his blast furnaces passes through a sheet-iron pipe, 7 ft. in diameter, with hopper-shaped receptacles to receive the deposit, and sliding doors beneath; after passing this pipe, it is joined by the smoke from the refining plant; and the mixed gases are conducted through a long underground dust chamber, with stone walls and a brick roof, and with 1-in. brick partitions built transversely nearly to the centre, from the left- and right-hand walls alternately, so that the fume is caused to take a devious path during its progress through the chamber; dwarf transverse walls are also built at intervals to a height of 2 ft. from the floor, to check the drifting of deposited fume along with the gaseous current. Iron pipes are cheaper than brick chambers, whilst they cool the gases more, and collect a larger proportion of fume; but they must be well painted. The author finds that the best paint for all iron surfaces is that known as silico-graphite paint, ground in oil, thinned with boiled linseed oil, and with a sufficient addition of No. 2 dryer. Comparing American with European practice, it may be said that the flues in the former case are measured by feet, in the latter case by miles.

(2.) *The filtering of the dust through flues, towers, or chambers, containing brushwood, coke, coarsely woven fabric, &c.; with water in jet, spray, or intermittent stream, to prevent clogging.*—Brushwood has now been generally abandoned as useless; coke is but little better, except for the short time which elapses before its pores become choked. Wire screens are always unsatisfactory. The use of water has never proved successful, owing in part to the difficulty of mixing fume and water. A system of coke filters has been employed at Balbach's works (New Jersey), but the author does not recommend any method in this division.

(3.) *The forcible projection of steam or drops of water into or across the current of smoke.*—The main difficulty in these processes is due to the solution of sulphur dioxide in the water, and the formation of liquids which attack the mortar and brickwork, or the iron of the flues. The best system consists in passing the smoke sinuously through a long underground flue, and then upwards through a compartment in a brick chamber 10 ft. wide by 20 ft. long by 12 ft. high; thence, passing over the top of the partition wall, it is led downwards through a series of 4-in. drain tiles supported on planking, and upwards again over similar tiles, being finally forced by 90-in. Sturtevant fans through a long wooden tuck with hanging curtains (which force it into close contact with the water), and a short chamber, to the brick stack. In the two tiled compartments and the curtained tank the smoke is subjected continuously to the action of water spray. Such a system was used by the St. Louis Smelting and Refining Company, and the smoke issuing from the stack was but slightly misty in appearance. The author would prefer a double set of condensing chambers, which could be used alternately, and would build them of glazed brick and heavy spar mortar.

(4.) *Passing the smoke through water; and (5.) passing it through water in which wire gauze diaphragms are immersed.*—The former method proved a failure, and is obsolete. Experiments, reported successful, were tried for the Sheffield Smelting Company by French and H. J. and J. W. Wilson, who forced the smoke through a 7-in. depth of water, containing a number of horizontal copper-gauze diaphragms, with 15 meshes to the linear inch: using a Root's blower absorbing 2.5 to 3 horse-power for the gases from a furnace smelting 15 tons of lead ore per diem. Oil and pyroligneous acid have been found more successful than water in retaining the dust, where no gauze baffles have been employed. The condensed matter obtained by these methods is not in a desirable form, and there would be difficulty in handling 250,000 cb. ft. of gas per minute, as is frequently necessary.

(6.) *The use of metal plates, hung in dust chambers, parallel to their length.*—This system has been used at Ems (Amer. Inst. Min. Eng., February 1883). The method

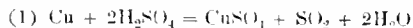
is only successful in long chambers (*cf.* Eng. and Mining J., July 1, 1882).

(7.) *The use of static electricity.*—Lodge's suggestion of passing high-tension electrical discharges through the fume has been tried on a practical scale at Bagilt (N. Wales), in the works of Messrs. Walker, Parker, and Co., but has been abandoned, because, although the deposit was effectually and rapidly produced in a closed chamber, no deposition occurred when the method was applied to the gases in motion in the flues; the temperature of the gases had no influence on the result, and the effect of moisture was excluded. The author is of opinion that this method may be made successful, and urges the reduction of speed by introducing a system such as that described by Cowper (Just. C.E. 1892-93, 112, Part II.) in a discussion upon papers by Collins and Malcolmson. This consisted in causing the furnace gases to divide themselves between a large number of flues placed parallel to one another, and communicating by small apertures with the main furnace flue at the one end and with the stack flue at the other. A plant of this nature put up in Spain had collected 190,000 lb. of fume in six months.

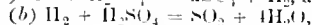
(8.) *Filtration through cloth or other textile fabric.*—The filters are usually in the form of bags of coarsely woven muslin or canvas. For business reasons the author gives no account of these systems, but appends a short bibliography, and refers to the Bartlett zinc-lead process (*see* this Journal, 1894, 13, 41).—W. G. M.

Copper and Concentrated Sulphuric Acid, Reactions between. C. Baskerville. J. Amer. Chem. Soc. 1895, 17, 901-912.

THE reactions between copper and strong sulphuric acid may be classed as primary and secondary; and in regard to the latter, the author's work accords in the main with that of Pickering (J. Chem. Soc. 1878, 33, 112). The primary reactions are—

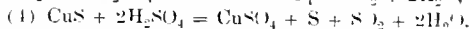
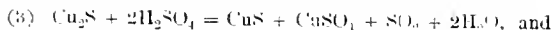


(which may be regarded as taking place in two stages,—



although no hydrogen could be detected in the evolved gases); and (2) $5\text{Cu} + 4\text{H}_2\text{SO}_4 = \text{Cu}_2\text{S} + 3\text{CuSO}_4 + 4\text{H}_2\text{O}$. Using sulphuric acid of 1.84 sp. gr. and copper ribbon, in an atmosphere of hydrogen or carbon dioxide, it was found that the former reaction predominated at temperatures between 0° and 270° C., the proportion of the mixture reacting according to equation (2), increasing from 0° to 100°, reaching a maximum at from 100° to 130°, and then decreasing up to 270°, when only reaction (1) was in operation, and no black residue was formed. At temperatures below 100°, only the primary reactions occurred; but at higher temperatures a prolonged action generally led to secondary effects, and always did so as soon as the whole of the free copper had been dissolved. The black deposit formed according to equation (2) has been observed and differently interpreted by Berzelius and others, but the authors find that in nearly all cases it is practically pure Cu_2S .

The secondary reactions result from equation (2); they are (numbered serially)—



As might be expected, these reactions take place simultaneously, but in varying proportions. By experimenting at 140°-150° C., using an excess of copper, all the primary and secondary actions were observable, and sulphur was deposited on the sides of the flask, whilst an excess of sulphur was found in the cuprous sulphide formed. No hydrogen sulphide could be detected, and the occurrence of sulphur on the flask walls is apparently due to the sublimation of sulphur produced by the direct decomposition of sulphuric acid.

In one instance, where copper strips were one-third immersed in the acid at 250° C. in an Erlenmeyer flask from which the air had not been removed, the black residue

consisted of an almost pure oxysulphide having the formula $\text{CuO} \cdot 2\text{Cu}_2\text{S}$.—W. G. M.

Tellurium, Its Separation from Copper Residues. C. Whitehead. J. Amer. Chem. Soc. 1895, **17**, 849—855.

THE extremely refractory character of telluride gold ores has rendered it customary to smelt them with those of lead or copper. In the Western States of America the copper ores, to be treated economically, are smelted with gold- and silver-bearing ores, which act as flux, and, by yielding their precious metals, more than cover the cost of refining the copper. The mattes, containing much tellurium, are Bessemerised in the wet, and the copper is brought east for electrolytic refining. This copper contains from 98.5 to 99.5 per cent. of copper, about 100 oz. of silver, and 0.3 oz. of gold per ton, together with some arsenic, antimony, lead, bismuth, selenium, and an average of 0.04 per cent. of tellurium. It is doubtful if any copper, as produced, is free from tellurium, unless it be the native copper of Lake Superior. In electrolytic refining, the Hayden process (this Journal, 1895, **14**, 756) is largely employed. The black slimes deposited in the vats are separated from the coarser copper by screening, and are boiled with a 20 per cent. solution of sulphuric acid in a lead-lined tank by means of live steam so injected as to carry in air with it. In this manner practically all the antimony, arsenic, and bismuth pass into solution, together with copper, oxidised either initially or through the action of the injected air. After an hour's boiling, a solution of silver sulphate is run in, and steam is applied for some minutes, until the whole of the remaining copper has passed into solution by displacement of silver; excess of silver sulphate is then removed by the addition of fresh slimes. The residue, consisting of gold, silver, tellurium, and lead sulphate, and no longer slimy, is separated by drawing off the liquid, and, after washing well, is filter-pressed. The press-cakes are then dried in an oven, and melted on the Portland cement bed of a furnace, in which the metal is subjected to the action of an air-blast, whereby portions of the tellurium and selenium, and all but a trace of the lead present, are removed. The resulting bullion is poured into shoe-bars of about 300 oz. each, and is approximately 950 fine in silver, with 10 parts of gold. After cooling, the bars are dissolved in hot sulphuric acid in a cast-iron kettle; and, when solution is complete, the liquid is cooled and allowed to stand for several hours, during which the gold precipitates, and the tellurium crystallises in white, lustrous crystals of tellurous oxide. The first portion of the clear liquid drawn off is precipitated by copper, and the silver is melted into bars 990 fine, the remainder of the solution serving to treat a fresh batch of slimes. When several hundred ounces of gold and tellurous oxide have collected in the kettle by accumulation, they are removed, washed with dilute sulphuric acid to extract silver, copper sulphate, and tellurous oxide, and afterwards with strong sulphurous acid to dissolve the last traces of silver and tellurium. After cooling and settling, the acid is drawn off, and the residue is washed until free from tellurium and silver sulphates: the gold is melted with borax and nitre to eliminate remaining traces of lead and tellurium, yielding a metal 990 fine, of which the impurity is silver. The tellurium is present in the washings from the gold as tellurous oxide or sulphate, and, after the removal of the silver as chloride, may be recovered either by precipitation with copper or by passing sulphur dioxide through the solution. The tellurium is precipitated as euprous telluride in the form of a black powder, by placing bars of copper in the solution and boiling with steam. The powder is dried, and any copper thus oxidised is removed by repeated treatment with 5 per cent. sulphuric acid. Any residual copper would subsequently combine with tellurium and cause loss. After drying, the residue is fused with three times its weight of sodium carbonate and one-fourth its weight of charcoal. The sodium telluride is dissolved out with boiled water, and the tellurium is precipitated as a galena-like grey powder by passing into it a current of air. The tellurium is filtered, boiled with dilute hydrochloric acid to remove iron, alumina, &c., washed, and boiled for several hours with strong

potassium cyanide solution to remove the selenium and most of the gold present.—W. G. M.

Mercury in Cinnabar, Electrolytic Method for Determination of. W. B. Rising and V. Lenher. J. Amer. Chem. Soc. 1896, **18**, 96.

See under XXIII., page 218.

Lead, The Volumetric Determination of. A. S. Cushman and J. Hayas Campbell. J. Amer. Chem. Soc. 1895, **17**, 901.

See under XXIII., page 217.

Cast-Iron, White, The Evolution Method for the Determination of Sulphur in. F. C. Phillips. J. Amer. Chem. Soc. 1895, **17**, 891.

See under XXIII., page 218.

Pig-Iron, Determination of Graphite in. P. W. Shimer. J. Amer. Chem. Soc. 1895, **17**, 873.

See under XXIII., page 218.

Manganese, Volumetric Estimation of. G. Auchy. J. Amer. Chem. Soc. 1895, **17**, 943.

See under XXIII., page 220.

Manganese and Tin, Quantitative Electrolytic Analysis of. C. Engels. Ber. 1896, **28**, 3182.

See under XXIII., page 219.

Sulphur in Refined Copper, Estimation of. G. L. Heath. J. Amer. Chem. Soc. 1895, **17**, 814.

See under XXIII., page 218.

Alloys of Lead, Tin, Antimony, and Arsenic, Analysis of. L. Andrews. J. Amer. Chem. Soc. 1895, **17**, 869.

See under XXIII., page 217.

Silver Ores [Rich], Notes on the Assay of. E. H. Miller and C. H. Fulton. Sch. of Mines Quart. 1896, **17**, 160.

See under XXIII., page 217.

PATENTS.

Ores and the Like, Improvements in Extracting Metals from, and in Utilising the By-Products. J. Miles. London. Eng. Pat. 1828, Jan. 26, 1895.

IRON ore is mixed into blocks with carbon, heated and cooled; the metal is picked out, dissolved in mineral acid, and the solution crystallised. The crystals are then to be heated until (according to the specification) the acid passes off, and the melted metal can be run into moulds.

—W. G. M.

Cyanogen Compounds, Improvements in the Production of. A. E. Morgans, London. Eng. Pat. 2660, Feb. 6, 1895.

See under VII., page 198.

"Fontes" and Alloys of Nickel and Cobalt, An Improved Process for the Desulphuration of. H. H. Lake, London. From P. Manhes and La Société Anonyme de Metallurgie du Cuivre, both of Lyons, France. Eng. Pat. 3959, Feb. 23, 1895.

IN the manufacture of nickel from siliceous ores, a "fonte" of iron and nickel is obtained, containing a small percentage of sulphur. To remove this sulphur and obtain an alloy of iron and nickel, the "fonte" is melted in any convenient manner with a quantity of lime or soda, mixed with the chloride of calcium or sodium. These reagents are preferably used, but the oxides and chlorides of other allied metals may also be employed.—A. W.

Heating Metal Sheets [Tin-Plate Works], Furnaces for, Improvements in. T. R. Ludford, S. R. Davies, and R. Davies, all of Llanelly. Eng. Pat. 4015, Feb. 23, 1895.

THE firegrate is placed at the back of the furnace and the flames and hot gases therefrom are made to pass through a flue built immediately underneath the entire bed of the

chamber in which the plates are to be heated. The gases travel to the front end of the furnace, through three vertical flues into this chamber, back again through it over the top of the plates, and finally up a shaft built above the fire-grate. Uniformity of temperature is the chief object of this arrangement. The grate and the shaft are connected by a flue, with a damper to be opened if desired. The plates to be heated are made to rest on a kind of grating placed on bearers on the floor of the heating chamber, and the furnace is provided with the usual doors and dampers.

—A. W.

Protecting Iron, Steel, and like Materials from Rust, A Process of and Means for. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 4027, Feb. 25, 1895.

See under XIII. B., page 208.

Smelting Metals, Improvements in Furnaces for. L. Rousseau, Paris. Eng. Pat. 5513, March 15, 1895.

AN upper ring is fitted on to the top of a crucible as a continuation; the ring is perforated so that all the products of combustion may pass through into the top of the crucible itself, which thus becomes a combustion chamber. An oscillating furnace is described, to which this device is especially well adapted. This furnace is half sunk, and is supported over a closed ash-pit in such a way that it may be oscillated on trunnions. The outer casing is of metal, and is lined first with masonry and then with a thin layer of plumbago. The crucible is supported on the fire-bars by a plumbago block, and is kept in position by wedges placed between the crucible and the furnace lining. The top of the annular space between the two is closed, but apertures, provided with covers, are left for the introduction of fuel. All the products of combustion thus pass through the apertures in the crucible and continuation-ring already described; and the crucible itself has no lid. The ash-pit being closed, air is discharged into the space beneath the furnace through a bent pipe. A support is provided for the ladle, and a movable cover is placed over an open portion of the ash-pit (separated from the blast chamber by an iron partition) to facilitate arrangements for pouring.

—W. G. M.

Zinc Chlorides, Improvements in the Production of C. Hoepfner, Giessen, Germany. Eng. Pat. 5662, March 18, 1895.

See under VII., page 198.

Galvanisers' Flux Skimmings, Improved Method of Treating to Recover Ammonia and Facilitate the Extraction of the Zinc, with Apparatus for Use therein. C. G. T. Bennett, and E. H. Shortman, Pelsall, Staffordshire, and B. Bracey, Bristol. Eng. Pat. 5958, March 21, 1895.

GALVANISERS' flux skimmings are finely powdered and charged into a closed heated horizontal cylinder, in which is fitted a revolving shaft carrying an agitator. A proper proportion of milk of lime is run in to liberate ammonia. A large iron pipe, charged with cinders, is set upright on the cylinder or separator, through which the ammoniacal vapours pass, issuing by a tube on the top into a small enclosed tank, whence they pass into a cooling coil, flowing out as ammonia solution. The small tank is provided with a down pipe for returning to the separator any liquid condensed in it. By means of a valved tube, water can be run from the cooler on to the top of the cinders in the vertical pipe, to wash them when necessary. The contents of the separator are kept boiling and agitated until all the ammonia is removed, and are then run into settling tanks. The sediment is dried, and the zinc is extracted by ordinary methods.—E. S.

Plates (Metal), Coating with Tin, Terne, or other Metals or Alloys, Improved Method of and Apparatus for. H. J. Ridley, Llanelli. Eng. Pat. 6673, April 1, 1895.

A VERTICAL and a horizontal bath are described. In each instance the plates are removed from the bath between

corrugated metal plates, which act as rubbers, and two sets of rolls working in grease. The grease-pot is so contracted at the lower part that there shall be the minimum of contact between the metal bath and the fat; and a special heating or cooling chamber is provided for regulating the temperature of the grease. In the horizontal plant, the bath is covered with a lid, the central portion of which is depressed so that it is beneath the level of the molten metal, whilst the two end portions are removable in order that access may be had to the bath, to effect the removal of dross as it is formed.—W. G. M.

Basic Slag, Improvements in the Preparation of, for Fertilising Purposes. W. Hutchinson and A. Hickman, both of Wolverhampton. Eng. Pat. 6112, March 25, 1895.

See under XV., page 209.

Gold and Silver, Improvements in Extracting, from Ores and the like. J. S. MacArthur, Pollok-shields, and J. Yates, Glasgow. Eng. Pat. 6802, April 2, 1895.

THE apparatus consists of a barrel or closed cylinder lined with wood, and set horizontally with a shaft running through its centre from end to end. On the shaft, inside the barrel, are fixed amalgamated corrugated plates. The whole is so arranged that, by the revolution of the shaft, the barrel or the plates, or both of them, may be made to revolve with it. The finely pulverised ore is introduced into the barrel through a door in its side, together with water or a weak solution of cyanide, and the whole is then agitated until the amalgamation is complete. In the case of cyanide solution being employed, the contents of the barrel are afterwards run into a tank, the liquor separated, and the gold recovered therefrom by any known method.—A. W.

Alloys (Improved) of Refractory Metals with more Fusible Metals, An Improved Process of Manufacturing. W. P. Thompson, Liverpool. From La Société Neo Métallurgie Marbeau, Chaplet, and Co., Paris. Eng. Pat. 7847, April 19, 1895.

ALLOYS of chromium, molybdenum, or tungsten with iron, copper, or other metal, are made by introducing the metals or their oxides, simultaneously or successively, into an electric furnace, which is heated by horizontal carbons in such a way that the electrodes do not come into contact with the materials under treatment. The process is intended mainly for the production of alloys containing high percentages of the refractory metal, which may then be used to make the more ordinary alloys in the usual way.

—W. G. M.

Brass and other Metal Turnings and similar Fine Metal Scrap, Improvements in Means for Facilitating the Smelting of. R. Baumann, Seebach, Switzerland. Eng. Pat. 23,817, Dec. 12, 1895.

THE turnings are melted in a crucible placed concentrically within a refractory casing, with radial distance-blocks at the lower part to prevent eccentricity. The whole arrangement is placed over a smelting furnace, so that the waste gases from the latter may pass through the annular space around the crucible. At the upper part of this space, solid segmental covers may be introduced, partially to cover the aperture and so control the flow of the heated gases, and hence to regulate the temperature of the furnace.

—W. G. M.

Lead Oxide Making, An Improved Process of. H. H. Lake, London. From T. Benfield, N.J., U.S.A. Eng. Pat. 25,009, Dec. 31, 1895.

See under XIII. A., page 207.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Paranitro Compounds, Electrolytic Reduction of, in Sulphuric Acid Solution. A. A. Noyes and J. T. Dorrance. *J. Amer. Chem. Soc.* 1895, **17**, 855.

See under IV., page 194.

PATENTS.

Electro-Chemical Decompositions, Metallic Mixtures and Alloys for Effecting. O. Imray, London. From L. Diehl, Hamburg, Germany. Eng. Pat. 2804, Feb. 8, 1895.

MIXTURES of different metals are employed which, when added to liquids, act as voltaic couples. These may be comminuted and mixed in various proportions, but it is preferred to fuse them together to form a more or less imperfect alloy, and then use this alloy in small fragments, shavings, filings, or other forms presenting an extended surface. These mixtures or alloys may be immersed and agitated in the liquid to be decomposed, or arranged so that the liquid percolates through them. For gold-carrying solutions, percolation in an upward direction is best. For the evolution of hydrogen in neutral solutions (hot or cold water), an alloy is prepared of lead, 10; aluminium, 30; tin, 20; zinc, 50 (*parts*). For the precipitation of gold and silver from their cyanide solutions, an alloy is preferred containing aluminium, 5; lead, 5; zinc, 90 (*per cent.*), if the cyanide solution contain about 0.1 per cent. or more of cyanide; and an alloy of aluminium, 10; lead, 5 to 7½; zinc, 82½ to 85 (*per cent.*), if the solution contains less than 0.1 per cent. of cyanide. For the weakest solutions it is useful to add to the alloy a small quantity of tin, say about 1 per cent.—J. C. R.

Alkali Chlorates, Improvements in the Electrolytic Manufacture of. J. Wetter, London. From The Elektrizitäts-aktiengesellschaft vorm. Schnerk and Co., Nürnberg, Bavaria. Eng. Pat. 7364, April 10, 1895.

See under VII., page 198.

Primary, Secondary, and Dry Batteries, Electrodes for An Improved Process for the Preparation of. H. Leitner and E. Reicher, Nieder-Schonhausen, Germany. Eng. Pat. 18,036, Sept. 26, 1895.

ELECTRODES are constructed of a mixture of a lead oxide and a small percentage of carbon dust. To this mixture is added a binding material (glycerin) and the whole is then moulded by pressure into a solid body, composed principally of lead oxide. Lead foil may be added to the paste mixture. These electrodes are peroxidised by sodium hypochlorite (saturated solution) and by electrolysis.—J. C. R.

Caustic Soda, Hydrogen, and Chlorine, Improved Process for Obtaining, by Electrolysis of Sea-Water, and in Treating the By-Products obtained during such Process. G. B. Baldo, Trieste, Austria. Eng. Pat. 18,406, Oct. 2, 1895.

See under VII., page 198.

Orange Colouring Matters by Electro-Chemical Process, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 22,482, Nov. 25, 1895.

See under IV., page 195.

Batteries, Secondary Voltaic, Improvements in. L. Epstein, London. Eng. Pat. 21,516, Dec. 21, 1895.

CELLS are made of "light weight"; provision is made against short-circuiting by fragments of the active material and loss of mercury from amalgamated plates. Claims: (1) "In a secondary voltaic battery, casings enclosing the positive plates, and extending below them, their walls being porous except in their lower parts . . ." (2) "In a

secondary voltaic battery having negative plates coated with zinc and mercury amalgam, troughs holding the lower edges of the negative plates . . ."—J. C. R.

(B.)—ELECTRO-METALLURGY.

Iron and Steel, Permeability of [Magnetism]. M. Osterberg. *Sch. of Mines Quart.* 1896, **17**, 118—127.

THE causes of variation in the magnetic permeability of iron are:—Chemical composition, temper, temperature, rapid magnetising and demagnetising (frequency), and previous history of the specimen. Samples of steel made by the basic open-hearth process, and containing, C = 0.07, Si = 0.053, P = 0.008, S = 0.032, and Mn = 0.22 per cent., are compared with acid open-hearth samples containing C = 1.406, Si = 0.077, P = 0.032, S = 0.032, and Mn = 0.470. Permeability curves were obtained for each of these metals after ordinary cooling, annealing, hardening followed by annealing, and hardening alone. From these curves and the accompanying numbers, it is seen that the harder the steel, the poorer is the permeability; all the low carbon specimens were superior to any of those with higher carbon, but it is noteworthy that the curves in the former case agreed more closely among themselves than did those of the latter, among which the hardened specimen was far inferior to the others. The harder the steel the more definite will be the curve. Only at temperatures approaching 400° to 600° F. does the iron begin to lose its magnetic properties, the loss being complete at 760°. Rapid magnetisation and demagnetisation heat the metal and cause loss by "hysteresis," and iron which has been repeatedly magnetised has a slightly increased permeability. (If a magnet be discharged, *i.e.*, if the current flowing through the solenoid be suddenly broken, a considerable time elapses before the magnet is completely demagnetised. To shorten this time, a current must be sent through the solenoid in the opposite direction, thus using up energy. The energy thus lost is called "the hysteresis loss.")—W. G. M.

Aluminium prepared by Electrolysis, Presence of Sodium in H. Moissan. *Comptes rend.* **121**, 794—798.

THE conflicting results obtained by those who have essayed the industrial employment of aluminium, are due to the differences in the purity of the commercial article. The author has shown that the metal often contains nitrogen and carbon, which materially affect its properties. He now finds that it sometimes contains sodium, which has an important effect on the preservation of the metal. The amount of sodium was obtained by placing aluminium filings in a bottle of the same metal, and adding water distilled in a metal still. This mixture was heated to boiling daily for two weeks, after which the solution was filtered, evaporated in a platinum dish, hydrochloric acid added, when there was quick effervescence of carbon dioxide, and the sodium converted into sodium chloride, which, after evaporating to dryness, was estimated with silver nitrate. In an old sample 0.4 per cent. of sodium was found; the amount in more recent samples varied from 0.1 to 0.4 per cent. When aluminium contains sodium it is attacked by cold water. If the same water remains for some time on a sheet of the metal it takes up the sodium, which reacts on the metal, forming sodium aluminate; this is decomposed by the water, when alumina is deposited on the metal, and the water becomes again alkaline, and again attacks the metal. In this way the decomposition becomes more rapid after a time, the water becoming more alkaline. The sodium also affects the alloys prepared from such aluminium. M. Riche has found that alloys of aluminium and tin decompose water at ordinary temperatures. The author prepared an alloy containing 6 per cent. of tin with aluminium very free from sodium, and found that after two months' immersion in *seine* water, aerated daily, it became coated with little specks of alumina, but did not produce any hydrogen. With alloys containing a higher percentage of tin, if sodium be present, the decomposition of the water is still more rapid. The non-homogeneity of aluminium seriously affects its preservation. If such aluminium be placed in water, especially salt water, little spots of hydrated alumina quickly appear, and

these are found to be formed round little centres of carbon, and are a frequent cause of the alteration of the metal. In conclusion, the author states that aluminium, which has a great tendency to form an electric couple with any other metal, should never be employed except by itself, and free from carbon, nitrogen, or sodium.—A. W.

Molybdenum Bronzes. A. Stavenhagen and E. Engels.
Ber. 1895, 28, 2280—2281.

A COMPOUND similar to tungsten bronze is formed by electrolysing fused acid sodium molybdate, prepared by melting together 10 parts of Na_2MoO_4 and $3\cdot2$ of MoO_3 , the substance resulting from this fusion having the formula $3\text{Na}_2\text{O}\cdot\text{MoO}_3$. This acid salt is fused in a platinum crucible with the aid of the blowpipe; and a current of $8\cdot5$ ampères and 1·9 volts is used, generated by three accumulators placed in series. The bronze separates quickly at the cathode in beautiful crystals, which must be washed with boiling water and dilute hydrochloric acid. Under water the crystals appear as indigo-blue needles with a metallic lustre, but on drying, the colour becomes darker and the lustre less. Under the microscope the needles are seen to be quadratic. They are soluble in alkalis, and in nitric acid and aqua regia, but not in hydrochloric or sulphuric acids. Their composition, as found by analysis, corresponds to the formula $\text{Na}_2\text{Mo}_2\text{O}_5$.—W. G. M.

PATENTS.

Zinc from its Ores, and Electro-Deposition of Zinc upon Iron or other Metal or Alloys, Improvements in and means to be Employed for the Obtainment of. The Cowper-Coles Galvanising Syndicate, Limited, and S. O. Cowper-Coles, London. Eng. Pat. 2999, Feb. 11, 1895.

BRIGHT deposits of zinc upon iron are obtained from the following electrolyte:—A gallon of water, zinc sulphate 35 ounces, iron (preferably ferric) sulphate 12 ounces. The electrolyte is fed with zinc dust, or the anode is made from a zinc ore, of zinc dust, a basic salt of zinc or zinc oxide. Commercial ferrous sulphate is converted into the ferric salt (by electrolysis at the anode and reduced by hydrogen at the cathode) by atmospheric air, oxygen, ozone, or bichromate of potash, or any other suitable oxidising agent. The articles to be coated with zinc may first receive an adherent coating of oxide by treatment with bichromate of potash solution, and be dried in an oven before placing them in the zincing bath. "The electrolytic oxygen, liberated when the zinc is deposited, prevents the formation of hydrogen compounds of zinc and consequently of zinc sponge."—J. C. R.

Electro-Deposition, Improvements in Apparatus for Use in. The Cowper-Coles Galvanising Syndicate, Limited, and S. O. Cowper-Coles, London. Eng. Pat. 4154, Feb. 26, 1895.

THE anodes and the articles to be coated make contact with conducting cross- or bridge-pieces, "girders," superposed but insulated from each other. These cross-pieces make contact at their ends with conductors running along the tank. The object is to bring the anodes and the articles to be coated into close proximity in a simple and convenient manner.—J. C. R.

XII.—FATS, OILS, AND SOAP MANUFACTURE.

Oils, Californian, Physical and Chemical Properties of. W. C. Blasdale. J. Amer. Chem. Soc. 1895, 17, 935—941.

THE author has carried out this investigation, first, with the view of the accurate determination of the limits of some of the standard constants of California olive oils; secondly, as a practical test of the application of the Babcock method

of determining adulterants in butter to a similar purpose for olive oil; and thirdly, a determination of certain constants of some new and undescribed oils of vegetable origin (compare Nos. 16 and 17). The following samples of oils have been examined:—

1. Pendulina 1st. 2. Pendulina 2nd. The difference between these samples marked 1st and 2nd is that the latter includes oil from the "pits" as well as from the pulp of the olives. A small amount of warm water was added to the "pomace" before pressing in the latter case. The oils, as received from the press, were repeatedly washed and filtered until clear. 3. U'varia 1st. 4. U'varia 2nd. 5. Rubra 1st. 6. Rubra 2nd. 7. Redding pieholine. 8. Nevadillo blanco 1st. 9. Nevadillo blanco 2nd. 10. Manzanillo 1st. 11. Manzanillo 2nd. 12. Yellow mustard seed. 13. Black mustard seed. 14. Walnut oil, prepared from the kernel of the English walnut (*Juglans regia*), grown in the southern part of California, by extracting with petroleum ether. 15. Acorn oil, obtained by extracting the fruit of *Quercus agrifolia* with petroleum ether. It is a deep brown fluorescent oil, solidifies at 10°C ., and on long standing deposits wax. 16. Pine-nut oil, probably from the fruit of *Pinus monophylla*; a brown drying oil with an unpleasant odour and taste. 17. California outmeg oil, from the fruit of *Tunioia Californicum*. 18—27. Nine samples of commercial salad oils.

These samples were subjected to the following determinations and tests:—

Specific Gravity.—This was determined in an accurately standardised pycnometer of about 50 c.c. capacity.

Index of Refraction.—Determined by an Abbe refractometer of the Zeiss pattern.

Thermal Degree.—The increment of temperature which results from mixing 15 c.c. of oil with 5 c.c. of concentrated sulphuric acid in a calorimeter with constant stirring, an initial temperature of at least 20°C . being employed.

Viscosity Test.—The author employs Babcock's method (Methods of Detecting Adulterations in Olive Oil; report of Olive Growers' Convention, San Francisco, July 1891). 15 grms. of oil are placed in a saponification flask with 30 c.c. of water containing exactly 7·5 grms. potassium hydroxide and 10 c.c. of alcohol, and heated on a water-bath until saponification is complete. The resulting soap is washed into a large evaporating dish, heated until the alcohol is expelled, and diluted to 500 c.c. at 15°C .; the viscosity of the solution is determined by means of a torsion viscosimeter. The results are calculated in terms of the number of grms. of sugar which must be added to a litre of water in order to produce a solution of equal viscosity. In the case of the two mustard-seed oils it was necessary to dilute the solution to one litre.

Saponification Number.—Determined by the standard method, using 2·5 grms. of oil.

Iodine Absorption.—The Hübl method was employed. The standard of the hyposulphite (thiosulphate) solution was based on pure potassium bichromate, according to the method of the Association of Official Agricultural Chemists.

Melting Point of Fatty Acid.—A drop of the fatty acid is dropped on a thin but wide glass tube, and allowed to solidify. This is attached to a bulb of a thermometer, placed in a water-bath, and heated to a temperature at which the fatty acid runs down the side of the tube.

Elaidin Test.—Pontet's method was followed, which involves the use of a freshly prepared solution of mercurous nitrate.

Millian's Test.—(Compare this Journal, 1888, 7, 593.)

From the values enumerated in the following table the author regards as successful the application of the viscosity test to the detection of adulterated olive oils; the variations in the figures obtained from the different samples of pure oil are considerable, but not so great as to admit of confusion with any of the adulterated oils. Mixtures of mustard and cotton-seed oil could not, however, be detected by this test. The method promises to be of value in detecting lard oil, for which there is at present no satisfactory specific test.

	Name of Oil.	Specific Gravity.	Index of Refraction.	Thermal Degree.	Viscosity.	Melting Point of Fatty Acid.	Iodine Absorption.	Saponification Number.	Elaudin Test.	Milliau's Test.
Miscellaneous oils.	Pendulina 1st.....	0.9171	1.4716	47.0	648	24	85.58	193.52	Reaction in 4 hours	No reaction.
	2nd.....	0.9170	1.4714	47.0	593	25	84.33	193.29	" " "	" " "
	Uvaria 1st.....	0.9171	1.4717	"	573	21	85.05	190.52	" " "	" " "
	2nd.....	0.9172	1.4715	"	598	22	85.91	190.48	Reaction in 6 hours	" " "
	Rubra 1st.....	0.9165	1.4711	46.0	655	24	83.93	191.83	" " 2 1/2 hours	" " "
	2nd.....	0.9162	1.4711	45.0	650	25	84.72	191.88	" " 2 1/2 "	" " "
	Redding picholine.....	0.9161	1.4711	"	587	26	83.78	190.85	" " 3 "	" " "
	Nevadilla blanco 1st.....	0.9168	1.4714	46.0	595	24	86.53	192.74	" " 2 "	" " "
	2nd.....	0.9169	1.4713	47.0	610	24	85.44	192.51	" " 2 "	" " "
	Manganiila 1st.....	0.9163	1.4710	46.0	625	25	86.43	191.81	" " 1/2 hour	" " "
	2nd.....	0.9166	1.4710	46.0	623	25	79.97	191.90	" " "	" " "
	Yellow mustard seed ..	0.9151	1.4751	"	315	16	98.41	173.94	Brown colour, no reaction	" " "
	Black.....	0.9161	1.4769	"	225	15	103.57	174.08	Yellow-brown, "	" " "
	Walnut oil.....	0.9256	1.4804	110.0	100	15	132.72	194.43	Brown colour, "	Questionable.
	Acorn oil.....	0.9162	1.4731	60.0	305	25	100.66	199.26	No reaction	Slight reaction.
	Pine-nut oil.....	0.9333	1.5709	71.0	100	19	161.30	192.81	Brown colour, no reaction	" " "
	California nutmeg oil ..	0.9072	1.4766	77.0	235	19	94.71	191.30	" " "	Questionable.
	R. olive oil.....	0.9210	1.4730	71.0	305	33	107.41	193.91	" " "	Reaction.
	M. alpha oil.....	0.9175	1.4689	59.0	615	24	82.20	190.17	" Good reaction	" " "
	M. olive oil.....	0.9218	1.4730	67.0	320	27	107.98	195.01	Questionable reaction	" " "
	Serra M. olive oil 66 L. and B.	0.9157	1.4685	49.1	461	"	82.93	"	Good reaction	No reaction.
Commercial oils.	Colours olive oil.....	0.9172	1.4705	47.0	653	"	81.97	"	" " "	" " "
	Darand and Co.'s olive oil.	0.9238	1.4754	83.0	275	33	117.67	193.51	No reaction	Reaction.
	Francis, Am. Oil Co.	0.9231	1.4751	79.0	215	35	115.96	195.76	" " "	" " "
	Cooper's California oil ..	0.9184	1.4725	57.0	585	23	91.57	190.83	Reaction in 3 hours	No reaction.
	F. Aristoy's oil.....	0.9159	1.4702	45.0	568	22	83.63	190.76	" " 1 hour	" " "
	Bossil's oil.....	0.9158	1.4703	45.0	653	23	84.00	192.22	" " "	" " "
									" " "	" " "

J. L. B.

Wool Grease, Composition of. L. Darmstaedter and J. Lifschütz. Ber. 28, 1895, 3133—3135.

The alkaline liquid obtained from the partial saponification of wool grease was evaporated to a thick paste and treated with dilute alcohol. A large portion of the brown mass was dissolved, leaving an insoluble crystalline residue, which the authors have examined. After washing with dilute and then with strong alcohol the residue was boiled with dilute sulphuric acid until all the fatty matter had collected on the surface as a soft grey mass. It was then suspended in water and thoroughly extracted with ether. The substance was thus separated into an insoluble and a soluble portion. The insoluble part crystallised from absolute alcohol is a white, tasteless, and inodorous substance, which is insoluble in water, ether, the mineral acids, and alkalis. It dissolves in warm concentrated sulphuric acid however, imparting a yellow colour to the solution, but it gives neither the cholesterol nor the iso-cholesterol reaction. It is easily soluble in acetic acid, acetic anhydride, and in hot alcohol, chloroform, benzene, &c. From dilute alcohol it separates with half a molecule of water of crystallisation, melting at 105° — 109° . It has the same composition as menthol, $C_{10}H_{20}O$, and appears to be a hitherto unknown alcohol belonging to the unsaturated series $C_nH_{2n}O$. The soluble portion crystallised from alcohol melts at 82° — 87° and has the composition $C_{11}H_{22}O$. It appears to be the next homologous alcohol of the above series, the one following being probably the lanoline alcohol described by Marchetti. The yield of the two alcohols amounts to 2.5—3.0 per cent. of the wool grease.

—J. S.

Spermaceti, Characters of. L. F. Kehler. Amer. J. of Pharm. 68, 7.

The United States Pharmacopœia requires that spermaceti shall possess a specific gravity of "about 0.943," and a melting point near 50° C. The author gives a table showing the result of the examination of 17 specimens, and he concludes that the melting point of spermaceti varies from 42° to 47° C., and that of cetin from 48.9° to 55.5° ; the specific gravity of spermaceti ranges from 0.905 to 0.945 at 15° , and its saponification number from 125.8 to 134.6, whilst the acid number varies with the age of the sample. Thus, it is pointed out, that the requirements of the United States Pharmacopœia would appear to correspond with the figures for cetin rather than with those for spermaceti.

Salts of Fatty Acids and Soaps, Behaviour of, in Presence of Water. III. F. Krafft and H. Wiglow. Ber. 28, 1895, 2566—2573. (Compare this Journal, 1894, 1207.)

In former papers it has been pointed out that on cooling hot soap solutions, acid sodium stearate is precipitated from a solution of the pure soap at a higher temperature than acid sodium palmitate, and this again at a higher temperature than acid sodium elaidate. It was also found that the separation of the solid acid soap or mixture took place at a temperature of about 15° — 20° C. below the melting point of the free acid. In the present communication the pure sodium soaps of various acids have been compared and the exact temperature of separation observed. The results are contained in the following table: in all cases one part of the sodium salt was dissolved in 100 parts of water:—

Sodium Salt of	Temperature of Separation.	Melting Point of Acid.	Difference.
Stearic acid.....	69.0	69.2	9.2
Palmitic acid.....	45.0	62.0	17.0
Myristic acid.....	31.5	51.5	23.0
Lauric acid.....	11.0	43.6	32.6
Elaidic acid.....	35.0	51.0	16.0
Oleic acid.....	0	14.0	14.0

The temperature of crystallisation of the soaps always lies below the melting point of the free acid, and the difference between both temperatures regularly increases on descending the homologous series.

In general, a soap can only exercise its full effect when it is dissolved in water, and the above table clearly shows why soaps rich in palmitic and stearic acids are best used in hot aqueous solution, whereas soaps containing oleic salts produce the required effect at the ordinary temperature. In performing experiments of this nature it is imperative that the carbonic acid in the air be carefully excluded, otherwise it will combine with the alkali formed on the hydrolysis of the soap, and hence vitiate the result.—J. S.

Salts of Fatty Acids and Soaps, Behaviour of, in Presence of Water. IV. F. Krafft and H. Wiglow. Ber. 28, 1895, 2573—2582. (Compare preceding Abstract.)

SIXTEEN soaps in general are nearly insoluble in water at 0° C., determinations of molecular weight by the cryoscopic

method are rendered impossible. The authors have attempted to determine the molecular weights of soaps by the ebullioscopic method, but without success. Sodium salts of the higher fatty acids, or the real soaps, on being dissolved in water, raise its boiling point, but if sufficient soap be added to form a concentrated solution, the boiling point falls to nearly the original boiling point of the water employed. On cooling such a solution it solidifies to a gelatinous mass. There is only one class of substances—namely, the *colloids*—which dissolves in water without affecting its vapour pressure, and hence the authors conclude that the sodium salts of the higher fatty acids, or the real soaps, are colloids.

—J. S.

Trimethylene Glycol; Occurrence as a By-Product in the Manufacture of Glycerin. A. A. Noyes and W. H. Watkins. J. Amer. Chem. Soc. 1895, **17**, 890—891.

By submitting an abnormally light glycerin from a soap manufactory to fractional distillation, first at diminished and then at ordinary pressure, a liquid boiling at 214° — 217° and with a specific gravity of 1.056 at 20° was obtained, the ultimate analysis of which agreed with that of trimethylene glycol. The compound probably resulted from the fermentation of glycerin after spontaneous saponification and prior to the addition of the alkali. Refuse house-fat formed a considerable part of the soap stock. The presence of the glycol might be a source of danger in the manufacture of nitroglycerin, since it reacts with nitric acid with explosive violence. It would be detected by the low specific gravity of the glycerin and by the high oxidation equivalent, as shown by the bichromate titration.—W. G. M.

Sesamé Oil, The Characteristic Reaction of. J. Wauters. Bull. de l'Assoc. Belge des chimistes, **9**, 275.

See under XXIII., page 221.

Linseed Oil and Varnish, The Examination of. H. Amsel. Rev. Chim. Indust. 1895, **6**, 313, and 1896, **7**, 13.

See under XXIII., page 222.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

Lead, White; Electrolytic Process of Manufacture.

R. P. Williams. J. Amer. Chem. Soc. 1895, **17**, 835—842.

This process, invented by A. B. Brown, of Boston, U.S.A., consists in electrolysing sodium or potassium nitrate solution in a wooden vessel divided by a porous partition into two cells, one of which contains a pig-lead anode, the other a copper cathode. The anode dissolves under the action of the current, forming lead nitrate, whilst alkaline hydroxide and free hydrogen are produced in the cathode cell, the copper being unacted upon. The two solutions thus obtained are drawn off and mixed; lead hydroxide comes down as a white precipitate, and an alkaline nitrate solution is left, which is available for use again as electrolyte. The lead hydroxide is finally mixed with sodium bicarbonate (or normal carbonate), whereby a pure lead carbonate is obtained; and the resulting sodium hydroxide has only to be recarbonated in order to render it available for use once more. The original alkaline nitrate solution may be of any convenient strength, but 1 lb. per gallon (10^3 B.) is recommended as being sufficiently concentrated. A plant capable of producing 500 lb. of white lead per diem has been in operation for several months in Cambridge (Mass.). The process is economical, as compared with the old system, inasmuch as it uses pig-lead without remelting, whilst there is not a residue of from one-half to one-third unattacked, as in the Dutch process; again, it is practically instantaneous, and effects a saving in material and labour. The white lead produced is globular, and so fine that no grinding is necessary. The electrolytic paint is found, after two years' experience, to be as durable and opaque as, and to have a covering power from 12 to 20 per cent. higher

than that of the Dutch paint. The practical failure of the French rapid precipitation process is said to be due to the low covering power of the product ("Clichy white"), resulting from its crystalline form, the superiority of the Dutch paint being due to its globular character. The new material being globular, and even finer in texture than the latter, has therefore an improved covering power.—W. G. M.

PATENTS.

New Powders to remove Paint and Organic Matters from Wood, Iron, Stone, and other Materials. G. J. C. M. Baron de Liebhafner, London. Eng. Pat. 4940, March 8, 1895.

Sodium carbonate, slaked lime, and permanganate are mixed dry, then made into a paste with water, and applied to the surface from which paint is to be stripped.—E. S.

Pigments or Lakes suitable for the Manufacture of Wall-Papers, Improvements in and connected with. C. Denecys, St. Petersburg. Eng. Pat. 16,398, Sept. 2, 1895.

The base of these pigments consists of strontium carbonate, instead of the usual barium carbonate or sulphate. It is claimed that the lakes so obtained are brighter in shade than when barium is employed, and also that a given weight of dye is able to stain a greater amount of base. When using diazo dyes, it is advisable to produce the colouring matter together with the strontium carbonate in one operation. The cold diazo solution is mixed with the necessary quantity of strontium chloride, and the alkaline solution of the phenol, &c., containing the requisite amount of sodium carbonate to precipitate the strontium, added with constant stirring.—F. H. L.

Improved Metallic Paint, and Method of Making same. R. A. Sloan, Liverpool. From "The Ineh Non-Corrosive Metal Co.," Baltimore, U.S.A. Eng. Pat. 17,786, Sept. 20, 1895.

This consists of a mixture of 2 parts of tin and 1 of zinc melted together and granulated, then suspended in oil, with a drier. The paint is said to resist "the action of water and the atmosphere, and is practically non-corrosive."

—F. H. L.

Compound or Material for Use in connection with Non-Oleaginous Protective Coverings or Paints. J. C. Sellars, Birkenhead. Eng. Pat. 24,063, Dec. 16, 1895.

This patent describes a composition to be used for filling up the cracks or pores existing in coverings produced as described in Eng. Pats. 1457 and 5291, 1895, which are made without oil. $\frac{1}{2}$ lb. of rosin are dissolved in 36 lb. of petroleum, and 9 lb. of creosote are added, ground wood or pigments being also employed if desired.—F. H. L.

Lead Oxide Making, An Improved Process of. H. H. Lake, London. From T. Benfield, N.J., U.S.A. Eng. Pat. 25,009, Dec. 31, 1895.

This is a process for oxidising metallic lead in the presence of water by the action of air or oxygen. The metal in a finely divided state is put into a cast-iron vessel provided with stirrers, which are made hollow, and through which a current of air is constantly passing. Water is added to cover the lead, and the agitators are set in motion. After a time, a cock placed in the side of the apparatus, some little way above the bottom, is opened, and the finer particles of the lead, already partly oxidised, are run off into a second vessel similarly constructed, where they are again treated with air or oxygen as before. The process is stated only to require a few hours to effect complete oxidation, and to yield a product free from crystalline structure. It is thus said to be a superior article for making lead chrome, carbonate of lead, &c.—F. H. L.

(B).—RESINS, VARNISHES.

Linseed Oil and Varnish, The Examination of. H. Amsel. Rev. Chim. Indust. 1895, **6**, 313, and 1896, **7**, 13.

See under XXIII., page 222.

PATENTS.

Protecting Iron, Steel, and like Materials from Rust, A Process of and Means for. H. E. Newton, London. From "The Farbenfabriken vorm. F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 4027, Feb. 25, 1895.

THE surface of the metal, either in the wrought or unwrought state, is washed with a 10 to 25 per cent. aqueous solution of hydroferro- or hydroferri-cyanic acid or a mixture of both, containing also, if desired, a small quantity of mineral acid; or the active ingredients may be mixed with alcohol, and 2 or 3 parts of oil, varnish, &c. added before application to the iron.—F. H. L.

French and the like Polishes, Improvements in and relating to. C. F. F. Bratsch, Berlin. Eng. Pat. 23,896, Dec. 13, 1895.

AFTER ordinary French polish has been applied to wood for some little time, it is apt to "bloom" or exude from the surface. This is stated to be due to the presence of "vegetable wax" in the shellac, which, together with the oil used in polishing, produces a soft, smeary substance, never becoming properly hard. To overcome this, the patentee removes this "vegetable wax" by repeated filtration of the polish, and also employs stick lac to replace part of of the shellac. His formula is:—Stick lac, 25 parts; shellac, 20; gum benzoin, 4; 95 per cent. alcohol, 100; and oil of rosemary, 1 part.—F. H. L.

(C).—INDIA-RUBBER, &c.

Caoutchouc and Gutta-Percha Substitutes. Chem. Rev. Fett u. Harz Ind. 1896, [34], 27—29.

VARIOUS substances and mixtures have been proposed for replacing gutta-percha as an insulating material for cables, but although many of them are effectual in other particulars, none have, so far, rivalled it in point of durability under prolonged exposure to the action of sea-water. Paraffin alone is too brittle, but the plastic products of the incorporation of ozokerite with small quantities of caoutchouc form a medium which in insulating power and durability, almost rival the latter substance in its pure state. The degree of insulation attained by Henly's cable, which is coated externally with ozokerite, is 5,000 megohms per knot. Nigrite, prepared by kneading together caoutchouc and the residue from the distillation of ozokerite, is far superior, both mechanically and as an insulator, to gutta-percha, and is less susceptible to heat than caoutchouc. The composition, consisting of a mixture of resin and heavy resin oils, used for the Brooks cable has a high insulating power, several samples having indicated regularly 19,000 megohms per mile. Wray's composition, made from caoutchouc, silica, powdered alum, and gutta-percha, is largely used in climates too hot for gutta-percha by itself, but is quickly attacked by sea-water.

Latterly, attention has been directed to balata (this Journal, 1894, 430) as a substitute for caoutchouc. This gum is obtained by tapping the balata tree, of which there are large forests in British Guiana and other parts of South America. There are two varieties—the red or "bullet tree," and the white, or true balata; they grow to a height of 90 to 100 ft. and can yield about $2\frac{1}{2}$ lb. of gum in a year without overtaxing their strength. The liquid gum soon hardens on the surface, which is then removed, and this continues till the whole has solidified.

For insulating purposes balata gum is inferior to caoutchouc, but it makes a good waterproofing material and is highly suitable for driving-belts. The trade is rapidly increasing, the exports from British Guiana having risen from 41,000 lb. in 1881 to 237,450 lb. in 1892. The industry is also being developed in Dutch Guiana under the auspices of some enterprising Americans.—C. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

PATENTS.

Animal Skins, New or Improved Process for the Treatment of. C. Marter and I. Levy, London. Eng. Pat. 1820, Jan. 25, 1895.

THIS invention applies especially to skins having particularly long fibres, such as those of the wild animals of the Dutch Indies and surrounding regions, and has for its object the rendering of the skins hard and transparent, so that they may be capable of being pressed or otherwise fashioned into buttons, &c. The raw skins are washed, dried, and stretched, and painted with an aqueous solution of "arsenic" containing about 1 gm. per litre. When this solution has dried, the skins are placed in cold water for from 1 to 15 days and then limed in three successive baths containing, say, $2\frac{1}{4}$, $4\frac{1}{2}$, and $6\frac{3}{4}$ kilos. of lime per 1,000 litres respectively. In the first bath, hair and flesh are loosened and may be subsequently removed, in the second the skins are degreased, and in the third they are hardened. The duration of the liming depends on the nature of the skin and on the desired degree of transparency. The skins may next be dyed and dried. They are finally immersed in two baths of linseed oil—which may be either cold, warm, or boiling, as found most convenient—for a period depending on the degree of hardness required; thus, from one to ten minutes immersion in boiling oil, or from a few hours to several weeks in cold oil, may suffice. Completion of the process consists in sponging with alcohol in order to fix the oil.—A. G. B.

Tanning Hides, Improved Process for. C. Kuees, Oshawa, Ontario, Canada, and D. W. Alexander, Toronto, Ontario, Canada. Eng. Pat. 22,714, Nov. 27, 1895.

THE unhaired and fleshed hide is treated in a pin wheel with a liquor consisting of bicarbonate of potash to the extent of "about 5 per cent. of the weight of the hide, $2\frac{1}{2}$ per cent. of sulphuric acid, 5 per cent. of the weight of the hide in neat's foot oil, and the balance of water," until it has become thoroughly permeated therewith. It is then transferred to another pin wheel, in which it is similarly treated with a liquor consisting of "10 per cent. of the weight of the hide of hyposulphite of soda, with sulphuric acid $7\frac{1}{2}$ per cent., 5 per cent. of neat's foot oil, and the balance of water." The hide is then left to dry. The order in which the compositions are applied may be the reverse of that here stated.

—A. G. B.

Sterilising Calgut and other Materials, Improved Process of and Apparatus for. J. Leman, Berlin. Eng. Pat. 23,504, Dec. 7, 1895.

CARGUT used in surgical operations is spoiled by steam sterilisation, and cannot be completely sterilised by alcohol and other substances hitherto tried. But exposure to the vapour of boiling alcohol containing 10 per cent. of water and 5 per cent. of phenol answers the purpose admirably, and does not damage the gut. The process is carried out in a suitable closed boiler having a condensing worm at the top to condense and return the vapours. Sponges and other materials may be sterilised in the same way.—L. A.

Hides and Skins in the Manufacture of Leather, A Process for Treating. A. K. Y. Anderson, St. Kilda, Melbourne, Victoria, and J. Mackintosh, Melbourne, Victoria. Eng. Pat. 24,950, Dec. 30, 1895.

THE raw hides and skins are soaked in cold water until softened. They are then rough-fleshed and soaked in water at a temperature of 27° C. for about half an hour. After having been drained, they are hung in an hermetically sealed vessel, into which carbonic acid gas is forced up to a pressure of about 30 lb. to the square inch. After an hour's sojourn in this chamber, the hair or wool will have become sufficiently loosened to be easily removed by unhairing knives. The pores of the skins are so opened by the treatment that tanning takes place rapidly.—A. G. B.

XV.—MANURES, Etc.

PATENT.

Basic Slag, Improvements in the Preparation of, for Fertilising Purposes. W. Hutchinson and A. Hickman, both of Wolverhampton. Eng. Pat. 6112, March 25, 1895.

To render the phosphoric acid more soluble when basic slag from the Bessemer or Siemens furnace is used as a fertiliser, it is mixed while molten in a ladle with about an equal quantity of molten slag from the blast furnace or from a cupola in which iron is being re-melted. The mixture when cold is ground to a fine powder ready for use. The proportions may vary from the above, the blast-furnace slag being reduced in quantity if the basic slag be very rich in phosphorus.—A. W.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Advances in, for the Third Quarter of 1895. B. Cane-Sugar. Dingl. Polyt. J. 1895, 298, 138—139.

The yields obtained by Centrifugalsing Mascacutes.—H. C. Prijsen-Geerligs (Archief voor de Java Suiker industrie, 1895, III., 50) has carried out experiments, the object of which was to ascertain whether the differences of yield frequently observed when mascacutes—especially those from after products—are centrifugalsing can be ascribed to the different methods of boiling, cooling, and centrifugalsing. Very pronounced differences are observed when the yields, even of first product mascacutes from different factories, are compared. Every care should be taken during boiling to prevent the formation of false grain; it is, however, possible that fine grain may be formed in cooling down, and this would cause a loss during centrifugalsing. This latter occurs to a marked extent with after-product molasses which are not boiled with the object of forming grain. The size of the grain depends chiefly on the physical properties of the mother-liquor, small crystals being obtained from a viscous mascacuite. This partly applies also to first-product mascacutes, for the more impure these are, the smaller will be the grain that separates on cooling; and the greater, the loss on centrifugalsing. In mascacutes containing large quantities of invert sugar it has been found advantageous not to wait for the after crystallisation, but to centrifugalsing direct from the vacuum pan. With pure mascacutes this course is not advisable, since the after crystallising sugar adheres to the first grain, and so increases the yield. First product mascacutes should neither be too much nor too slightly boiled. The more rapid the cooling down the more viscous the syrup, the larger the amount of calcium salts, the finer the grain, and the smaller the yield. The author concludes from his observations with first as well as with second product mascacutes, that differences in yield are due to mechanical rather than to chemical causes.

In a paper on *A Method for the Rapid Detection of Magnesium Oxide in the Lime employed in Sugar Manufacturing* (D. Zuckerind. 1895, 20, 985), Prijsen-Geerligs states that there should not be more than 0.5 to 1 per cent. of magnesium oxide in lime, since the former has an injurious effect on the juice. He advises testing the lime for magnesia when the separation proceeds slowly, or when an abnormally large amount of the lime is needed, or finally when the thick juice has a bottle-green colour. The method employed is based on the fact that when ammonia is added to neutral solutions of calcium chloride no precipitate is produced; if however, magnesium salts are present a gelatinous precipitate of magnesium hydroxide separates, which is insoluble in water and ammonia, but soluble as a double compound in solutions of ammoniacal salts. 1 gm. of the lime is treated with 10 c.c. of water, warmed, and dilute hydrochloric acid added until nearly all the lime is dissolved, and the liquid is neutral or slightly alkaline. The solution is boiled to remove carbon dioxide,

filtered, and ammonia added. The presence of 1 per cent. of magnesia is sufficient to produce the gelatinous precipitate. When limestones are examined, 1 c.c. of lime water is added to the neutral chloride solution to precipitate iron and alumina, and ammonia added subsequent to filtration.

Heating Experiments with Fuels Employed in the Cane-Sugar Industry (D. Zuckerind. 1895, 20).—Carp has ascertained that the semi-gas furnace (Grundel's Patent) possesses the following advantages as compared with the ordinary fire-grate:—1. When dry bagasse is used more steam is obtained for a similar grate surface, and if the draught be properly controlled, economy of fuel is effected. Damp, or a mixture of damp and dry bagasse, can be burnt in emergency, although of necessity there is a diminished production of steam. 2. The fuel value of dry cane leaves (trash) is higher than that of dry Djatti wood (*teetonia grandis*) and only slightly inferior to bagasse. The semi-gas furnace is not so well suited as the ordinary grate for firing with dry cane leaves.

Crystallisation in Motion (Winter, D. Zuckerind. 1895, 20).—This author considers that with a general introduction of Bock's process of "crystallisation in motion," the Javanese cane-sugar industry may rival the beet-root sugar factories as to yield, and further that this process has more promise for the cane-sugar industry than the "diffusion" process. A number of points of advantage arising from the use of the process are dealt with; they chiefly have to do with increased purity, saving of time, and labour.

Lillie's Evaporating Apparatus (D. Zuckerind. 1895, 20).—This apparatus has recently been successfully introduced into Louisiana in place of the Yaryan evaporator, which likewise depends upon the film evaporation (this Journal, 1893, 745). The admission of thin, and running off of thick, juice is automatically regulated by floats and flap valves, which open more or less widely in proportion to the increase of the specific gravity of the juice. It is stated that in six minutes a 5 per cent. sugar solution can be raised to 30° B. The apparatus requires little attention, and causes no inversion of the juice.

Rational Treatment of Juice with Sulphurous Acid and Baryta (D. Zuckerind. 1895, 20).—Dupon has devised a new process based on the simultaneous application of lime and baryta. The experimental results show that sulphuration of the juice in presence of baryta improves its purity and salt coefficients, whereas sulphuration in presence of lime has the opposite effect. The following advantages accrue from sulphuration in presence of baryta. Sulphuric acid is completely removed from the juice, consequently the formation of incrustations is avoided. The greater portion of the lime salts are eliminated, so that an increase of purity—and salt—coefficient results. Most of the natural alkalis (potash and soda) are liberated, the alkalinity necessary for the preservation of the juice being thus secured.

Kruger remarks that baryta separates with difficulty and so hinders defecation, at the same time imparting some of its poisonous properties to the juice.—J. L. B.

Beetroot Juice, Gelatinous Separation in. F. Glaser. Centralb. Bakteriöl. 1895, 2 Abth. 1, 879.

THE so-called "frog-spawn" appearance in beetroot juice is generally ascribed to *Leuconostoc mesenteroides*. But the author shows that another bacterium which differs from *Leuconostoc* in not flourishing in a 10 per cent. neutral molasses, can also produce this phenomenon. The organism is known as *B. gelatinosum betæ*, and grows very readily in beetroot-juice gelatin. After 24 hours a plate culture exhibits white milky colonies which rapidly liquefy the gelatin. These colonies contain the bacteria; if the culture be fresh they are very motile, and when stained with methylene blue, appear as short rods frequently joined to one another. The bacteria develop with great rapidity from stored beetroot juice; after a few hours at the maximum temperature of 40° to 50° a slight evolution of gas occurs, and at the expiration of 12 hours the contents of the flask are covered with a gelatinous scum. Higher temperatures prevent the growth of the bacteria, yet they are not killed by prolonged heating of the infected juice at 100°. A similar growth appears more slowly in beer worts.

As stated above, this organism does not grow in a 10 per cent. molasses, but if the slimy precipitate obtained by the addition of alcohol to beetroot juice or its ash be added, development takes place. *Pari passu* with the gelatinous formation, inversion of the cane-sugar occurs and alcohol is produced in considerable quantity. The presence of lactic acid was not observed. The gelatinous mass possesses the properties of the so frequently described beetroot gums.

—J. L. B.

Carbohydrates, Action of Alkalis on. Conversion one into the other of Glucose, Fructose, and Mannose. T. A. Lobry de Bruyn and W. A. van Ekenstein. Ber, 28, [19], 3078—3082.

In their studies of the behaviour of glucose, fructose, and invert sugar towards alkaline salts of weak acids, the authors have discovered that very minute proportions of alkalis considerably affect the rotation of several carbohydrates. The influence thus exercised bears evidence to a certain degree of transformation, for glucose and fructose give as a result syrups which are almost inactive, whilst galactose yields a syrup of which the value of $[\alpha]_D$ is about $+30^\circ$, the respective normal values for $[\alpha]_D$ being about $+53^\circ$, -91° , and $+81^\circ$. It has been found, as the general result of a large number of experiments, that this change is due to reciprocal transformation of the different sugars one into the other. This has been established in the case of glucose, fructose, and mannose, each of these sugars being transformable under the influence of hydroxyl ions, alkalis, &c., into the other two.—W. S.

Megass and Refuse Furnaces. W. P. Abell. Proc. Inst. Civil Eng. 1895, 123, 3—10.

"The use of megass as fuel in the manufacture of cane-sugar has during the last few years become more general; and on many estates in the West Indies it has entirely replaced coal, of which 25 cwt. were formerly required for the production of 1 ton of sugar. During the years 1890—94, 520 furnaces were rebuilt in British Guiana at a cost of 50,000*l.*, the annual saving thus effected amounting to 100,000*l.*"

The moist megass (containing 50 per cent. of water), as it comes from the crushing rolls, forms about 28—31 per cent. of the whole sugar-cane, and when utilised as fuel fully satisfies, not only to evaporate the whole of the juice, but also to generate the power required for crushing the canes, curing the sugar, &c., without the assistance of any other fuel whatever.

Types of the furnaces employed—both of older and more modern design—are described in detail and illustrated by drawings.—H. T. P.

Bect-Juice; Acids, Mineral and Organic in, Simultaneous Determination of. D. Sidersky. Comptes rend. 1895, 121, 1161.

See under XXIII., page 222.

Levalose, Estimation of, in Honey and other Substances. H. W. Wiley. J. Amer. Chem. Soc. 1896, 18, 81—90.

See under XXIII., page 222.

Sugar, Action of, on Ammoniacal Silver Nitrate. J. Henderson. Proc. Chem. Soc. 1896, [159], 9.

See under XXIII., page 222.

PATENTS.

Evaporating Apparatus, Improvements in and relating to. J. Foster, Glasgow. Eng. Pat. 3118, Feb. 13, 1895.

See under I., page 185.

Sweet Compound, and of certain Intermediate Products therefor, The Manufacture or Production of a. H. E. Newton, London. From "The Farbenfabriken vorm. F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5135, March 11, 1895.

See under XX., page 213.

XVII.—BREWING, WINES, SPIRITS, Etc.

Wine, Technically Pure Glucose used in the Production of, Bearing thereof on the Detection of Adulteration. W. Fresenius. Zeits. Anal. Chem. 1896, 35, [1], 50—56.

It has been customary to infer the fraudulent addition of starch-sugar to wines during the process of manufacture, from the marked dextro-rotation of samples so adulterated, the dextro-rotation being due to the unfermentable and unfermented constituents (dextrin, isomaltose, dextrose) existing in ordinary glucose. Since 1892, however, the use of a certain proportion of "technically pure dextrose" (containing, as now obtainable, less than 1 per cent. of unfermentable matters) is permitted. It is pointed out that wines of this description, not being adulterated (*i.e.*, with common glucose), might yet be classed as such if they retain any appreciable amount of unfermented dextrose. To make sure that any excessive dextro-rotation observed is not due to dextrose, the wine should be completely fermented by means of beer-yeast (not pressed yeast, which has been shown to ferment dextrin, &c.) and again polarised. According to the author's experience, the dextro-rotation should now not exceed 0.3° , or 0.5° after evaporation to a syrup, precipitation with alcohol, and dilution to one-seventh of the original volume.—H. T. P.

Wine, Estimation of Alcohol and Extract by the Refractometer. E. Riegler. Zeits. Anal. Chem. 1896, 35, 27.

See under XXIII., page 223.

PATENTS.

Yeast, Improvements in the Manufacture of. H. Elien, Rotterdam. Eng. Pat. 17,496, Sept. 19, 1895.

The patentee employs a dilute filtered solution of molasses or sugar syrup to which has been added the necessary quantity of phosphoric acid or phosphates for growing yeast. A moderately weak solution—about 16 or 17 kilos. diluted to 100 litres—is found to work best, and phosphoric acid—either free or as a salt—is added at the rate of about 0.4 to 0.8 kilo. P_2O_5 to 100 kilos. of molasses used. The solution should be filtered bright, and should preferably be sterilised before the addition of the seed-yeast, and the latter should be free from foreign organisms. The patentee claims to get a very pure and vigorous yeast.—L. T. T.

Brewing and Apparatus therefor, Improvements in. S. Kuhlmann, Hoxter, Germany. Eng. Pat. 23,997, Nov. 6, 1895.

The patentee believes he has discovered that the clouding of beer in casks arises from overheating of the wort in the brew-pan. The invention consists in employing jets of water or cold air to damp down the fire under the brew-pan when desired, and so prevent overheating of the wort.

—L. T. T.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY AND WATER PURIFICATION, DISINFECTANTS.

(A.)—CHEMISTRY OF FOODS.

Potatoes, Solanine in. G. Meyer. Arch. Exp. Path. Pharmacol. 1895, 36.

A SERIES of determinations of the solanine in potatoes before and during germination has been carried out by the author under the direction of Prof. Schmiedeberg, of Strassburg. Sound potatoes contained 44 parts of solanine per million; when peeled, the amount was only half as much. Young potatoes contained, between July and August, from 201 to 236 parts per million; Maltese potatoes only 50 parts per million. Whilst sprouting in a cellar between March and July, the solanine increased from 90 to 112 parts per million, and the sprouts contained from 2.72 to 5 per cent.

of the alkaloid, according to their length. Shrivelled potatoes contained 144 parts per million, whilst rotten ones covered with black fungus contained as much as 1,340 parts. Experiments with rabbits by Schmiedeberg showed that, with doses insufficient to cause vomiting, the mucous membrane of the stomach and intestine may be affected, without augmenting the tendency to pass into the stage of acute poisoning. Hence potatoes cannot have toxic effects unless the amount of solanine becomes unusually large under special and, indeed, unusual conditions. Nevertheless the results show that such influences may possibly be exercised.—W. S.

Tinned Iron Receptacles for Preserved Vegetables, Cause of the Black Coloration developed in. A. Rossing. Zeits. Anal. Chem. 1896, 35, [1], 38—50.

TINNED preserved vegetables, especially peas, are frequently spoiled, owing to the development of a blackish or brownish coloration, which first appearing on the metallic surface of the tin, then spreads to that portion of the contents in immediate contact therewith. The author states that this black stain generally consists of sulphide of tin—rarely containing iron—and concludes that its formation is due to the spontaneous decomposition of the organic sulphur compounds existing in all vegetables, whereby other bodies are produced (sulphides, mercaptans?) capable of acting on tin. Whether iron sulphide is ever formed is doubtful. The sludge of ferric hydrate occasionally observed appears to arise from the rusting of the iron wherever laid bare (the exposed edges at the joints in the side, top, and bottom of the tin). Air should therefore be excluded, as far as possible, by completely filling the tins with boiled water prior to sealing. The theory that the black stain is produced by free sulphur (and iron) derived from the rubber composition washers—now largely employed, instead of solder, to make air-tight contact between the tin and its lid—is shown to be erroneous. The rings are perfectly harmless.

The proneness to blackening exhibited by different vegetables depends, more or less, on their relative richness in sulphur compounds—with beans, for example, which contain very little sulphur, the trouble is rarely, if ever, experienced—and in any case is pronounced proportionately to their degree of ripeness or staleness. Hence it is of great importance that only young and perfectly fresh vegetables be submitted to the tinning process. Entire prevention of the trouble, however, can only be arrived at by the use of receptacles not acted upon by sulphur compounds, &c.; and in this connection it has been stated that tins, varnished inside, have proved perfectly satisfactory, even in the case of acid preserves.—H. T. P.

Butter, Testing of, by Viscosity Determinations. Pollenske. Apoth. Zeit. 11, 97.

See under XXIII., page 223.

PATENTS.

Casein, An Ammonium Compound of, The Manufacture or Production of. W. Majert, Falkenberg, Germany. Eng. Pat. 9, Jan. 1, 1896.

POWDERED dried casein is brought into contact with ammonia gas; or it is suspended in alcohol, ether, light petroleum, or benzene, and the gas passed through the liquid. The combination of the ammonia and the casein is accompanied with development of heat. The product is a white powder, permanent in the air, and readily soluble in water, forming a tasteless liquid, which is said to possess valuable nutritive qualities.—L. de K.

Peptonised Milk and Cocoa, An Improved Preparation of. W. H. Thew, Westminster. Eng. Pat. 4886, March 7, 1895.

THE inventor claims the manufacture of powder, or solid blocks or cakes of peptonised milk and cocoa, with or without sugar. The moist mixture (Eng. Pat. 14,965, 1894) is placed in shallow pans, heated by means of water

at 45°—55° C., so as to obtain a dry mass. Whilst drying, it is broken up by means of wooden spatules, and when dry enough it is reduced to powder by crushing or grinding.

If blocks or cakes are wanted, the powder is placed in suitable moulds and subjected to the required pressure.

—L. de K.

Soluble Albumen of Animal Food, A New or Improved Method of Obtaining and Preserving the. J. L. Johnston and Bovril, Limited, London. Eng. Pat. 6257, March 26, 1895.

THE object of the invention is to preserve the soluble albuminous matters of flesh without the use of antiseptics. The juice is separated from beef, mutton, &c., by means of hydraulic pressure, and collected in glass vessels. It is then spread over glass slabs or sheets and then allowed to dry at a gentle heat, which must, however, never get high enough to cause coagulation of albuminous matters. The dried mass is scraped from the glass slabs, and keeps for a lengthy period in air-tight packages.—L. de K.

Perishable Organic Substances, An Improved Method or Process for the Preservation and Storage of, by Cold. J. D. Postle, Sydney, New South Wales. Eng. Pat. 17,844, Sept. 24, 1895.

THE substance is first chilled by being brought to freezing point, and is afterwards thoroughly frozen to a depth of $\frac{1}{2}$ to $1\frac{1}{2}$ ins. Carcasses of sheep, &c. may now be packed as if frozen through. The arrangement for preventing thawing consists of an inner uninsulated chamber, all the walls of which are perforated for free circulation of air, and an outer insulated chamber having only one door. A fan works in the intermural space, and drives the air, which is directed by flanges and partitions, through every part of the inner chamber. A thermostat works a shutter in connection with a freezing coil so as to keep the air at a low and constant temperature.

The circulating air may be renewed by the automatic opening of a door, so that vitiated air may escape, whilst a door, where there is a partial vacuum caused by the currents of air, admits fresh and sterilised air. Thus fungoid growths on the surfaces of the carcasses are prevented.

—L. de K.

Green Vegetables and the Like, Improvements in the Preservation of. M. Braumann and A. Braumann, Wallhausen, Germany. From W. P. Thompson, London. Eng. Pat. 24,282, Dec. 18, 1895.

GREEN vegetables, such as cucumbers, beans, cabbage, spinach, &c., in the uncooked or unpickled state, can be preserved for a long time without the use of hermetically sealed vessels or a great cold, as follows:—

Cut salad, for instance, is placed in a perforated vessel lined with oak leaves, and a mixture of one part of sugar and four parts of salt is scattered over it. The bottom of the vessel is then covered with a lid and gently pressed. The mass is now placed in the forwarding vessel, the walls of which have been carefully rinsed with spirits of wine, and it is then again covered with a layer of sugar and salt.

—L. de K.

Bread Making, Improvements in or connected with.

R. L. Clarke, Reading. Eng. Pat. 20,978, Nov. 6, 1895.

3,516 PARTS of unmalted meal (Eng. Pat. 20,799, 1895) and 306 parts of malted meal (Eng. Pat. 20,798, 1895) are well mixed with a solution of 84 parts of bicarbonate of soda in 3,072 parts of water, to which 7 parts of hydrochloric acid of 1.142 sp. gr. have just been added. The mixture is then ready for baking.

If a fermented bread be required, the bran must be first removed and an aqueous infusion made of it at 150° F. for 30 minutes. This liquid is then filtered and used instead of the plain water. Instead of water, milk may be used; in this case the liquid need not be filtered, it being essential that the bran shall be retained.—L. de K.

Milk, An Improved Method of and Apparatus for Preserving. A. E. Jara, Santiago, Chili. Eng. Pat. 22,344, Nov. 22, 1895.

THE inventor claims a process for effectually preserving milk in tin cans without adding any preservatives, and without exposing it to the air during the process.

The fresh milk is at once filtered through charcoal into a tinned copper cylinder, and then forced through a tube furnished with a nozzle plugged with sponge, into a vacuum cylinder, which it enters through a spray in a state of fine division. The gases separate from the milk and collect in the upper part of the cylinder. A descending piston drives off the gases through a tube and subsequently forces the milk into a steriliser, where it may be heated by steam to 100° C. for seven or eight minutes. The milk is now driven by a second charge coming from the purifier into a refrigerator, where it is rapidly cooled to 0° C., and hence into an accumulator. The rapid heating and cooling are to keep the casein in an albuminous state. The cans are very shallow, so that the layer of cream may be thin; also the absence of air prevents churning. They are connected by tubes placed in a frame in the filling apparatus. Steam is first passed through until the cans are at the right temperature, afterwards milk until quite full, under pressure. The connecting tubes are then pinched and soldered. The milk is further sterilised by heating the cans to, say, 120° C. for 10 minutes, and placing them in water kept moving for 24 hours.—L. de K.

Blood, A New or Improved Method of Preventing the Putrefaction of. F. V. Friderichsen, Copenhagen, Denmark. Eng. Pat. 23,006, Dec. 2, 1895.

BLOOD is mixed with 10 to 50 per cent. of molasses or treacle, which will keep it from putrefying for a long time. The mixture may be administered as a nourishing cattle food, either as such or after being converted into a dry powder or meal.—L. de K.

(B.)—SANITARY CHEMISTRY.

Nitrates in Water, Detection of. Alessandri and Guassini. Bollet. Chim. Pharm. 1895, 490.

See under XXIII., page 216.

Potable Waters, Determination of Nitrites in. A. H. Gill and H. A. Richardson. J. Amer. Chem. Soc. 1896, 18, 21.

See under page XXIII., page 220.

PATENT.

Extracting Precipitated Sludge or Solids from the Bottoms of Inverted Cone-shaped Precipitating Tanks for Sewage or Waste Water, Improvements in the Means of. E. W. Ives, Derby. Eng. Pat. 22,545, Nov. 26, 1895.

INSTEAD of the apex of the inverted cone terminating in a sump, the inventor cuts off the apex, thus forming a flat surface. Upon this flat surface he places a cone, and over this a larger cone connected at its apex with a suction pipe. A space is left between the two cones for suction of the sludge from the bottom of the tank.—L. A.

(C.)—DISINFECTANTS.

PATENTS.

Washing Powders, Improvements in the Manufacture of. A. Warwick, J. Smith, and P. W. Nicolle, London. Eng. Pat. 2471, Feb. 5, 1895.

SODIUM benzoate, a powerful antiseptic and germicide, as well as a detergent and non-poisonous, is incorporated into washing powders in the proportion of from 0.25 to 1 per cent. The use of the benzoates of the other alkalis and of the alkaline earths for the same purpose is also claimed.

—L. A.

Improved Disinfecting Materials. J. B. McArthur, New-ferry, Chester. Eng. Pat. 5258, March 12, 1895.

CAMBOTIC, cresylic, and similar "acids," the oils of cloves, eucalyptus, peppermint, and similar fluids, are absorbed by means of carbon, especially certain forms of waste carbon named in the specification, also waste calcium sulphate and mixtures of the above with wood sawdust. Solutions of chlorides of calcium, zinc, or magnesium, or glycerin may be added. The mixture may be used as a powder, or may be moulded into tablets, &c. with the help of glue, paste, silicate of soda, &c.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

PATENT.

Waterproofing Paper and other Fabrics, and Apparatus therefor, and in Means for Applying Waterproof Designs thereto, Improvements in. F. Girard, Paris, France. Eng. Pat. 1518, Jan. 22, 1895.

THE paper (more especially such as is used for making cigarettes) is passed in continuous bands, while pressed down by a brush, over a "porous depositing plate," to which melted paraffin wax, stearin, &c., or varnish, is conveyed by a pump, the mechanism of which is arranged to make the rate of descent of its piston in the cylinder correspond with the rate of motion of the paper over the porous "plate." The latter is preferably composed of sheets of metal or other suitable material, fixed parallel to one another and separated by layers of felt, sponge, porous paper, &c. It is mounted so that the paper comes into contact with the edges of the sheets of metal.

Modifications of the apparatus are described in the original specification, by means of which the waterproofing agent may be applied (in pattern, &c.) to portions only of the paper.—E. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Ozone, Production of. Brimk. Zeits. anorg. Chem. 1895, 222.

WHEN oxygen is prepared in the ordinary way from KClO_3 and MnO_2 , it is found to contain ozone. If manganese peroxide be heated to 400° C., or even to redness, and oxygen gas be passed over it, ozone is also formed. The oxides of cobalt, silver, nickel, mercury, lead, chromium, uranium, and gold, act more or less in the same way. Lead peroxide heated to 400° C. yields ozone even in a stream of CO_2 .—W. S.

Mydriatic Drugs. Pharm. J. 1896, [1336], 83.

J. LAUTERER has found that the old leaves and twigs of *Duboisia myoporoides* contain hyoscyamine, the fresh young leaves, scopolamine. When the flowers commence to bud, the leaves are richest in alkaloid, containing then 0.3 per cent. In winter the amount falls to 0.03 per cent. Dry leaves contain 0.97 per cent. of alkaloid and are much stronger than belladonna leaves. *Duboisia leichardtii* is richer in alkaloid and contains chiefly amorphous scopolamine. The leaves of *Brugmansia arborea* and *B. knightii*, natives of South America acclimatised in Queensland, contain less alkaloid, consisting of two-thirds hyoscyamine, and one-third atropine.—W. S.

Ledum-Camphor, The so-called. E. Hjelt. Ber. 28, 1895, 3087—3089.

INVESTIGATIONS by the author show that ledum-camphor, from *Ledum palustre* (melting point, 104°—105° C.; boiling point, 282°—283° C.), possesses the formula $\text{C}_{15}\text{H}_{26}\text{O}$, and is isomeric with patchouli-camphor, caryophyllene alcohol, camphacol, and other sesquiterpene hydrates.

The leaves of the plant yielded 1·30 per cent. of crude oil or 0·30 per cent. of the camphor, whilst young shoots gave 0·75 per cent. crude oil or 0·28 per cent. of camphor.

—J. S.

Apo-Quinine, the Preparation and Rotatory Power of.
E. Lippmann. Ber. 1895, 28, 1971—1972.

RECENTLY, the author and Fleissner (this Journal, 1895, 677) have shown that apo-quinine—first described and prepared by Hesse—cannot be obtained in a state of purity by the process employed by its discoverer. This conclusion the author maintains,—although Hesse (Ber. 28, 1301) has since denied its correctness,—and states that by acting on quinine with hydriodic instead of hydrochloric acid, under the conditions before described, apo-quinine may be obtained free from impurities. Apo-quinine separates from ether in colourless needles, containing ether of crystallisation. The latter is slowly expelled at 110° C., and the alkaloid becomes yellow in colour, and yields a brown solution in alcohol. $[\alpha]_D^{20}$ (in alcoholic solution) = -217·1°.

The production of isomerides of quinine (in Hesse's process) is confirmed. Hitherto, the author has isolated a base, with difficulty soluble in ether, m. pt. = 170—171° C.; also the sulphate of a base ($C_{20}H_{21}N_2O_2$), m. pt. = 209—211° C.—H. T. P.

Caffeine, Synthesis of. E. Fischer and L. Ach. Ber. 28, [19], 3135—3143.

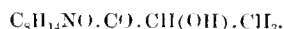
THE relation of caffeine to uric acid was first indicated by Rochleder. Subsequently Strecker traced its connection with theobromine. The common relationship of these two bases with xanthine was next established by E. Fischer, and more recently theobromine has been represented as dimethylxanthine, whilst caffeine has been regarded as trimethylxanthine. As shown in formulae given, uric acid is closely allied to xanthine, though, as Fischer points out, there are essential constitutional differences.

The structure of the carbon chain in the methyl derivatives of uric acid hitherto known, has remained unaltered, whilst hydrogen and oxygen have been removed from the alloxan nucleus. The authors have now succeeded, for the first time, in replacing both hydrogen atoms of the alloxan nucleus by methyl, and have thus obtained γ -dimethyl uric acid, which by the action of phosphorus oxychloride and pentachloride, may be converted into chlortheophylline. By reduction with hydriodic acid, chlortheophylline is converted into theophylline, chlorine being replaced by hydrogen. The yield is almost quantitative. Theophylline is contained in tea to a small extent, so small, however, that the attempt to extract it is of little use. Hence it has proved best to prepare it from caffeine, which is first converted into dimethyluramil (Ber. 28, 2475), and this by treatment with pure potassium cyanate passes almost quantitatively into dimethylpseudo-uric acid. On fusion of the latter with oxalic acid, a 60 per cent. yield of γ -dimethyluric acid is obtained, yielding 35—40 per cent. of pure theophylline, which means about 10 per cent. on the caffeine employed.

Finally, the authors succeeded in converting the theophylline obtained as above, into caffeine, by methylating according to Kossel's process.—W. S.

Lactyltropine. Pharm. Centrallh. 37, 73.

This substance has the formula—



It is prepared by heating an aqueous solution of equal parts of lactic acid, tropine, and hydrochloric acid of sp. gr. 1·12 to from 70° to 100° C. for several days on the water-bath, replacing any hydrochloric acid evaporated. The liquid is then made alkaline, and the base is removed by shaking with chloroform, the residue left after evaporating down the separated chloroform solution being purified.

Lactyltropine hydrochloride forms colourless crystals easily soluble in water or alcohol. The base itself forms bundles of acicular needles melting at 74° to 75° C.—W. S.

Triphenine. J. von Mering. Pharm. Centrallh. 37, 73.

This substance is prepared by heating *p*-phenetidine with propionic acid. It is a homologue of phenacetine, and is introduced as an antipyretic and antineuralgic. It dissolves in 2000 parts of cold water, and melts at 120° C. Seven to nine grains form a dose, said to reduce the body temperature by 2° or 3° C.—W. S.

Alkaloids, Volumetric Determination of, by Means of Iodine Solutions. C. Kippenberger. Zeits. Anal. Chem. 1896, 35, 10—27.

See under XXIII., page 223.

Thymol and Carvacrol, Test for. W. G. Correll. Pharm. Review, 14, 33.

See under XXIII., page 222.

Mercurous Tannate, Determination of Mercury in. C. Glücksmann. Oesterr. Zeits. 1, 147.

See under XXIII., page 223.

Nitrous Acid in Mercurous Nitrate, and Nitrites, Test for. K. Gorter. Apoth. Zeit. 11, 95.

See under XXIII., page 216.

Albuminoids and Phenols, Some Reactions of. E. Ackermann. Rev. Chim. Indust. 1895, 6, 322.

See under XXIII., page 221.

Ergot, Valuation of. H. Beckurts. Oesterr. Zeits. 1, 31.

See under XXIII., page 223.

Berganot, Oil of, Examination as to Purity. A. Bornträger. Zeits. Anal. Chem. 1896, 35, 35.

See under XXIII., page 223.

PATENTS.

Succin Compound, and of Certain Intermediate Products therefor, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vorm. F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5135, March 11, 1895.

ORTHO-SULPHOBENZOIC ethers, $SO_2H.C_6H_4.COOR'$, are readily made by the action of alkyl-haloids on the salts of the corresponding acid, or by digesting the disodium or dipotassium salts with alcohol in the presence of hydrochloric or sulphuric acid. The corresponding chlorides, $SO_2Cl.C_6H_4.COOR'$, are readily formed by the action of phosphorus oxychloride on the sodium or potassium salts of the orthosulphobenzoic ethers. When these chlorides are treated with ammonia in excess, and the action is allowed to proceed energetically, they yield saccharin, and on acidulating the solution, the latter separates in a pure state. Mixtures of ortho- and parasulphobenzoic acids may be employed, as the sodium and potassium salts of the parasulphobenzoic ethers are much less soluble than the corresponding salts of the ortho-ethers, and so can be largely and readily eliminated; and the parasulphamine benzoic ethers are also almost insoluble in water, and so can be filtered off and the saccharin left in solution.

The patentees claim the following advantages for this process over that at present employed for making saccharin. For preparing the halogen derivative, a small quantity ($\frac{1}{2}$ mol.) of phosphorus oxychloride can be employed instead of the much larger quantity (2 mols.) of the more expensive phosphorus pentachloride now necessary for preparing the dihalogen compound. The mono-halogen ethers are more stable towards water than the dihalogen compounds, and therefore aqueous ammonia can be employed for their decomposition in place of the gaseous ammonia necessary with the dichloro-derivative.—L. T. T.

Oxygen Gas and Apparatus therefor, Improvements relating to the Production of. A. Sweetser, West Dulwich, Surrey. Eng. Pat. 12,245, June 24, 1895.

This is an apparatus intended to generate oxygen (for lime-light and other purposes) as and at the time wanted. It consists essentially of a tube (attached to suitable vessels

and a suitable receiver) through which a band, impregnated with potassium chlorate, or endless chain carrying pellets of potassium chlorate, is made to pass by means of an outside crank handle. When the tube is strongly heated the oxygen can be generated as required by moving on the band or chain by means of the handle.—L. T. T.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographic Plates and Films, Improvements in the Manufacture of. C. E. Oakley, Thornton Heath, Surrey. Eng. Pat. 2986, Feb. 11, 1895.

THE object of this invention is the prevention in photographic plates of the effects known as halation "by first coating the glass plate or other support with gelatin or other suitable non-sensitive material; then immersing the support in a solution of potassium permanganate or other material which will colour the gelatin and render it non-actinic by entering into the substance of same, and also harden the gelatin and render it practically insoluble, and therefore prevent it giving up its colouring matter to the sensitive emulsion; and then coating the support with a sensitive emulsion."—W. M.

Without Transfer, Images with their Half-Tints, An Improved Photographic Process, giving; and the Application of this Process to Photography in Colours. B. J. H. Mills, London. From A. and L. Lumière, Lyon-Montplaisir, France. Eng. Pat. 7188, April 8, 1895.

THE inventors have observed that bichromated glue soluble in a cold state, which does not give the half-tints when employed alone, acquires this property when insoluble substances are added to it under certain conditions. If, for example, to a 10 per cent. solution of glue there be added about 5 per cent. of bichromate of ammonia and from 5 to 10 per cent. of bromide of silver emulsion, and this preparation be spread upon a glass plate, a sensitive surface is obtained, which, when exposed under a negative, and washed with cold water, gives an image, only scarcely visible, which can be coloured suitably, the bromide of silver being dissolved out by hyposulphite of soda. With this process, it is easy to produce polychrome images, by utilising the principle of Cros and Ducois de Haumont's process, by obtaining successively upon one plate three monochrome images, red, blue, and yellow, arising from the corresponding negatives, taking care to isolate each image from the preceding one by an impermeable coating of collodion.—J. C. C.

Stripping Films for Photographic Purposes, Improvements in the Manufacture of. J. B. B. Wellington, Elstree, Herts. Eng. Pat. 10,666, May 29, 1895.

THE object of this invention is the production of flexible transparent films intended for the support of photographic emulsions, and to provide a film of insoluble gelatin which is supported during exposure upon a backing of paper, from which backing it is stripped prior to printing. The major claim is for a stripping film consisting of the combination of a paper backing, a substratum consisting of a solution of a suitable gum or resin coated thereon, a layer of gelatin upon such substratum, and a final layer of sensitive emulsion.—W. M.

XXII.—EXPLOSIVES, MATCHES, Etc.

Guncotton, Inspection of Cotton for Use in the Manufacture of. C. E. Munroe. J. Amer. Chem. Soc. 1895, 17, 783.

WEAVERS' waste, or the waste from cotton-gauze factories, is most used for the manufacture of guncotton, on account of its cheapness, and because it permits of ready handling, and also because its compactness makes it less buoyant than cotton wool.

The cotton should be free from oil, grease, &c., and from cops, tangles, &c.

The method of inspection is as follows:—1. Ocular examination for colour, cleanliness, presence of cops, knots, tangles, and foreign bodies, and for relative length and strength of fibre. 2. Odour. 3. Moisture, which is determined by drying at 100° C. to constant weight. 4. Ether extract, which is determined by subjecting a weighed sample to the action of petroleum ether (b. pt. = 50°–80° C.) in a Soxhlet extractor until the sample ceases to lose weight. The complete extraction of the oily matters generally requires several exhaustions. 5. Soda-lye extract, which is determined by boiling the weighed sample (10 grms.) for 8 hours in 104 c.c. of a solution of caustic soda (17·305 grms. of NaOH to 1 litre of water), fresh water being added from time to time to keep up the volume. Pour off the liquid, wash on a cotton filter until the wash-water gives no alkaline reaction, and then dry to constant weight. 6. Ash. Weigh out 1–1·5 gm. of the sample into a platinum crucible, pour melted paraffin upon the mass, ignite it from the top, and let it burn slowly until the flame dies out, and then ignite the residue to constant weight. 7. Rate of absorption of water. This is determined by dropping a sample of the cotton on to distilled water, and noting the time from the moment the cotton touches the water until it sinks completely below the surface. Cotton suitable for making smokeless powder should sink in two minutes. The cotton may be tested for rate of absorption, not only in its original condition, but also after treatment with ether, after drying for moisture, and after boiling with soda lye.

In 18 samples of cotton waste, the moisture varied from 3·38 to 8·40 per cent., the ether extract from 0·00 to 7·10 per cent., the soda-lye extract from 3·53 to 5·36 per cent., the ash from 0·65 to 1·79 per cent., and the rate of absorption after soda-lye extraction, from one second to over 24 hours. Experiments were made as to the absorptive capacity of the cotton, and "one 6-grm. sample of cotton was found to retain 93 grms. of water."—A. S.

PATENTS.

Explosives, Improvements in. W. D. Borland, Dartford. Eng. Pat. 6289, March 26, 1895.

THE use of insoluble or sparingly soluble chromates, such as zinc or aluminium chromate mixed with nitrocellulose, is patented. The explosive substance may be gelatinised or compressed into sheets or blocks.—W. M.

Pyrotechnic Compounds, Improvements in the Manufacture of. W. Weippenbach, Stuttgart, Germany. Eng. Pat. 24,725, Dec. 24, 1895.

THE following mixture is given; the proportions must not be materially departed from, or the result will be uncertain:—Potato starch, 250–300 parts; dextrin, 100–110; gum arabic, 50–60; powdered charcoal, 38–40; magnesium powder, 75–100; steel filings, 200 parts (may also be omitted).

The ingredients are mixed with water and then allowed to ferment, and afterwards, on standing some days, oxygen is absorbed and thus "nitrate, chlorate, and the other oxygen-containing substances hitherto employed are dispensed with, and replaced in their action by active oxygen, which during the process is itself absorbed from the atmosphere by the materials and is combined probably in the form of magnesium superoxide."—W. M.

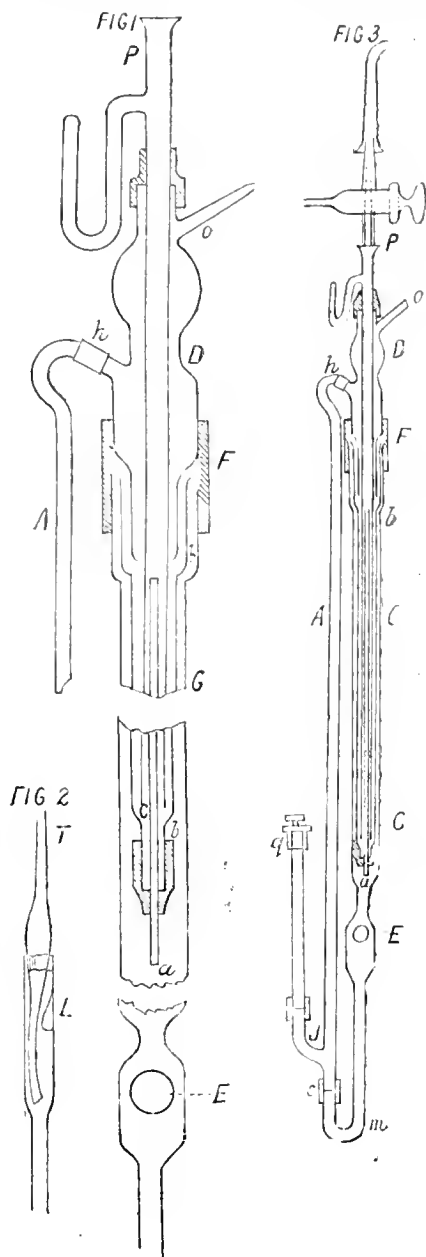
XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Mercury Air Pump, Distillations with an Automatic. F. Krafft and W. A. Dyes. Ber. 28, 1895, 2583–2589.

THE automatic mercury air pump is shown in the cut. It consists of a series of concentric glass tubes G, the innermost one, *a*, Fig. 1, being a Sprengel tube 3–4 dm. long. A quantity of mercury (about 600–650 grms.) is introduced

at *o*, which is then connected with an ordinary water-pump. The mercury sinks down to *C* and then rises up between the Sprengel tube and the next tube outside it. When it reaches the level of the top of the Sprengel tube it falls through the Sprengel tube, carrying the air or gas from *P* with it. At *a* the air or gas which has been carried down by the mercury is sucked up by the water-pump between the outermost tube and the next tube within it. The mercury, on the other hand, descends past the ball-valve *E*, which closes with an excess of pressure outside and collects in the bend *m*, Fig. 3. The side tube *J A h* conveys the mercury back to the reservoir again, the action going on continuously as long as the water-pump is at work. The valve *q* is so regulated that it admits a slow current of air, filtered by passing through cotton wool between *q* and *J*, in sufficient quantity to carry up the pistons of mercury in the side tube *A*. The top of the Sprengel tube is best made in the form shown in Fig. 2 of the block. The apparatus can easily be clamped on the laboratory table by a retort stand.



The water-pump reduces the pressure in the whole apparatus to about 15 mm., and this is still further reduced to 1 mm. or less by the Sprengel pump. If water vapour be given off during the distillation, it is well to interpose a tube containing a suitable dehydrating agent between *P* and the distilling apparatus.

In order to test the pump, which is a modification of v. Babo's, the authors have made several distillations in a high vacuum, and find it very satisfactory. For example, mannite was found to distil under a pressure of 1 mm. at 276°—280°, under 2.5 mm. at 285°, and under 3—3.5 mm. at 290°—295°. The boiling points or temperatures of sublimation of dulcitol, succinic, fumaric, mesaconic, and itaconic acids were also determined at greatly reduced pressures.—J. S.

PATENTS.

Thermometers, Improvements in. J. J. Hicks, London. Eng. Pat. 1254, Feb. 27, 1895.

The improvements relate to the construction of a thermometer of the Six pattern, in which there is a combination of four parallel tubes of nearly equal length connected together and forming a continuous tube, two of the tubes being used as thermometric and two as recording tubes, and each containing a separate indicator. The series of tubes is connected with a spirit bulb and either one or a pair of expansion bulbs.—J. S.

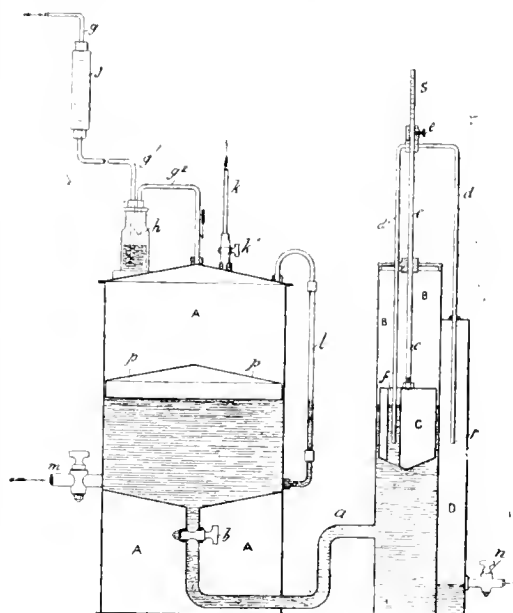
Gases, Collecting and Analysing of, Improvements in and relating to. F. G. Waller, Delf, Holland. Eng. Pat. 1040, Jan. 16, 1895.

In the figure, A and B are two communicating vessels united by a pipe *a*, which is provided with a cock *b*. The smaller vessel B contains a float *C*, to which is attached a vertically guided rod *c*, and to this rod a siphon tube *d* is secured by a clamp *e*, so that the siphon tube may be fixed in any desired position. The one end of the siphon dips into the fluid through a hole *f* in the float *C*, and the other end *r* hangs free in the vessel *D*, provided at its lower end with a cock *n*.

The larger vessel A contains a float *p* to separate nearly the whole of the surface of the fluid from the space above it, and so prevents absorption of the gases by the fluid.

From the upper part of A, a small pipe *g* serves to convey the gases to be collected, and is provided with a soot filter *j* and a draining apparatus *g*¹ and a non-return valve *h*.

The vessel A is also provided with an inlet cock *m* and has a gauge glass *l* fitted at its side.



The apparatus is filled by pouring the liquid into the vessel B, the cocks *b* and *k* being open and *m* and *n* closed.

When filled, *k* is closed and *n* open; the siphon is then fixed on the rod *c*, so that the velocity of discharge of the liquid has the desired value, which velocity remains constant, as the siphon descends with the float C, and a volume of gas is collected at a regular speed. When sufficient gas is collected, the cock *n* is closed, the level in the cistern D rises, and the siphon stops without being emptied.

The gas may then be driven out into the analysing apparatus by closing cock *b* and forcing liquid through *m* into the vessel A.—J. C. C.

New Indicator, Luteol (Hydroxychlorodiphenylquinoxalin).
W. Autenrieth. Archiv. d. Pharmacie, 233, 43.

In contact with alkalis the solution of this substance becomes coloured intensely yellow. For its preparation 1 mol. of ethoxyphenylenediamine is heated to boiling with 1 mol. of benzyl in alcoholic solution. A crystalline precipitate of ethoxyphenylquinoxalin is obtained. This substance (m. pt. = 150° C.) is recrystallised from alcohol, and is heated in the paraffin bath at 70°–90° C. with pentachloride of phosphorus, whereby an atom of chlorine enters into combination, and phosphorus trichloride and hydrochloric acid escape.

The ethoxychlorodiphenylquinoxalin is then heated in a sealed tube with hydrochloric acid to from 180°–200° C., whereby ethylchloride is separated. The substance thus obtained is repeatedly crystallised from alcohol.

The fine, wool-like and yellow coloured needles obtained, melt at 246° C., at higher temperatures subliming without decomposition. In water the substance (Luteol) is insoluble, with difficulty soluble in cold alcohol, easily soluble in hot alcohol, and in ether. Concentrated sulphuric acid dissolves luteol, forming a red solution, from which addition of water effects separation of the unchanged luteol. It is slightly soluble in strong hydrochloric acid, completely soluble in dilute. Alkalis dissolve it easily, forming a yellow coloured solution. If 1 drop of dilute caustic soda solution be added to 1 litre of water, and of the solution 5–10 c.c. be taken, and to this liquid a few drops of alcoholic luteol solution be added, a very perceptible yellow tint is produced. The delicacy is considerably greater than in the colour reactions produced by litmus or phenolphthalein. Luteol has the advantage over phenolphthalein that it can be used with ammonia, and over litmus in that it shows a very sharp indication of permanent tint, without any production of intermediate shade, as with litmus. A luteol solution of convenient strength is one of 1 grm. in 300 c.c. of pure alcohol.—W. S.

INORGANIC CHEMISTRY.—QUALITATIVE.

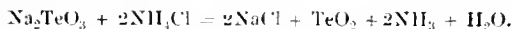
Hydrogen Peroxide, Reagents for the Detection of. L. I. von Nagy Hosva. Ber. 1895, 28, 2029–2031.

Bach (this Journal, 1895, 399–400 and 597) has described a very sensitive colour reaction which hydrogen peroxide yields with a dilute solution of aniline and potassium bichromate. The author finds that other aromatic amines furnish similar results. Adopting Bach's *modus operandi*, the following colorations were obtained with a solution of hydrogen peroxide containing 1 per 1 to 2 millions:—Dimethylaniline, yellow; sulphanilic acid, violet-red; *o*-toluidine, yellow-green, not characteristic; *p*-toluidine, copper-red; tolylenediamine, pale rose-red; xylydine, yellowish-pink, changing to reddish-violet; naphthylamine, reagent decolorised, then changed to bluish-violet. Of these, dimethylaniline is the most sensitive, giving a distinct reaction in 5 minutes with a peroxide solution containing only 1:5,000,000. It must be noted, however, that dimethylaniline, tolylenediamine, and naphthylamine cannot be relied upon in presence of traces of nitrous acid. Moreover, ozone yields with all the above reagents colorations very similar to those furnished by hydrogen peroxide.

—H. T. P.

Tellurium Salts, New Reactions of. C. Whitehead.
J. Amer. Chem. Soc. 17, 849.

THE addition of an ammonium salt in solution to a solution of sodium or potassium tellurite produces a white precipitate, which becomes granular on boiling; a small amount of a substance, probably tellurium, that may be precipitated by sulphur dioxide, being left in solution. The author is engaged in examining this substance. The reaction may be expressed thus:—



On passing hydrogen telluride for some time into a solution of tellurium chloride, tellurium and tellurides are precipitated, but the solution still contains tellurium. The equation is: $\text{TeCl}_4 + 2\text{TeH}_2 = 3\text{Te} + 4\text{HCl}$. Potassium ferrocyanide added to tellurium chloride gives no change at first, but after a few hours much Prussian blue is formed.

Aluminium Telluride.—Aluminium combines directly with tellurium with explosive violence, forming a difficultly fusible, chocolate-coloured compound, having the formula Al_2Te_3 . It is so brittle that it may be ground to powder; it is of constant composition, and forms hydrogen telluride in moist air, and reacts rapidly with water according to the equation $\text{Al}_2\text{Te}_3 + 3\text{H}_2\text{O} = \text{Al}_2\text{O}_3 + 3\text{TeH}_2$. The hydrogen telluride is, however, much more easily oxidised than hydrogen sulphide, and if unboiled water be used in the above experiment, fully one-half of the tellurium will remain as metal: $\text{TeH}_2 + \text{O} = \text{H}_2\text{O} + \text{Te}$. The aluminium compound gives no reaction with 95 per cent. alcohol even on boiling, and, being less oxidisable than alkaline tellurides, is the best source from which to prepare the organic salts.

Electrolytic Separation from Copper.—Even the feeblest current deposits tellurium, but not in the reguline state. To separate it from copper, the solution is mixed with an excess of sodium hydroxide and about 3 grms. of potassium cyanide per grm. of copper present. A current, such as is used for depositing copper, will in 12 hours throw down all the tellurium from this solution as a black non-adhesive precipitate; it is then filtered off and weighed, either as Te or as TeO_2 , and the solution is acidified with sulphuric acid and electrolysed for copper. With the right amount of cyanide, and if the current be not passed for too long, the tellurium is quite free from copper; and, given sufficient current-strength, no tellurium will adhere to the cathode.

—W. G. M.

Nitrous Acid in Mercurous Nitrate, and Nitrites, Test for. K. Gorter. Apoth. Zeit. 11, 95.

THE author points out that Denigés' test with mercurous acetate is practically identical with that of Plugge, devised in 1875. He showed that mercurous nitrate, when free from nitrous acid, gives no red tint with phenol, but that the minutest trace produces the red coloration.—W. S.

Nitrates in Water, Detection of. Alessandri and Guassini. Bollet. Chim. Pharm. 1895, 490.

THE evaporated residue of the water, whilst warm, is mixed with a few drops of a solution of carboic acid in strong hydrochloric acid. On heating, an intense reddish-violet coloration is produced, when the smallest trace of nitrates is present. Addition of ammonia changes the colour to emerald green. Water with very minute traces of nitrates gives the violet tint, a green tint being produced when the trace becomes almost a vanishing quantity.—W. S.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Phosphoric Acid, Estimation of, by Titration. De Molinari. Bull. de l'Assoc. Belge des Chimistes, 9, 280–282.

THE Pemberton method, whilst applicable in its original form to slags and ordinary phosphates, gives results that are too high when free sulphuric acid or sulphates are present. In such cases it becomes necessary to effect a precipitation of the acid by barium chloride or to add to the solution under examination an equal bulk of alkaline ammonium citrate (Petermann's formula) before performing the titration. Directions are given for the determination of

(1) the phosphoric acid soluble in water, (2) total phosphoric acid in superphosphate, (3) that soluble in water and alkaline ammonium citrate (in mixed manures), (4) that soluble in acid ammonium citrate.—C. S.

Silver Ores [Rich], *Notes on the Assay of*. E. H. Miller and C. H. Fulton. *Sch. of Mines Quart.* 1896, **17**, 160—170.

A COMPARISON is made between the crucible and the scorification assays as applied to two ores, one being a cerussite, containing about 2,000 oz. of silver and 0.28 oz. of gold per ton, with 28 per cent. of lead; the other being a rich silver sulphide, with 17,000 oz. of silver and 240 oz. of gold per ton. In each case the amounts of precious metal left in the slag and in the cupel were determined separately, and the residues left in the second (cleaned) slags and the second cupels were determined together, these forming the "second correction" noted below. In the crucible, an increase in the proportion of litharge adds very slightly to the silver in the slag; and the weight of silver obtained from the lead button increases regularly with the size of that button to a maximum of 28 grms., and then diminishes owing to the greater loss of precious metal during the subsequent scorification and cupellation. The weight of silver recovered from the cupel is usually greater than that from the crucible slag, increasing regularly, but not in direct proportion, with the size of the button. Feathers on the cupel are not in all cases a correct indication of temperature, but depend to some extent on the position of the cupel in the muffle. The best method of assaying must be worked out for each ore, but the following conclusions appear to be warranted:—(1.) The crucible assay is the best for all gold ores, and for silver in pure ores, particularly in those which have a basic gangue. (2.) Uncorrected scorification assays are higher than uncorrected crucible assays for impure materials (sulphides, &c.) carrying silver. (3.) The corrected crucible assay is usually slightly higher than the corrected scorification assay, because of the loss of silver by volatilisation during scorification. The amount of gold recovered in correcting either assay is very small, but is greatest in the scorification process. The actual loss of gold during the cupellation of the richer ore was found to range from 0.00075 to 0.00095 mgrm. per grm. of lead button cupelled, the loss of silver being often a thousand times as great as this. The average results of the assays are shown in a table.

Other investigators working in the same field have obtained similar results. Mason and Bowman found a loss of silver in scorification equal to 0.55 per cent., and of gold 0.574 per cent., whilst in cupellation, the losses were 1.99 and 0.295 per cent. respectively (this *Journal*, 1895, **14**, 39). Dewey found a correction of 2.6 per cent. necessary for lead carbonate carrying from 100 to 500 oz. of silver, and of 1.26 per cent. for scorification assays of precipitated sulphides running 17,500 oz. per ton (this *Journal*, 1895, **14**, 301). Steinfeldt for similar materials obtained the numbers 2.9 and 1.2 per cent., but these omit the second correction given by the author. Furman gives the average losses in the crucible assay as 2.58 per cent. for silver and 0.30 per cent. for gold. Finally Rose has shown that of the gold lost, 82 per cent. is absorbed by the cupel.

—W. G. M.

Alloys of Lead, Tin, Antimony, and Arsenic, Analysis of. L. Andrews. *J. Amer. Chem. Soc.* 1895, **17**, 869—873.

First Method.—About 0.5 grm. of the alloy in the form of turnings, is placed in a porcelain boat within a combustion tube, in which the tube being covered with an asbestos tent, it may be heated by an argand burner to 210° C. During this time fuming hydrochloric acid is allowed to flow through a capillary tube into strong sulphuric acid contained in a flask; in this way, a steady and slow stream of hydrochloric acid gas is generated and passed through a second flask containing 10 c.c. of nitric acid (1.5 sp. gr.) and thence into the combustion tube. The gaseous products of the reaction with the alloy, traverse a well-cooled Volhard absorption flask containing potassium bromide solution. After two hours the action is complete; the

snow-white residue in the boat contains all the lead, and is quite soluble in boiling water; the lead is weighed as sulphate. The sublimate in the unheated part of the combustion tube is rinsed with hydrochloric acid into the absorption flask, which then contains the antimony, arsenic, and tin. The arsenic is removed by Gooch's method of distillation, and the tin and antimony are then separated according to Carnot's process (this *Journal*, 1892, 941) by boiling the solution, containing an oxalate, free oxalic acid, and much ammonium chloride, with sodium thiosulphate. Besides observing the precautions recommended by Carnot, it is necessary to boil the solution violently until one-fourth is evaporated, and to ensure that the acid is finally in excess in regard to thiosulphate.

Second Method.—When antifriction or type metals are treated with hydrobromic acid a residue of pure antimony is left, but a small proportion of antimony passes into solution owing to oxidation. By adding a reducing agent, such as hydriodic acid, the whole of the antimony will be left in the residue. 1 grm. of the metal in turnings is therefore boiled for an hour with hydrochloric acid (1.1 sp. gr.) and 1 grm. of potassium iodide. The residual dark grey powder of antimony is filtered boiling, washed with boiling water until free from lead iodide, dried, mixed with sulphur, and gently ignited in a current of carbon dioxide. If the antimony be weighed direct, the results will be about 0.7 per cent. too high, in consequence of the retention of water or hydrogen by the metal. In igniting antimony sulphide in this manner, the required temperature of 400° C. is most conveniently obtained by supporting the tube over an Argand burner, and there covering it with a tent of asbestos or sheet-iron. This method of heating is recommended as giving absolute control over a wide range of temperatures, and as being safer than direct heating by means of a Bunsen burner.

Results by both processes, as quoted, were excellent.

—W. G. M.

Lead, The Volumetric Determination of. A. S. Cushman and J. Hayes-Campbell. *J. Amer. Chem. Soc.* 1895, **17**, 901—904.

THE authors recommend a modification of the Schwartz process. 1 grm. of the ore is digested in a porcelain dish with 15 c.c. of a mixture of 2 parts of nitric with 1 of sulphuric acid until decomposition is complete. 10 c.c. more sulphuric acid is added, and the liquid is evaporated until it fumes freely. It is then cooled, and 10 c.c. of dilute sulphuric acid (1:10) and 40 c.c. of water are added successively. The mixture is heated to boiling, filtered, and washed with dilute (1:10) sulphuric acid by decantation, getting as little as possible of the precipitate upon the filter. The residue in the dish is mixed with 20 c.c. of strong ammonia, and the mixture is then slightly acidified with acetic acid, and boiled until the lead sulphate is dissolved, when it is poured over the filter, which must have been previously moistened with ammonia. The filter is washed with dilute ammonium acetate solution, and then with hot water. After cooling the filtrate, an excess of standard bichromate solution is added from a burette, until the precipitate settles rapidly and the supernatant liquid is yellow. The precipitate is allowed to subside, and after a few minutes it is filtered, if possible under pressure, and washed; and the excess of bichromate is titrated back with standard ammonio-ferrous sulphate solution. The whole process can be conducted in 30 minutes. In the absence of bismuth and antimony, nitric acid alone may be used in attacking the ore; the acid solution is then mixed with an excess of ammonia, and afterwards with acetic acid, to dissolve any lead sulphate that may have been formed. The additions of bichromate and ferrous salt are made as before. The time required is thus materially shortened. The standard ferrous solution may be preserved for a long time unchanged in a corked bottle with a siphon and pinchcock, and with a thin layer of paraffin oil resting on the surface of the liquid. The results are a trifle low, averaging about 99.6 per cent. of the true number.

—W. G. M.

Mercury in Cinnabar, Electrolytic Method for Determination of. W. B. Rising and V. Lenher. *J. Amer. Chem. Soc.* 1896, **18**, 96—98.

THE mercuric sulphide is treated with hydrobromic acid in which it dissolves very readily; the solution is nearly neutralised with caustic potash, pure potassium cyanide added in sufficient excess to redissolve the precipitate which is at first formed, and the solution is electrolysed by means of a weak current; the operation is carried out in a platinum dish which acts as the negative electrode and on this the mercury becomes deposited. The advantage of hydrobromic acid over aqua regia, is that it dissolves cinnabar at low temperatures so that no loss of mercury by volatilisation occurs. Results are given showing the accuracy attainable.—A. K. M.

Sulphur in Refined Copper, Estimation of. G. L. Heath. *J. Amer. Chem. Soc.* 1895, **17**, 814.

THE author criticises the existing methods for the estimation of sulphur in copper. The method of R. Fresenius (*Zeits. Anal. Chem.* **13**, 223), in which the sulphur is precipitated by barium nitrate from a slightly acid solution of copper nitrate, is inaccurate on account of the solubility of barium sulphate in copper nitrate solution.

There are two or three possible sources of error in W. Lampe's method, which consists in passing pure dry chlorine gas over the heated copper, and absorbing the sulphuric acid evolved in water saturated with chlorine. The sources of error are:—1. The existence of the sulphur in different forms. 2. The incomplete removal of oxygen and other impurities from the chlorine gas. 3. The formation of a layer of melted chloride, which may prevent the complete oxidation of the sulphur.

The author made a series of experiments to test the accuracy of H. J. Phillip's method (*Chem. New.* **62**), in which the sulphur is precipitated from a hydrochloric acid solution, after removing all the nitric acid by repeated evaporation. He obtained the following results:—With 0.1 gm. of copper present and the volume of the solution not exceeding 100 c.c., the barium sulphate is completely precipitated whether the solution is strongly acidified or not. With 2.5 grms. of copper and the volume of the solution increased to 350 c.c., the barium sulphate is completely precipitated in 72 hours. If the copper be increased to 10 grms., the precipitation is very slow, and in the strongly acidified solutions at least, is not complete. Cupric chloride retards the precipitation of the barium sulphate, especially when strongly acidified. The following is an accurate method devised by the author and L. M. Norton and improved by the former.

Enough copper is taken to yield a weighable amount of barium sulphate, generally about 10 grms.

Dissolve the copper in a mixture of 60 c.c. of nitric acid (1.42 sp. gr.) and 15 c.c. of hydrochloric acid (1.20 sp. gr.), in a large beaker over an alcohol flame. Evaporate nearly to dryness, add 50 c.c. of strong nitric acid and evaporate again. Repeat this operation and then add 300 c.c. of water and a little nitric acid, if a trace of basic salt remain undissolved. The addition of hydrochloric acid and subsequent evaporation with nitric acid may be dispensed with if experiment shows that nitric acid alone will oxidise all the sulphur in the material operated upon.

Filter into a 700 c.c. beaker and make up to 600 c.c. with distilled water. Introduce two electrodes, a large cone or a sheet of platinum 4 by 5 inches as the negative, and a piece of platinum wire or foil as the positive. Cover the beaker with glass and connect the electrodes, preferably with an Edison incandescent lamp circuit. When the liquid is colourless or nearly so, remove the electrodes and wash them with distilled water, allowing the washings to run into the main solution. Pour off the clear liquid from any bits of spongy copper, washing these on a small filter. Add 0.1 gm. of pure sodium carbonate and evaporate to dryness over an alcohol flame, being careful to avoid loss by spitting. Heat strongly and then allow to cool. Add to the residue 10 c.c. of strong hydrochloric acid and 5 c.c. of water and evaporate to dryness on the water-bath. Repeat this and then dissolve in 50 c.c. of water and 1 c.c. of strong hydrochloric acid, filter and

wash with hot water. Heat the solution of sodium sulphate to boiling, precipitate with a slight excess of barium chloride and allow to stand for 24 hours, or, if the results be desired at once, keep the liquid at a temperature of not less than 75 °C. for three hours. If lead be present, it will mostly remain in solution, and be deposited on the platinum, but if any lead sulphate remain on the filters, they must be boiled with a solution of pure sodium carbonate, the solution filtered, and the sulphuric acid recovered as barium sulphate.

The acids and distilled water used in the analysis should be measured and a blank analysis made.—A. S.

Pig-Iron, Determination of Graphite in. P. W. Shimer. *J. Amer. Chem. Soc.* 1895, **17**, 873—876.

THE estimation of graphite by the treatment of iron with hydrochloric acid is known to give higher results than when nitric acid is used, and the former process is therefore generally preferred. The difference is now found to be due to titanium carbide, which is insoluble in hydrochloric or sulphuric, but soluble in nitric acid. Other insoluble carbides, for example, that of vanadium, may also contribute to the result. In a pig-iron, containing 0.399 per cent. of titanium, and therefore 0.1 per cent. of carbon in the form of TiC, the graphite as determined by nitric acid was 3.206, and by hydrochloric acid 3.327 per cent. The hydrochloric residue from this iron, boiled with nitric acid (1.2 sp. gr.) for an hour, lost so much in weight that the final result agreed with that obtained by direct solution of the iron in nitric acid. The author has never met with a sample of pig-iron free from titanium, and usually finds from 0.05 to 0.40 per cent. of this element, which would therefore increase the apparent percentage of graphite, as determined by hydrochloric acid, by from 0.013 to 0.1 per cent. In irons which have a coarsely crystalline fracture, the cubical crystals of titanium carbide will always be found. It is therefore desirable to make determinations of the total carbon, of the true graphite by the nitric acid method, and of the carbon insoluble in hydrochloric acid; which would show the amount of graphite, of carbon combined with iron and manganese, soluble in hydrochloric acid, and of carbon in the form of carbides insoluble in that acid. In high-silicon low-sulphur titaniferous irons the percentage of insoluble may exceed that of the soluble carbides. If the insoluble carbon be present as titanium carbide disseminated in crystals through the metal, it probably has less influence upon the hardness of the pig-iron than if it be diffused as iron and manganese carbides, and it is therefore probably better that it should be reported as graphite than as combined carbon; and hydrochloric acid would in this case be the more satisfactory solvent to employ alone. But in any case the method employed should be stated.—W. G. M.

Cast-Iron, White; The Evolution Method for the Determination of Sulphur in. F. C. Phillips. *J. Amer. Chem. Soc.* 1895, **17**, 891—900.

IT has long been recognised that the evolution method gives low results with cast-iron samples that contain much combined carbon. Experiments with an iron containing 0.17 per cent. of sulphur, as found by the aqua regia method, are described at length, the object being to find and to obviate the sources of error. On treating the iron with hydrochloric acid and absorbing the gases in bromine water, an oil condensed in the absorption flask. This oil was separated, and found by ignition in nitrous oxide to contain sulphur; this sulphur thus resisted oxidation by bromine, and heating with concentrated nitric acid for two hours also failed to convert it into sulphuric acid; but evaporation with barium nitrate, followed by ignition, led to the formation of barium sulphate. The oil, however, was not a pure sulphur compound, it gave acetylene on treatment with alcoholic potash, and probably, therefore, contained ethylene dibromide. Drops of oil left in the evolution flask also gave evidence of containing sulphur, whilst the silica remaining in the flask, when extracted with boiling alcohol and boiling chloroform, successively, as in the process of fat extraction, yielded a yellow oil, which was left on distilling off the solvent, and contained sulphur.

The siliceous residue, after extraction, was free from sulphur. Finally the ferrous chloride left in the flask yielded a sulphur compound to chloroform by agitation. There were thus obtained from 100 parts of the iron—in the oil from the bromine solution, 0.008; in the oil rinsed from the evolution flask, 0.010; in the siliceous residue, 0.013; and in the ferrous chloride, 0.009; or 0.04 parts in all of sulphur; and this was exclusive of any contained in more volatile compounds lost in evaporation. By passing the gases from the dissolving iron through alkaline lead acetate, in addition to the black lead sulphide, there was produced a yellow precipitate soluble in excess of the liquid, which gave unmistakable evidence of the presence of methyl hydrosulphide; on passing the gases through alcoholic mercuric chloride, a white precipitate was formed which had the properties of $(\text{CH}_3)_2\text{S} \cdot \text{HgCl}_2$, so that methyl sulphide was probably present also.

Attempts were made to obtain satisfactory analytical results by oxidising the gases by combustion, but, for various reasons given, the experiments were unsuccessful. The following process was ultimately devised, and was found to give results which accorded well with those obtained by the *aqua regia* method. The iron was dissolved in hydrochloric acid (sp. gr. 1.12) with a slow stream of carbon dioxide passing through the flask, heat being applied as the action became slower; the mixed gases were led through a porcelain tube heated to dull redness, whereby methyl sulphide and hydrosulphide would be converted into H_2S . The delivery tube from the flask projects so far into the porcelain tube that it allows any drops of condensed liquid to fall upon a roll of platinum foil 8 ins. long, placed within the porcelain tube for the purpose (to minimise risk of fracture). The gases then pass to a nitrogen flask containing a hydrochloric acid solution of bromine as an absorbent, and thence to the bottom of an 8-litre flask containing a little of the same solution to retain the last traces of sulphuric acid, which would otherwise escape. The flask containing the ferrous chloride must be kept gently boiling for two hours, a slow current of CO_2 passing all the time, to ensure the removal of all the oily particles. Two samples of cast-iron gave the following results as the mean of several sulphur determinations in each case:—By the *aqua regia* method, 0.160 and 0.171; by the old evolution method, 0.052 and 0.094; and by the author's method, 0.099 and 0.180 per cent. respectively.—W. G. M.

Manganese and Tin, Quantitative Electrolytic Analysis
of. C. Engels. Ber. 1896, 23, 3182–3189.

Manganese.—The deposition of an adhesive coating of manganese peroxide upon a roughened anode surface has not hitherto been effected successfully with more than 0.05 gm. of manganese present. With suitable proportions of ammonium acetate, hydrogen peroxide, and ammonia a greater weight of manganese may be determined, but the best results are obtained in the presence of chromium oxide, whereby 0.7 gm. of manganese peroxide may be separated in a perfectly adhesive form in the space of an hour and a quarter. A dish with a matt surface must be employed, in it the manganese salt is dissolved in about 50 c.c. of water, 10 grms. of ammonium acetate, and from $1\frac{1}{2}$ to 2 grms. of chrome alum are added, and then after making up the solution to 150 c.c., it is heated to 80°C . and electrolysed with a current of $\text{ND}_{100} = 0.6$ to 1 ampère, obtained from four accumulators joined in series. The current strength may vary within wide limits, but an increase beyond $\text{ND}_{100} = 0.9$ to 1 ampère leads to no saving of time. After electrolysing for an hour, the addition of water to the solution should show that no further deposit is coming down. The fall of potential between the electrodes ranges between 3 and 4 volts. To ensure the adhesion of the deposit, the dish must be perfectly clean, and the temperature during the deposition must exceed 80°C . The quantities above given are calculated for use with 0.2 to 0.25 gm. of manganese, and they must be increased or diminished according as the weight of manganese is greater or less than this, provided that the extreme limits, of 5 and 15 grms. for ammonium acetate, and 1 and 3 grms. for chrome

alum are not passed. The manganese must be present as sulphate, and an addition of 5 c.c. of 50 per cent. acetic acid is not prejudicial, but the use of chlorides destroys the adhesion of the oxide. After the completion of precipitation the current is discontinued, and the deposit is washed several times with water and alcohol, and dried. Although pulverulent, the particles of the peroxide should be so cohesive and adhesive that even a powerful jet of water should fail to detach any, and only rubbing (as with the finger) will suffice to dislodge them. The dish with the deposit is then heated more strongly until the change of colour to a uniform dark or light red-brown, indicates conversion into manganous-manganic oxide. The original manganese peroxide retains traces of chromic acid with great obstinacy, but the latter may be completely removed, without loosening the deposit, by washing it *after ignition* several times with cold water and alcohol. The dish, after drying, is then ignited for a moment in the blowpipe flame, cooled, and weighed. Repeated reheating is unnecessary. The dish always loses 1 mg. in weight, and this occurs during electrolysis, the final weight of the cleansed dish must therefore be deducted instead of the initial weight. During electrolysis the chromium trioxide is converted more or less completely into chromic acid, and the colour of the liquid changes accordingly from green to yellow; it is probable therefore that, by absorbing the nascent oxygen at the anode, the chromium salt prevents the formation of gas bubbles and favours the adhesion of the deposit. At the same time it appears to reduce a portion of the manganese peroxide, as the precipitated oxide usually contains only from 75 to 95 per cent. of that substance. As another reducing agent, alcohol, in the proportion of 5 to 10 c.c., with 10 grms. of ammonium acetate, and 0.2 gm. of manganese gave a good result when electrolysed at a temperature of $70^\circ\text{--}80^\circ\text{C}$. With larger quantities of manganese the deposit scaled to some extent, but only in large flakes, which could be washed in the dish easily, and without loss. The chrome addition gave similar results in this respect. The effect of 0.2 to 0.3 gm. of hydroxylamine sulphate, when added to the solution, was similar to that of urea, but 1 to 2 grms. of the hydroxylamine sulphate or chloride entirely prevented precipitation. Similar proportions of potassium nitrite and hydrogen peroxide also stopped the deposition, until they became decomposed by the action of the current. The hydroxylamine salt appears to be regenerated during electrolysis, and the quantity named suffices to retain the manganese in solution during a treatment of several hours, and since it exerts no similar influence on the deposition of lead peroxide, its use enables a quantitative separation of manganese and lead to be made. Other separations, with the help of hydroxylamine, are in progress. The results obtained by the chrome alum and the alcohol methods are accurate under the conditions named above, but the use of greater weights than 0.3 to 0.4 gm. of manganese is contra-indicated.

Tin.—Hydroxylamine salts have the same effect of preventing deposition of peroxide upon the anode in tin solutions that they have in the case of manganese. Working in the cold a low current density ($\text{ND}_{100} = 0.2$ ampère) and a high voltage (7 volts) is desirable. Certain other salts, may with advantage be added; and the process finally recommended as applied to the analysis of pure ammonium-stannic chloride, is as follows:—About 1 gm. of the double salt is dissolved, and any slight turbidity is cleared up by the addition of a few c.c. of oxalic acid solution; about 0.3 to 0.5 gm. of hydroxylamine sulphate, 2 grms. of ammonium acetate, and 2 grms. of tartaric acid are then introduced, the solution is made up to 150 c.c., heated to $60^\circ\text{--}70^\circ\text{C}$., and electrolysed at that temperature with a current of $\text{ND}_{100} = 0.9$ to 1.0 ampère and 4 to 5 volts. Evaporation must be checked by means of a cover-glass, or a dark ring will form around the top of the deposit. With 1 gm. of the double salt, the tin should be completely deposited in three hours as a brilliant white and lustrous deposit. Using the same solution cold, with a current of 7 volts and $\text{ND}_{100} = 0.15$ ampère, the deposit had not such a brilliant appearance, but the quantitative results were equally satisfactory.—W. G. M.

Manganese, Volumetric Estimation of. G. Auchy.J. Amer. Chem. Soc. 1895, **17**, 943—947.

The author's experience with Williams' method of estimating manganese in steel, leads him to conclude that it usually but not always, gives accurate results. Attention is drawn to the following precautions in the practice of Volhard's method (this Journal, 1884, **3**, 522). 1. Too great an excess of sulphuric acid should be avoided during the evaporation to dryness. 2. The dry mass after cooling a minute or two should be taken up with hot water, for if cold water be used, on subsequent boiling red ferric sulphate separates, containing a considerable amount of manganese which remains insoluble. 3. It is essential that too large a quantity of zinc oxide should not be used, as it will separate when the solution is heated, and retard or completely prevent the deposition of manganese dioxide according to whether the steel is high or low in manganese, and thus render the observation of the end of the titration impossible. Before the zinc oxide is added the solution should be of small bulk, and nearly neutralised with sodium carbonate. 4. During titration the reddish colour produced by the permanganate should be completely changed into a clear yellow by shaking, before adding more, and at the end the liquid must be permanently rose-coloured after a dozen shakings.—J. L. B.

Molybdenum, Estimation of. C. Friedheim and H. Euler. Ber. 1895, **28**, 2061—2067.

I. Gravimetric Methods.—The estimation of molybdenum and its separation from the alkali metals has recently been effected by heating the molybdenum salt to 440° C. in a current of dry hydrochloric acid gas. An alkaline chloride remains behind and the molybdenum distils over in the form of the acid chloride $\text{Mo}(\text{OH})_2\text{OCl}_2$ (or $\text{MoO}_3 \cdot 2\text{HCl}$) which is condensed by passing into water. The solution, on evaporation, yields molybdenum trioxide which is weighed.

This method is, unfortunately, not always applicable, Peckard having shown that, in the presence of ammonium salts, or in combination with a metal yielding a readily fusible chloride, the molybdenum is not completely volatilised as acid chloride. In such cases the older analytical methods must be employed.

The authors of the present paper have found that the oxidation of the sulphide is best effected by direct heating, providing the following mode of procedure be followed.

The sulphide, precipitated from ammonium sulphide solution by means of dilute hydrochloric acid or from hydrochloric acid solution by the action of sulphuretted hydrogen, is allowed to settle and is then filtered. It is first washed with water containing a little sulphuric acid, and finally, to remove the acid, with aqueous alcohol. The moist filter paper and contents are now placed in a weighed porcelain crucible and dried at about 100° C. The covered crucible is next cautiously heated until hydrocarbons cease to be evolved, and, after removal of the lid, the carbon adhering to the crucible wall is burnt at as low a temperature as possible. The temperature is then carefully raised to convert the sulphide into oxide, this has been done when sulphurous anhydride ceases to come off. The trioxide is next dissolved in ammonia solution and filtered, and the filtrate evaporated to dryness. The residue is gently ignited until the ammonia has disappeared and the colour has become a uniform yellow; it is then weighed as trioxide.

The method gives good results and is applicable to the analysis of phosphorus and arsenic molybdates, &c.

II. Volumetric Methods.—The authors have found that, observing due precautions, the determination is best made in a Bunsen apparatus. They proceed as follows:—

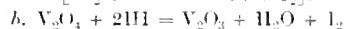
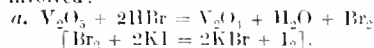
0.2—0.3 gm. of the molybdate is placed in the distilling flask of a Bunsen's apparatus with 0.5—0.75 gm. of potassium iodide and sufficient hydrochloric acid (sp. gr. 1.12) is added to fill the flask two-thirds full. The apparatus is then connected up and the contents of the flask gradually warmed and only raised to boiling temperature when the conducting tube is filled, as much as possible, with iodine vapours and danger of the condensing liquid flowing back begins. When the iodine is completely evolved, i.e., when no more red vapours are visible and the solution is of a light

green colour, the distillation is interrupted, and the iodine absorbed in the condensing flask in potassium iodide solution, titrated with sodium thiosulphate.

Care must be taken not to heat too rapidly at the start, or hydriodic acid may be evolved, and become decomposed by the air in the neck of the apparatus. The method cannot be used for molybdates of such bases as iron, which themselves separate from KI.—J. T. C.

Molybdenum Trioxide and Vanadium Pentoxide, Estimation of, in the Presence of each other. C. Friedheim and H. Euler. Ber. 1895, **28**, 2067—2073.

The method depends upon the fact that whereas molybdenum trioxide oxidises hydriodic acid, with liberation of iodine, it is without action on hydrobromic acid, whilst, according to Holverscheidt, the latter acid is readily acted upon by vanadium pentoxide, which undergoes quantitative reduction to the tetroxide. The following reactions are therefore involved:—



The authors show that hydrochloric acid is not sufficient to ensure complete reaction between V_2O_5 and KI, and that the presence of some other acid, such as phosphoric acid, is necessary; and further, that the reduction of V_2O_5 by successive treatment with hydrobromic and hydriodic acids proceeds in two equal stages.

The following mode of procedure for the separation of molybdenum and vanadium is then given:—

The substance is decomposed by distilling in a Bunsen's apparatus with potassium bromide and concentrated hydrochloric acid, and the iodine, liberated by passing the evolved bromine into KI solution, estimated with $\frac{1}{50}$ normal thiosulphate solution. To the cooled contents of the distilling flask about 1 gm. of solid potassium iodide and 1—2 c.c. syrupy phosphoric acid are added, and the distillation continued till the red colour, due to the distilled iodine vapours, has vanished. The iodine set free is titrated with thiosulphate, and by subtracting the amount of thiosulphate first used from the value now obtained, the number of c.c.'s due to molybdenum compounds, is found.

The authors state that this method (dependent on the varying stabilities of the halogen acids towards different oxidising agents) is capable of extended application.

—J. T. C.

Silicates, Decomposition of, by Boric Acid. P. Jaunisch. Ber. 28, 1895, 2822—2823.

In this preliminary note the author states that he has successfully decomposed silicates by fusion with dried boric acid. One gm. of the finely-powdered silicate is mixed with 5—6 grms. of the dried acid and strongly ignited for 15—20 minutes. The fused mass is then either completely soluble in hot water and alcohol, or only leaves a precipitate of silica behind. The solution is evaporated to dryness, the excess of boric acid expelled by repeatedly evaporating with strong hydrochloric acid and methyl alcohol, and the analysis is then conducted in the usual way.—J. S.

Potable Waters, Determination of Nitrites in. A. H. Gill and H. A. Richardson. J. Amer. Chem. Soc. 1896, **18**, 21—23.

The authors have tested a large number of waters for nitrites, both by Trommsdorff's iodo-zinc starch method and by Griess's α -naphthylamine test, and they find very marked discrepancies in the results obtained by the two methods when applied to peaty waters. For instance, in cases where the Griess test showed as much as 0.0010 part of nitrogen (as N_2O_5) per 100,000, the Trommsdorff method gave no blue coloration. This difficulty can be overcome and concordant results obtained if the water be decolorised by agitation with "milk of alumina" and then filtered. This milk of alumina is prepared by precipitating a boiling solution of 125 grms. of potash alum per litre, with ammonia, letting the alumina settle, and washing by decantation. Even with Griess's test it is found advantageous to decolorise peaty waters before applying the test.

The authors regard 0.0001 part of nitrogen (as N_2O_5) in 100,000 as the limit of the naphthylamine test, whilst the iodo-zinc starch method is incapable of indicating less than 0.0002 part of nitrogen per 100,000.—A. K. M.

Zinc, Sulphur and Carbon in. R. Funk. Ber. 1896, 28, 3129.

See under X, page 200.

ORGANIC CHEMISTRY.—QUALITATIVE.

Primary and Secondary Nitro Compounds, A Delicate Reaction for. M. Konowalow. Ber. 28, 1850—1852.

VICTOR MEYER'S reaction for nitro compounds is only satisfactory for those of low molecular weight, whereas their detection is a simple matter by the following reaction, depending upon the red colour of a ferrie salt formed. A small quantity of the substance is shaken with sodium alcoholate and the salt is extracted with water, the solution being subsequently mixed with a small quantity of ether or benzene. Ferrie chloride is then added to the mixture, which is vigorously agitated after each addition. A red coloration indicates the presence of a nitro compound. The colour due to the formation of a ferrie salt is more marked the higher the molecular weight of the compound, owing to the insolubility in water of the higher homologues and their greater solubility in ether, benzene, &c. As an example of the delicacy of the reaction, 1 part of α -phenyl-nitropropane ($C_6H_5CH_2CH_2NO_2$) in 14,000 parts of benzene gave a distinct coloration with ferrie chloride after standing about one hour in contact with the sodium alcoholate. The reaction is not given by isopropyl nor by amyl nitrite.

—T. A. L.

Sesame Oil, The Characteristic Reaction of. J. Wauters. Bull. de l'As.-oc. Belge des Chimistes, 9, 275—280.

REFERRING to the modification in the Baudouin reaction introduced by Villavecchia and Fabris (this Journal, 1894, 69), the author states that it may be rendered still more delicate by simply pouring the oil to be tested into the tube containing the reagents. The coloration forms at the point of contact, and is not masked by the yellow colour occasioned by rancid olive oil.

In testing butter, the latter should first be melted at 40 to 45°, which prevents setting from contact with the cold acid. As low as $\frac{1}{4}$ per cent. of sesame oil is detected by this reaction in fresh butter, but rancidity may cause sufficient brownish tinge to hide the rose coloration when the sesame oil is merely present in minute quantity.

The same reaction may be employed to detect the presence of furfural in distillation products by agitating 10 c.c. of sesame oil with an equal quantity of HCl and then adding the alcohol to be tested. The reaction is sensible to $\frac{1}{1000}$ part of furfural in the alcohol, but where the quantity is slight the amount of alcohol tested must be increased, 2 c.c. being required for the detection of the proportion just named. Of course the absence of bodies, such as sugar, yielding furfural on contact with HCl must be ascertained, but aldehyde, acetone, and amyl alcohol are without effect on the reaction.—C. S.

Albuminoid and Phenols, Some Reactions of. E. Ackermann. Rev. Chim. Indust. 1895, 6, 322.

TREATED with Millon's reagent, albuminoids yield a deep red colour, which appears slowly in the cold and rapidly at

REACTIONS OF MILLON'S REAGENT WITH VARIOUS PHENOLS AND PHENOLOID SUBSTANCES.

Substance.	I.			II.	
	At once, Cold.	In 10—15 Minutes, Cold.	Hot.	At once, Cold.	Hot.
Gallic acid.....	Yellow	Grey-yellow	Blackish	Brick-red	Greenish-black
Pyrogallol.....	Brownish	Brownish	Brown-black	Reddish	Red
Salicylic acid.....	Yellowish	Brown-rose	Reddish-brown	Whitish	Pale pink
Tannin.....	Pale yellowish	Yellowish	Yellowish	Yellowish-brown	Brown-black
Morphine hydrochlorate.....	Reddish-brown	Pale yellow	Greyish	White	Pale yellow
Creosote (beech).....	Red	Reddish-brown	Brown-black	Greyish	Red
Cresylol.....	"	"	"	"	Grey-yellow
Guaiacol.....	"	"	"	Pale violet	Reddish-yellow
Naphthol α	"	"	"	"	Yellow
" β	Bright red	"	Brown	Yellow	Orange-yellow
<i>o</i> -Hydroxyquinoline.....	Orange	Orange	Deep red	Pale rose	Yellow
Phenolphthalein.....	"	"	Deep red	Cloudy	Greyish
Resorcinol.....	"	"	Red	Whitish	"
Salicin.....	"	"	"	"	"
Salol.....	Pale yellowish	Pale yellow	Brown	Whitish	Yellowish
Morphine sulphate.....	Rose	Purple	Deep red	"	Pale rose
Zinc sulphocarbolate.....	Brown-rose	Reddish-brown	"	"	Yellow
Thymol.....	"	"	"	"	"

Substance.	III.			IV.	
	At once, Cold.	After some Minutes, Cold.	Hot.	At once, Cold.	Hot.
Gallic acid.....	Yellow	Yellow-brown	Yellow-brown	Yellow	Yellow
Pyrogallol.....	Brown	Brown-black	Brown-black	Reddish-black	Reddish-black
Salicylic acid.....	Yellow	Reddish-yellow	Red	Yellowish	Reddish-brown
Tannin.....	Brown	"	Yellow	Yellow-brown	Yellow-brown
Morphine hydrochlorate.....	Red	Orange	Brown-red	Red	Brown-red
Creosote (beech).....	Dark brown	Brownish-red	Brown-black	Brown-black	Brown-black
Cresylol.....	Brown	"	Brown-yellow	Brown	Brown
Guaiacol.....	Reddish-black	Red	Black	Red-black	Brown-black
Naphthol α	Yellow-brown	Deep yellow	Brown	"	"
" β	Orange	Brownish-yellow	Greenish-black	"	"
<i>o</i> -Hydroxyquinoline.....	Brown-black	Brown-black	"	"	"
Phenolphthalein.....	Yellowish	Yellowish	"	"	"
Resorcinol.....	Red	Brownish-green	Reddish-black	Red	Red-black
Salicin.....	Yellow	"	Red	"	"
Salol.....	Yellowish	Yellow	Brown-red	Pale rose	Red-brown
Morphine sulphate.....	Red	Orange	Yellow	Red	Yellow
Zinc sulphocarbolate.....	Brown-red	Deep red	Brown-red	Brown-red	Red-brown
Thymol.....	Green	Deep yellow	"	Greenish-brown	Dark red

—F. H. L.

the boiling point. The same colour is also characteristic of certain phenols; while, in the cold, the reaction may or may not be obtained, according to the manner in which the mercuric nitrate is prepared. The blood-red colour produced by a solution of titanous acid in sulphuric acid on phenols is also common to albuminoids in the dry state; and the red colour formed by the action of sulphuric acid in presence of sugar on the albuminoids, is yielded by certain phenols: resorcinol, naphthol, creosote, guaiacol, &c., and also by such bodies as morphine.

The colours recorded in the table were obtained by acting on 0.01 grm. of the substance with about 20 drops of the following reagents:—1. Millon's reagent—prepared by dissolving mercury in an equal weight of cold strong nitric acid, warming, adding double the volume of water, and decanting the clear portion after 24 hours. 2. Mercuric nitrate dissolved in a little water. 3. One part of mercuric oxide and two of nitrate in four of nitric acid. 4. One part of the nitrate in three of nitric acid.

Thymol and Carvacrol, Test for. W. G. Correll. Pharm. Review, 14, 33.

THESE substances are characterised by a beautiful purple-red coloration, produced by heating 0.01 grm. of such an oil as *Pycnanthemum lanceolatum* with 0.01 grm. of caustic potash and 20 drops of chloroform. Commercial carvacrol and thymol both give the same colour, as do also the oils of monarda and thyme, which are known to contain these phenols. Three samples of pennyroyal oil, two each of spearmint and turpentine oils, and one each of the oils of spike, lavender, rosemary, balm, peppermint, juniper, savin, cedar, balsam, fir, and white spruce were examined, but none of them gave this reaction, so characteristic for carvacrol and thymol.—W. S.

Sugar, The Action of, on Ammoniacal Silver Nitrate. J. Henderson. Proc. Chem. Soc. 1895, [159], 9.

THE author has investigated the reducing powers of the following substances on ammoniacal silver nitrate, viz., glucose, levulose, galactose, cane-sugar, starch, dextrin, lactose, and maltose. The results obtained may be thus summarised:—

(1.) When glucose, levulose, and galactose are heated with ammoniacal silver nitrate under the given conditions, a definite factor can be found in each case.

(2.) Cane-sugar, starch, and dextrin, when heated under the same conditions, exert no reducing action on ammoniacal silver nitrate.

(3.) In the case of lactose and maltose a definite factor cannot be obtained, owing to the gradual hydrolysis of the disaccharide by the ammonia.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Asphalts, Analysis of. S. P. Sadler. J. Franklin Inst. 1895, 5, 383—386.

THE author proposes the following plan as an improvement on that elaborated by L. A. Linton (this Journal, 1895, 315): 1—2 grms. of the finely-powdered sample are mixed with 10 grms. of sand carried on a felt of asbestos in a weighed Gooch crucible. The whole is dried at 100° C. and weighed. If the sample be a "maltha" (liquid bitumen), it is gently mixed with the sand layer, after slightly softening it in the drying oven. The crucible and contents are placed in a continuous-extraction apparatus formed by a small percolator within a larger, the inner percolator being held in position by a perforated cork. The outer percolator is connected with a flask and a vertical condenser, and extraction with acetone carried on until the loss of weight of the crucible and contents in 2 hours, does not exceed 2 mgrms. The matter extracted as acetone is reckoned as "petroleum." The extraction is continued with chloroform, the fraction thus extracted being called "asphaltene." A total extraction of 12 hours with acetone and 8 hours with chloroform usually suffices. The crucible containing the insoluble organic matter and ash, is then ignited in the ordinary way. Refined Trinidad asphalt tested in this manner was found to have the composition:

petroleum, 46.40; asphaltene, 15.14; organic non-bituminous matter, 3.02; ash, 35.44.—B. B.

Linseed Oil and Varnish, The Examination of. H. Amsel. Rev. Chim. Indust. 1895, 6, 313, and 1896, 7, 13.

LINSEED oil ought to be kept at least one or two years after expression, being drawn off from one tank to another every three months. Spread as a thin film on glass, it should then dry in three days, the glass plates being kept in a sloping position, about 30° from the horizontal, during the test.

Of the new low-temperature methods of making varnish, that devised by Andés is considered by Amsel as the best, the oil being heated to 132° C. in presence of oxygen or unstable metallic oxides. Summer has brought out a new varnish substitute, consisting of a mixture of fish oil and a hydrocarbon such as benzene or light petroleum. To remove the free fatty acids, the varnish is subjected to a current of dry air until all acid vapours have disappeared, a little terebenthine being added, and also some manganese soap if the varnish is to dry quickly.

Linseed oil yields, as harya number, 18.7; rape oil, 17.6; and fish oils, 25.2 to 52.8.

The author holds that the saponification number is a good index of the purity both of oil and varnish, whilst if the alcoholic soap solution obtained in the process before titration is diluted with water, the mixture should remain perfectly clear. (See also this Journal, 1895, 605.)

—F. H. L.

Beet Juice, Acids, Mineral and Organic, in, Simultaneous Determination of. D. Sidersky. Comptes rend. 1895, 121, 1164—1165.

THE alcoholic fermentation of beet juice is largely influenced by the proportion of organic acids set free by the added sulphuric acid to the amount of the latter remaining unsaturated. The differential determination of these acids may be effected by the use of suitable indicators. Blotting paper moistened with a $\frac{1}{10}$ per cent. aqueous solution of Congo Red 4 R' is turned blue by free mineral acids, whilst it is unaffected by free organic acids.

A still more delicate method is to make use of the colouring matter present in the juice. In beet juice a substance is present which rapidly absorbs oxygen from the air with the production of a reddish-brown coloration. This oxidation is, however, hindered by the presence of free sulphuric acid, the latter producing a clear and pale liquid. If now a titrated solution of potash be added (the titration being carried out in a shallow basin) the reddish-brown colour is noticeable and very distinct as soon as the free sulphuric acid is neutralised. The two methods give very concordant results, but the latter one is the simpler. The mineral acid found subtracted from the total acidity, of course gives the organic acid. High total acidity with a low proportion of mineral acid is disadvantageous to fermentation.—L. T. T.

Levulose, Estimation of, in Honey and other Substances. H. W. Wiley. J. Amer. Chem. Soc. 1896, 18, 81—90.

THE method described, is based upon the change in specific rotatory power which levulose exhibits when submitted to changes in temperature. A convenient form of jacket for the observation tube is described, and renders the employment of different temperatures comparatively easy. The observation temperatures recommended are 0° and 88°, but intermediate temperatures may also be employed, the specific rotatory power of levulose at the temperatures named being $[\alpha]_D = 108.21^\circ$ and 53.0° respectively. The solution to be tested should contain approximately 14 grms. of levulose in 100 c.c., and this is usually the case when about 38.5 grms. of honey are used in the estimation. The formula for calculating the results is:—

$$L = \frac{R}{K(t - t')} \div W, \text{ in which}$$

K = deviation in divisions of cane-sugar scale, or in angular rotation produced by 1 grm. of levulose for 1° temperature.

T and T' = the temperatures at which observations are made.

R = observed deviation in rotation.
W = weight of levulose obtained.
L = per cent. of levulose required.—A. K. M.

Wine, Estimation of Alcohol and Extract by the Refractometer. E. Riegler. Zeits. Anal. Chem. 1896, **35**, 27—31.

By this method the alcohol and extract in wine may be rapidly determined, with consumption of comparatively little material. The data required are the refractive indices of—

1. The original wine = N.
2. The de-alcoholised wine, diluted to its original volume with water = b.
3. Distilled water = a.

The observations should all be made at the same temperature, and with an instrument yielding results accurate to 5 decimal places. Then—

$$\frac{N-b}{0.00068} = \text{alcohol in grms. per 100 c.c. of wine.}$$

$$\frac{b-a}{0.00145} = \text{extract, " " " "}$$

The above formulæ are, of course, purely empirical, but appear to yield satisfactory results, and are, according to one analysis, also applicable to beer.—H. T. P.

Butter, Testing of, by Viscosity Determinations. Pollenske. Apoth. Zeit. **11**, 97.

By direction of the German Sanitary Department the author tested the method of determining adulteration by estimations of viscosity, as suggested by Killing. He has found that the viscosity of butter varies so much that a very considerable admixture of margarin might escape detection.

—W. S.

Bergamot, Oil of, Examination as to Purity.

A. Bornträger. Zeits. Anal. Chem. 1896, **35**, 35—38.

The proportion of linalyl acetate ($C_{10}H_{17}O \cdot C_2H_3O$) existing in oil of bergamot, appears to be sufficiently constant to serve as a criterion of purity. According to Schimmel and Co. (this Journal, 1895, 605) the genuine oil contains 34—43 per cent. of linalyl acetate; although inferior samples from immature fruit or press residues, especially when prepared by steam distillation, may contain considerably less. Campelo found in five specimens obtained by pressure (not distilled) 37.6—39.9 per cent. of ester. The latter figures the author considers to be fairly representative, and therefore adopts 38 per cent. of acetate as a minimum standard. The determination of linalyl acetate is made by boiling 1—2 grms. of the oil with 10—20 c.c. of semi-normal alcoholic potash for 1—1½ hours, the unconsumed alkali being finally titrated in the usual way. The proportion of free acid contained in oil of bergamot is, as a rule, very small, and may be neglected; but is readily determined by direct titration in alcoholic solution.

Oil of turpentine, the adulterant most frequently employed, yields, when tested as above, 1.1—1.5 per cent. of (apparent) linalyl acetate; any gross addition (exceeding 10—25 per cent.) of the same to oil of bergamot would therefore be at once detected. The deficiency in saponifiable matters, due to adulteration with turpentine, may, however, be made good by the simultaneous addition of fixed oils (and possibly rosin, acid anhydrides, &c.), so that the above test would fail to indicate the adulteration. For this reason the non-volatile matters should be determined—at least, in the case of samples not yielding a clear mixture with 1½—2 volumes of 80 per cent. alcohol—by heating 2—5 grms. of the oil on a water-bath until odourless. The weight of the residue should not exceed 6 per cent. of the whole. In any case the presence of rosin would be indicated by a relatively high percentage of free acid (abietic acid, &c.).—H. T. P.

Alkaloids, Volumetric Determination of, by Means of Iodine Solutions. C. Kippenberger. Zeits. Anal. Chem. 1896, **35**, 19—27.

THE author describes a general method for the titration of alkaloids, and to this end has investigated the composition of the super-iodide precipitates produced by the interaction of alkaloid, iodine and potassium iodide—and, in some cases,

hydriodic acid—solutions in varying proportions. In every case the unconsumed iodine and potassium iodide remaining in solution were estimated by titration with thiosulphate, the combined iodine (KI) being for this purpose liberated by means of potassium bichromate and sulphuric acid, and extracted by chloroform prior to titration. The results (in respect to narcotine, strychnine, and atropine) are tabulated.

As a rule the proportions of iodine and potassium iodide consumed, are considerably in excess of those demanded by the equation $Alk. HCl + KI + I_2 = Alk. HI. I_3 + KCl$, and are subject to fluctuations depending chiefly on the concentration of the solution in potassium iodide and the excess of the latter employed. This is explained on the theory that at first alkaloid hydriodide and hydrogen peroxide are formed by the action of the free iodine. The peroxide then attacks the potassium iodide present, setting free iodine, which at the moment of liberation is mechanically carried down and retained by the super-iodide precipitate. In confirmation hereof, iodine could frequently be extracted from the precipitates by treatment with strong potassium iodide solution.

The author concludes, however, that reliable quantitative results may be obtained, providing the actual analysis and the standardisation of the iodine solution be effected under as nearly as possible identical conditions as regards quantity and species of alkaloid, concentration of its solution, excess of reagent employed, &c. By trial, the proportion of potassium iodide that must be used in order to arrive at a consumption of 31:1 Alk. is readily found. In the case of strychnine solutions, however, by first adding potassium iodide and then, immediately afterwards, iodine in excess, the consumption of the latter is reduced to the theoretical amount (2 atoms).—H. T. P.

Ergot, Valuation of. H. Beckurts. Oesterr. Zeits. **1**, 31.

A VARIETY of samples was examined—Russian, Austrian, Spanish, and German. It was found that by percolation with petroleum spirit, the fixed oil but no alkaloid was removed. 25 grms. of each sample were therefore freed from oil by that means, dried, and shaken with 100 grms. of ether and 1 gm. of magnesia, previously suspended in 20 c.c. of water. 60 grms. of the ethereal solution were freed from alkaloid by repeated agitation with 0.5 per cent. hydrochloric acid, from which the alkaloid was then removed by ammonia and ether. The ether-ammoniacal liquid on evaporation left a yellowish-white crystalline residue of alkaloid. The determinations agreed with those previously made by Keller. It was shown that Russian and Austrian ergots were the best, the richest containing 0.2 per cent., whilst the best German yielded 0.15 and Spanish 0.14 per cent. Drying by artificial heat diminished the yield of alkaloid by about 10 per cent.—W. S.

Mercurous Tannate, Determination of Mercury in. C. Glücks-mann. Oesterr. Zeits. **1**, 147.

THE method of mercury determination usually adopted in the case of this preparation, the author finds to be unreliable. He prefers to dissolve the substance in aqua regia, dilute with water, reduce by means of a solution of pure barium hypophosphite acidified with hydrochloric acid, the precipitated mercurous chloride being filtered off. This is then dissolved in a measured quantity of decinormal solution of iodine with the aid of a little KI, and the excess of iodine is removed by a measured quantity of decinormal solution of sodium thiosulphate, the excess of which is determined by titrating back with the iodine solution. The author claims that quick and accurate results are attainable by his method.—W. S.

Alkaline Benzoates, New Method of Determining, by Titration. G. Rebière. J. de Pharm. et de Chim. 1896, **3**, (3), 113—116.

A WEIGHTED quantity of the benzoate is dissolved in water, hydrochloric acid added in slight excess, and the whole is evaporated to dryness so as to volatilise, not only the excess of hydrochloric acid, but also the whole of the benzoic acid. The base remains as chloride, and in this chloride the chlorine is determined volumetrically by Mohr's method

with the aid of decinormal silver nitrate. The same weight of the benzoate is again dissolved in water and the amount of sulphuric acid necessary to exactly unite with the base is calculated from the previous process (Mohr's titration), and this is then added to the solution. The benzoic acid will thus be set free by its precise equivalent of sulphuric acid thus added, and can be determined by standard alkali, using phenolphthalein as indicator. The results are said to be exact. The method cannot be used for ammonium benzoate owing to the volatility of ammonium chloride, but the difficulty is overcome as follows:—A known weight of ammonium salt is dissolved in decinormal caustic soda, and the mixture is heated to boiling to expel ammonia, the complete expulsion of which is ascertained by the approach of a glass rod, the end of which is moistened with Nessler reagent. Thus a solution of sodium benzoate is obtained, plus the excess of soda employed. This excess is determined with decinormal sulphuric acid. Another equal weight of ammonium salt is then treated with the exact quantity of decinormal sulphuric or hydrochloric acid to unite with the ammonium, and the benzoic acid is determined as before.—W. S.

Nitrogen, Determination of, by the Absolute Method, A Difficulty in. Wyndham R. Dunstan and F. H. Carr. Proc. Chem. Soc. 1896, 48—49.

The percentage of nitrogen in acetonitrile determined by the soda-lime process, using the base, or by the absolute method, using the hydrochloride, agrees well with that calculated from the formula $C_3H_3N_2O$, which is 2.1 per cent. A few years ago Richards and Rogers (Chemist and Druggist, 38, 242) stated that when the amount of nitrogen in acetonitrile is determined in the usual manner by the absolute method, it is found to correspond with nearly twice the percentage calculated from the formula given above, and they therefore proposed to alter the formula of acetonitrile to $C_{30}H_{40}N_2O_{12}$, in accordance with the results of their determinations. Recently the authors have had occasion to determine the nitrogen in the base by the absolute method, the air being expelled from the combustion tube by carbon dioxide and the gas collected in an azetometer. They were surprised to find that over 4 per cent. of gas was obtained instead of 2.1 per cent., the calculated quantity.

A quantity of this gas having been collected in different experiments which had given too high results, a complete analysis of it was made. Nitric oxide and carbon monoxide were absent. By exploding with excess of oxygen, measuring the contraction, and absorbing the carbon dioxide, methane was proved to be present. Estimating the methane in the mixed gas, and deducting it from the total volume taken, the nitrogen amounted to almost exactly 2.1 per cent., corresponding with that calculated from the formula $C_3H_3N_2O$.

Experiments made with artificially prepared mixtures have shown that when largely diluted with nitrogen, methane is burnt very slowly and with difficulty by red-hot copper oxide. In conducting the process in the usual manner the influence of the carbon dioxide used to expel the air from the tube, no doubt greatly aggravates the difficulty. Acetonitrile seems to be exceptional in giving rise to so much methane during combustion. Possibly the difficulty might be overcome by mixing the alkalioid, not merely with finely powdered copper oxide, but also with a more powerful oxidising agent, as, for example, lead chromate. Neither acetonitrile hydrochloride, benzoconiac, nor acetonitrile hydrochloride present this anomaly, and it has been observed that if acetonitrile be introduced into the tube along with a little cuprous chloride, the percentage of nitrogen gas obtained corresponds very nearly with the calculated quantity.

Coals, The Caking Power of. L. Campredon. Rev. Chim. Indust. 1896, 7, 8.

See under II., page 186.

Coals, Determination of their Heating Effect. W. A. Noyes, J. R. McTaggart, and H. W. Craver. J. Amer. Chem. Soc. 1895, 17, 843.

See under II., page 185.

Acetylene from Calcium Carbide, Separation of Phosphorated Hydrogen from; the Preparation of Pure Silver Acetylde, Silver Nitrate, &c. C. Willgerodt. Ber. 1895, 28, 2107—2115.

See under II., page 188.

Wine, Technically Pure Glucose used in the Production of. Bearing thereon on the Detection of Adulteration. W. Fresenius. Zeits. Anal. Chem. 1896, 35, [1], 50.

See under XVII., page 210.

Guncotton, Inspection of Cotton for Use in the Manufacture of. C. E. Munroe. J. Amer. Chem. Soc. 1895, 17, 783.

See under XXII., page 214.

XXIV.—SCIENTIFIC AND TECHNICAL NOTES.

Hydrogen Peroxide and Nitrous Acid; Reaction between in very Dilute Solutions. L. I. von Nagy Hlosva. Ber. 1895, 28, 2031—2032.

Highly dilute solutions (1:1,000,000) of hydrogen peroxide and nitrous acid were mixed and tested at intervals for hydrogen peroxide by means of aniline or *p*-toluidine (see page 216); for nitrous acid by means of sulphacetic acid and naphthylamine. It was found that:—

The mutual decomposition of hydrogen peroxide and nitrous acid, when existing side by side in equivalent amounts, proceeds very slowly, and is not complete even after 15—60 hours. When one of them, however, is present in excess, as compared with the other, the reaction proceeds more rapidly. The destruction of hydrogen peroxide is immediate and complete in presence of 15—20 times the amount of nitrous acid required by theory ($H_2O_2 + HNO_2 = H_2O + HNO_3$). On the other hand, nitrous acid proved far more resistant, and required for its immediate oxidation 800—1,200 times the theoretical amount of hydrogen peroxide. In any case their interaction is accelerated by direct sunlight, and proceeds somewhat more rapidly in acid than in alkaline solution.—H. T. P.

The Ferrates. C. A. O. Rosell. J. Amer. Chem. Soc. 1895, 17, 700.

The author succeeded in preparing sodium ferrate in the dry way by fusing ferric oxide with sodium peroxide. The fused mixture was treated with ice, and sodium ferrate thus obtained in aqueous solution. When water was added to the fused mass instead of ice, the resulting heat was sufficient to decompose the sodium ferrate.

Attempts to prepare iron dioxide failed, clearly proving that if this compound exist at all, it is so unstable that it is decomposed as soon as formed.

Carbon dioxide was passed through water containing barium ferrate in suspension; the barium ferrate was decomposed with formation of barium carbonate and ferric hydroxide, oxygen being set free. Barium ferrate was decomposed by hydrochloric acid with formation of chlorine. Barium chromate was digested with a solution of sodium ferrate, barium ferrate being formed along with sodium chromate. The author could not get the reverse action to take place. An alkaline sulphate decomposed barium ferrate which had not been dried, with formation of barium sulphate and ferric hydroxide, oxygen being set free.

The author found that the soluble ferrates were decomposed by nearly all soluble organic compounds, the most notable exceptions being the formates and acetates. They were also decomposed by some insoluble organic compounds, such as paper and the insoluble carbohydrates, but only very slowly by benzene and the paraffins.

The author found that the best way to prepare the alkaline ferrates was to pass chlorine through a strong

solution of the hydroxide containing ferric hydroxide in suspension.

The author points out the following errors in the literature of the ferrates:—1. The preparation of potassium ferrate by adding iron nitrites to caustic potash (Stahl). 2. That a solution of potassium ferrate turns green on standing (J. Denham Smith). 3. The insolubility of calcium ferrate in water (Fremy). 4. The preparation of thioferrates by passing hydrogen sulphide through a solution of a ferrate (Fremy). 5. The allegation that sodium ferrate cannot be made except in the wet way (Wurtz).

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—A. S.

Fixation of Nitrogen by the Metals of the Alkaline Earths. L. Maquenne. Comptes rend. 1895, 121, 1147—1148.

THE author calls attention to the fact, previously described by him, that the metals of the alkaline earths readily absorb nitrogen at a dark red heat. If a mixture of magnesium powder and lime be raised to a dull red heat, metallic calcium is freely liberated in a finely divided state. This mixture, at the same temperature, rapidly absorbs nitrogen with the formation of calcium nitride, Ca_3N_2 , and this latter compound is decomposed by water with evolution of ammonia. The lime may be replaced by barium oxide, but the absorptive power of the reduced barium for nitrogen is weaker than that of the calcium.—L. T. T.

Transparency of Ivory. Method of Modifying the. C. Raspe, Weissensee, Berlin, Germany. Eng. Pat. 24,928, Dec. 30, 1895.

THE glassy ivory is heated in oil, paraffin, turpentine, or glycerin for from 5 to 20 minutes at a temperature above 212°F , the actual temperature employed depending on the degree of turbidity required in the ivory. After removal of the adhering oil, &c. has been effected by a suitable solvent, the ivory is bleached by known methods.—A. G. B.

New Books.

HANDWÖRTERBUCH DER PHARMACIE. Praktisches Handbuch für Apotheker, Ärzte, Medicinalbeamte und Drogisten. Herausgegeben von A. BRESTOWSKI, Wilhelm Braumüller, k. u. k. Hof- und Universitäts-Buchhändler, Wien und Leipzig. 1895. H. Grevel and Co., 33, King Street, Covent Garden, London. Price per number, M. 2.40.

This number completes the entire work, and forms Part 24. It commences on page 865 with a continuation of the article on Sugar, which is completed on the following page (866). Two pages further on, the ordinary text of the work is concluded. An Appendix then follows, and extends from page 869 to 884, beginning with "*Acetamido-antipyrin*" and ending with "*Urotropin*" (*Formin*). The Alphabetical Index then follows. It fills 57 pages, and Lists of Errata for Volumes I. and II. conclude the work.

CHEMISCHE PRÄPARATENKUNDE. Von Dr. ADOLF BENDER und Dr. HUGO ERDMANN. Band II. Anleitung zur Darstellung organischer Präparate von Dr. HUGO ERDMANN. Mit 41 in den Text gedruckten Abbildungen.

Verlag von Ferdinand Enke, Stuttgart. 1894. H. Grevel and Co., 33, King Street, Covent Garden, London. Price M. 14 or 14s.

THE first volume of this work, devoted to the Preparation of Inorganic Substances, by Dr. A. Bender, has been already noticed in this Journal, 1893, 719. The present is the second and concluding volume, devoted to the Preparation of Organic Substances. It is an 8vo volume, in paper cover, and contains Preface, Table of Contents, Subject-Matter covering 590 pages, a List of the best sources of information in the shape of Journals and Text-Books, an Index (alphabetical) of all necessary raw materials needed for the preparations referred to, with sources of supply, and the Alphabetical Index of the volume. The text is illustrated with 41 well executed engravings representing the apparatus recommended, and is sub divided as follows:—

A. The Arrangement of a Laboratory for Organic Preparations. B. Hydrocarbons and their Halogen Derivatives. C. Groups of Alcohols and Phenols. D. Groups of Aldehydes and Ketones. E. Groups of Carboxylic Acids and Esters. F. Metallic Compounds of the Alcohols, Esters, and Hydroxy Acids. G. Iodo- and Iodoso-Compounds. H. Nitro-Compounds and Nitro-Esters. I. Nitroso-Compounds and Oximes. K. Group of Bases. L. Diazo-Compounds. M. Azo-Compounds. N. Cyanogen Compounds and Nitriles. O. Thio-Compounds. P. Sulphonic Acids. Q. Mercury Compounds.

CHEMISTRY FOR ENGINEERS AND MANUFACTURERS: A Practical Text-Book. By BERTRAM BLOUNT, F.C.S., F.I.C., and A. G. BLOXAM, F.C.S., F.I.C. Vol. I.—Chemistry of Engineering, Building, and Metallurgy. Charles Griffin and Co., Ltd., Exeter Street, Strand, London. 1896. Price 10s. 6d.

THIS is the first of two volumes, which will form the entire work. It is of large 8vo size, and is illustrated with 35 wood engravings. The authors in their Preface state that the chief object in view has been "the needs of practising Engineers, Managers of Works, and Technical Students desirous of obtaining some knowledge of Chemical Technology."

The text of Vol. I. covers 244 pages, including the Alphabetical Index.

The work is planned out according to the following divisions and sub-divisions:—

PART I.—I. Chemistry of the Chief Materials of Construction. II. The Chemistry of the Sources of Energy. III. The Chemistry of Steam Raising. IV. The Chemistry of Lubricants and Lubrication. PART II.—METALLURGY. Metalliferous Ores. Iron. Copper. Lead. Zinc. Cadmium. Tin. Antimony. Bismuth. Nickel. Cobalt. Mercury. Silver. Gold. Platinum Group of Metals. Metals difficult of Reduction.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

FRANCE.

Regulations affecting the Port of St. Nazaire.

The *Journal Officiel* of February 9th last, contains a Presidential decree, by which the Custom-house of St. Nazaire is added to others previously designated for the importation, under the rules for temporary admission, of chlorate of potash for conversion into chlorate of soda or of baryta.

SPAIN.

Oleo-Naphtha and Lubricating Oils.

According to the *Journal Officiel*, by a Royal order of December 10th, 1895, oleo-naphtha, lubricating oils, and other articles comprised in paragraphs 8 and 9 of the

tariff, imported in barrels or otherwise, will pay duty according to their net weight, tare being allowed for the recipients.

AUSTRIA-HUNGARY.

The *Bollettino di Notizie Commerciali* publishes extracts from ordinances of the Austro-Hungarian Customs, by which an additional 13 per cent. is to be added to the net weight of liquid chlorate (? chloride) of zinc imported in tank waggons.

UNITED STATES.

Crude potassium metal is to pay duty at the rate of 20 per cent. under section 3.

Magnesium powder is free of duty under paragraph 544.

JAPAN.

Duties to be charged on British Imports. Tariff.

No.	Articles.	Duty.
		Yen.
1	Caoutchouc, manufactures of	10 <i>ad val.</i>
2	Cement, Portland,	100 catties 0.065
18	Glass, window, ordinary:— (a.) Uncoloured and unstained	100 sq. ft. 0.302
	(b.) Coloured, stained, and ground,	10 <i>ad val.</i>
20	Indigo, dry	100 catties 12.953
32	Lead, pig, ingot, and slab	" 0.316
33	Leather:— (a.) Sole	10 " 5.690
	(b.) Other kinds,	10 " <i>ad val.</i>
37	Mercury or quicksilver	100 catties 5.948
39	Oil, paraffin	10 " <i>ad val.</i>
40	Paint in oil	100 catties 1.304
41	Paper, printing	" 1.163
42	Saltpetre (nitrate of potash)	" 0.490
47	Sugar, refined:— (a.) No. 15 to No. 20, inclusive, Dutch standard in colour,	" 0.748
	(b.) Above No. 20 Dutch standard in colour,	" 0.827
	Tin:—	
48	Block, pig, and slab,	10 " 1.902
49	Plates	10 " <i>ad val.</i>
	Zinc:—	
63	Block, pig, and slab,	100 catties 0.451
64	Sheet	" 0.928

Weights, Measures, and Coins.

The catty mentioned in this tariff is the Japanese weight. It is equal to 600 grms. of the metric system of weights, or 1.32277 lb. English avoirdupois weight.

The pound is the English avoirdupois weight.

The square yard and square foot are the English Imperial surface measures.

The yen is the present Japanese silver yen of 900 fineness and 416 grains in weight.

Rule for Calculating ad valorem Duties.

Import duties payable *ad valorem* under this tariff shall be calculated on the actual cost of the articles at the place of purchase, production, or fabrication, with the addition of the cost of insurance and transportation from the place of purchase, production, and fabrication, to the port of discharge, as well as commission, if any exists.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

PEAT-COAL IN NORWAY.

Board of Trade Journal, March 1896, 317.

A report has been received from Her Majesty's Acting Consul-General at Christiania, enclosing specimen of a new fuel, peat-coal, together with report of the inventor, Mr. William Schöning, who claims to have discovered a practical means of converting peat into a cheap and valuable fuel.

Mr. W. Schöning states that he presses the peat, at the same time carbonising (charring) it in the press.

The new fuel was analysed by Mr. Schmeleck, analyst to the City of Christiania, with the following results:—

	Per Cent.
Carbon	66.15
Hydrogen	6.60
Oxygen	17.75
Nitrogen	1.86
Sulphur	0.38
Ash	3.76
Moisture	3.50
	100.00

According to Mr. Schmeleck's further analysis it has a calorific value of 6,556 calories per kilo.

THE CAMPHOR TRADE.

Board of Trade Journal, March 1896, 281.

The following particulars concerning the camphor trade are based on the "Official Returns of Trade" for 1894, compiled by the Chinese Imperial Maritime Customs, on reports by (1) Sir Ernest Satow, Her Majesty's Minister at Tokio in 1895; (2) Her Majesty's Consul at Hiogo in 1892 and 1895; (3) M. Klobukowski, Consul-General for the French Republic at Yokohama; and (4) on a special report on the island of Formosa, furnished by Mr. N. Perkins, Assistant in Her Majesty's Consular service.

In times gone by camphor was produced in Sumatra and Borneo and in other parts of the East Indies, as well as in China; now, however, the crude camphor of commerce is a product of Japan proper and the island of Formosa exclusively.

Great difficulties remain to be surmounted before the Formosa trade can be depended on, for the trees are only found inland, where the inhabitants are aboriginal barbarians, who make matters most unpleasant for explorers.

The Formosa drug is inferior to the Japanese; the latter, by reason of its greater purity, pinkish colour, and bold grain commanding in foreign countries higher prices, by some 2 per cent. or 3 per cent., in spite of its comparative abundance.

The districts in Japan famed for camphor trees are Kinsu, Shikoku, Iga, Suruga, Isé, and Kishiu. The forests owned by the people are almost denuded of timber, and soon very little will be left. However, the Government forests are still very rich in camphor trees, and it has been estimated that this alone will maintain annually, during the next 25 years, the full average supply of crude camphor.

Formerly very little care was bestowed upon the preservation and cultivation of this valuable timber. More recently, however, not only the Government but also the people have been giving to this most important question the attention it long ago deserved.

The roots contain a much larger proportion of camphor than the trees, 10 lb. of crude camphor out of 200 lb. of wood-chips being thought satisfactory. The Suruga timber yields a much smaller percentage.

It appears that the only process of extracting camphor from the wood among the mountains in Japan, and the materials used, are of the roughest and most unscientific description. The wood-chips are boiled, the vapour being conducted into a receptacle containing several partitions surrounded by cold water. In the sides of these partitions are apertures, which cause the vapour to fill the divisions by a circuitous route, thus improving the grain of the camphor.

The crude article is brought to market, as a rule, in very rudely constructed wooden tubs.

To make it fit for shipment requires much work, diligence, and experience. Each tub is carefully sampled, vertically and diagonally, and the samples are tested by fire and sometimes by alcohol. If no solid adulterant is discovered, the condition of the drug is next inquired into, the difficulty of this step being best explained by at once stating that this crude camphor contains a quantity of water, or oil and water, varying anywhere between 5 per cent. and 20 per cent.

This trouble overcome, the rest is comparatively easy, and consists in weighing, cutting, mixing, and packing for

shipment, the packing being in tubs prepared on the premises, partly out of the original packages.

Of course the camphor cannot be packed in its crude condition; much of it has to be drained and dried, and frequently a special parcel of "dry" must be bought, at a very high figure, for mixing with it.

Exports of camphor from Japan appear to have increased in value, in proportion to the quantity, during the last 10 years, as the following table will show. In this case the value of the yen has been converted, at the average rate for the years given, which varies in each case.

Export of Camphor from Japan.

Years.	Quantity.	Value.
	Lb.	£
1886	7,267,000	151,000
1887	8,687,000	179,000
1888	6,074,000	153,000
1889	6,823,000	213,000
1890	5,952,000	314,000
1891	5,905,000	272,000
1892	1,419,000	186,000
1893	3,317,000	167,000
1894	2,762,000	109,000

An intelligent and well-directed exploitation of the island of Formosa, where the camphor tree is so abundant, would probably have the effect of lowering prices, by increasing the amount of camphor placed on the market.

The principal countries dealing in camphor are Hong Kong and the United States. The exports from Japan in 1894 were as follows:—

Countries.	Quantity.	Value.
	Lb.	£
Australia	10,600	918
India	78,800	6,096
China	6,600	268
France	4,100	302
Germany	13,100	7,459
United Kingdom	108,600	5,928
Hong Kong	1,654,300	87,524
United States	772,500	37,464
Other countries	2,900	162

Hong Kong is only a transit port where the camphor is refined previous to exportation to Europe.

A special feature of the year 1894 was a material reduction in business in camphor from Japan (as distinguished from camphor from Formosa, now also a part of Japan) in comparison with former years, attributable perhaps to the ever-increasing production of Formosa and the gradual improvement of the quality of the island product.

During the year there was a fraudulent attempt at mixing inferior Formosa camphor with Japanese produce, and passing it off as Japan camphor. Through the energetic and effective measures which were at once taken by leading camphor exporters, supported by the Japanese Chamber of Commerce, the attempt was discovered at once, and no such mixtures left the ports.

Another feature of remark was the formation of a guild amongst the native sellers, with the declared object of establishing a much-needed reform in quality by introducing certain new and uniform delivery terms, and these have no doubt done away with a great deal of the trouble and disputes previously existing.

Mr. N. Perkins, Assistant in Her Majesty's Consular Service, in his report on the island of Formosa, dated January 31, 1895, states that in the north of the island the trade in camphor is rapidly growing in importance; it is, however, attended by considerable risks, as heavy advances have to be made, and sometimes, whether due to the raids of savages or other causes, without any return, either in cash or camphor.

New districts are from time to time opened up, the chief at present being Hoonim or Yünlin, Kagee or Chia-I, Chip Chip, Polihsia, and Ao-doi-pö.

According to the returns of trade for the year 1894, compiled by the Chinese Imperial Maritime Customs, the exports of camphor from Tamsui in 1894 (almost entirely to Hong Kong) represented 91 per cent. of the total value of the trade, the total shipments having been 3,708,000 lb., of the value of 569,365 H. taels (about 91,000£.).

From the port of Tainan during 1894 the amount of camphor exported was 1,565,000 lb., of a value of 263,878 H. taels (about 42,200£.).

Tainan and Tamsui are the only two ports of Formosa where there is a camphor trade of any importance.

There are no available figures as to the amount of camphor exported from Formosa for any period subsequent to 1894, but according to a recent report of Sir Ernest Satow, Her Majesty's Minister at Tokio, the amount exported from Japan during the first six months of 1895 was 1,530,000 lb., of a value of 649,457 yen (about 69,000£.).

FRUIT-DRYING EXPERIMENT.

Cons. Reps., Ann. Series, 1895, No. 1652.

Mr. Wilfrid Powell, British Consul at Stettin, reports that a manager of a Government peat-moor, wishing to keep some apples and pears during the winter months, thought he would try packing them in "mull," that is to say, the dust obtained from the dry moss litter when being torn up by the disintegrator. In this mull, or dust, he packed a number of pears and apples, enclosing the whole in a wooden case, and pressing the mull well down, taking care that each fruit was kept a little distance from the other. At the end of three months he found the pears and apples perfectly dried and as sound as those prepared for commerce by the more elaborate methods, while on being placed in warm water they began to swell out again to their former proportions. Mull sells in Germany at about 1s. 3d. per cwt., and, as it is exceedingly light, 1 cwt. will dry a large quantity of fruit, while it can be used again many times over, has no smell, and does not convey any taste to the fruit. It merely absorbs the moisture which the fruit contains, at the same time protecting it from the air.

GENERAL TRADE NOTES.

MINERALS IN SOUTHERN RUSSIA.

Board of Trade Journal, March 1896, 329.

The *Revue Commerciale* of Berliansk, states that vast deposits of iron, graphite, kaolin, and other minerals have been found at the village of Grand Tounak and in German colonies; anthracite has been discovered near Orekhov at the village of Belitskoié. Specimens of kaolin have been already analysed at St. Petersburg, Berlin, and Marseilles; and it has been found that the quality is excellent for the manufacture of porcelain. As for the iron ore, it was said to contain from 62 to 72 per cent. of pure iron and very little sulphur or phosphorus, in which it resembles the celebrated ore of Krivoi-Rog.

PACKING BUTTER FOR EXPORT.

The *Australasian*, in a recent issue, states that one of the chief obstacles in the way of the successful development of the dairying industry has hitherto been found in the difficulty of discovering a cheap, clean, and attractive way of packing butter, honey, and other perishable farm products. It will come as a surprise to many to learn that a simple process has been discovered, and is now in operation in Australia, by which the inventors claim that they can supersede costly refrigerating plant completely, and despatch butter, honey, jam, and similar comestibles to any part of the world, with the certainty that when opened the article will be found in perfect condition.

How far these expectations are warranted by results already attained cannot as yet be stated definitely, but it is a fact that butter packed in Melbourne by the new process

has been opened at Kimberley, South Africa, 700 miles from Cape Town, and found to be as good as when it left the butter factory in Victoria.

By the new process, the butter is packed in a box made of six small sheets of ordinary glass, the points of juncture being covered with gummed paper. The glass casket is then covered with a mould of plaster of Paris about a quarter of an inch thick, which in turn is covered with specially prepared paper. The package then presents the appearance of a solid brick of plaster or cement, and as the plaster is a non-conductor of heat it is claimed that the butter packed hermetically inside is unaffected by any change of temperature. The prime cost of packing 1 lb. of butter in this way is about 1d., and the convenience and portability are obvious. The inventor states that these solid bricks of butter can be and have already been loaded on shipboard as ordinary cargo, and delivered in perfect condition in Coolgardie, Northern Queensland, and South Africa.

Cases manufactured in the same way, and capable of holding 2 cwt. of butter, have also been manufactured by the syndicate at its large factory, where 40 hands, principally boys and girls, are engaged in making the glass boxes and covering them with plaster of Paris, all except the top, which is put on afterwards by a simple mechanical device, and removed by the purchaser in an equally easy manner.

It is claimed that a saving of 25 per cent. is effected on freight and packing as compared with butter frozen and carried in the usual way. In the future the new invention may revolutionise present methods of dealing with dairy produce for export.

CYLINDERS FOR COMPRESSED GASES.—REPORT OF THE COMMITTEE.

Eyre and Spottiswoode, 1896.

After the explosion at Fenchurch Street Station, Mr. Asquith appointed a Departmental Committee of inquiry into the causes of such explosions, and the precautions necessary to ensure safety in dealing with cylinders of compressed gas. The Committee, which consisted of Profs. Unwin, Boys, and Dixon, with Dr. Dupré and the Rev. T. J. Smith (Lecturer on Mechanics, Oxford), has just issued its report and recommendations. A general official inspection of all factories manufacturing compressed or liquefied gases is recommended as being desirable, and it is suggested that such inspection might be conducted under the Factory Department of the Home Office, or even by a department of the Board of Trade.

For cylinders intended to contain oxygen, hydrogen, or coal-gas, the greatest working pressure recommended by the Committee is 120 atmospheres, or 1,800 lb. per square inch, the cylinders to be permanently marked with a rotation number, a manufacturer's or owner's mark, an annealing mark with date, and a test mark with date. Testing is recommended to be repeated every two years, and annealing at least every four years, a record being kept of all tests. Hydrogen and coal-gas cylinders should have left-handed threads, and be painted red, whilst a minimum weight should be fixed for each size of cylinder in accordance with its required thickness. The greatest working pressure recommended for cylinders for carbonic acid is also 120 atmospheres, and it is stated that no cylinder ought to contain more than $\frac{1}{4}$ lb. of carbonic acid per pound of water capacity, if for this country, or $\frac{2}{3}$ lb. if for the tropics. A notice ought to be affixed to the cylinder stating that it contains carbonic acid and should be kept cool, and not exposed to the sun. Ammonia cylinders are recommended to have a working pressure not exceeding 1,000 lb. per square inch, and they should not contain more than $\frac{1}{4}$ lb. of ammonia per pound of water capacity, whilst a similar notice should be affixed to that recommended for carbonic acid cylinders. No oil or similar lubricant should be used for cylinder valves, pressure gauges, regulators, or other fittings; pressure gauges should have a check to prevent a sudden inrush of gas, and those for hydrogen and coal-gas should have left-handed screws and be painted red. Several other recommendations are made with regard to minor details, and it is stated that, subject to a reasonable guarantee that all the

specified conditions are complied with, the Committee will be prepared to recommend that cylinders should be distributed by road or rail unpacked.

NEW SOUTH WALES PLATINUM.

Engineering and Mining Journal, February 22nd, 1896, 182.

In view of the enormously increased consumption of platinum in electrical work it is agreeable to note the well accredited statement that large deposits of this valuable mineral have been discovered at Fittfield, New South Wales. It has been known for several years that platinumiferous lead existed in this locality, and the deposits have been worked, though only on a small scale. It is now found, however, that the platinumiferous lead is over a mile long, varying in width from 60 ft. to 150 ft., and covered with from 60 ft. to 70 ft. of loam. The precious metals are practically confined to the bedrock and the drift for 3 ins. above the bottom. Nuggets which weighed from a few grains up to 5 dwts. have been occasionally found. The crude metal contains about 75 per cent. of platinum, and realises at the present time upon the field 24s. per oz.

THE CARRIAGE OF ACETYLENE AND CALCIUM CARBIDE IN GERMANY.

Chemist and Druggist, February 29th, 1896, 309.

The following regulations have been issued for the carriage of acetylene and calcium carbide on the German railways:—"The rules relating to the despatch of liquid carbonic acid and nitrous oxide are also to be applied to liquid acetylene, with the additional proviso that vessels used for acetylene-carriage may not contain any parts of copper, brass, or other copper alloys. The pressure-test is to be applied to all containers, and the maximum admissible is, for acetylene, 250 atmospheres and 1 kilo. of liquid for every 3 litres of space in the vessel. Calcium carbide must be packed in iron vessels closed air-tight, and no other goods may be added to any package containing either acetylene or calcium carbide."

MATCHES IN FRANCE.

Chemist and Druggist, March 14th, 1896, 372.

The match difficulty, which has given the French Government so much trouble for some time past, seems at last to be in a fair way to be solved. The problem has been to produce a match that offers no danger to the workers. A Dijon chemist, M. Pouteaux, now claims to have perfected a process by which permanganate of potash can be used for matches, the difficulty met with hitherto having been that all the glues used with this substance up to the present time decomposed the permanganate and thus rendered it useless. M. Pouteaux has succeeded in using a "glue" made by dissolving guncotton in acetate of amyl. The match is plunged into this mixture after having been steeped in sulphur in the first place. M. Pouteaux's matches will require a special striker, which is considered to be an objection to their becoming rapidly popular with the lower classes.

LAMP ACCIDENTS AND LAMP-OILS.

E. Stanford, 1896.

The official report of Mr. Alfred Spencer, chief officer of the Public Control Department of the London County Council, is a very full one, and replete with results of tests and experiments. He thinks that if no oil were burned below 100° F. close test, lamp accidents would be far less frequent, but he thinks the point would have to be raised to far above 100 to give a full measure of safety. He thinks it would be impracticable to fix that standard, and is of opinion that, if the lamps are properly made, accidents would cease gradually as the safe lamps replaced the unsafe ones. Mr. Spencer then discusses the construction of lamps at considerable length and in an interesting manner. He summarises his conclusions thus:—

1. That the number of accidents arising from the burning of mineral oil in lamps has increased and is still increasing, notwithstanding the voluntary efforts made for preventing them, and that effectual means of prevention can only be found in compulsory measures.

2. That raising the flash-point fixed by the Petroleum Acts would not alone be effectual in preventing lamp accidents, as this would not prevent the sale and use for illuminating purposes of oil below that flash-point.

3. That the prohibition of the retail sale and the prevention of the use for illuminating purposes of mineral oil below a flashing-point sufficiently high to prevent all lamp accidents would be effectual if it were practicable.

4. That the prohibition by statute of the sale of unsafe lamps would be another means of putting an end to lamp accidents, as both experience and experiment have proved that mineral oils such as are now in common use can be safely burnt in properly constructed lamps.

5. That a practicable method of preventing the sale of unsafe lamps would be by a clause similar to that submitted by me to the Select Committee on Petroleum in 1894, which is as follows:—

The Secretary of State may from time to time by order make, and when made, rescind and alter, specifications of lamps or other appliances intended to be used for burning mineral oil for the purposes of illumination, heating, cooking, or otherwise, and it shall be unlawful for any person on and after the day of

189 , to keep, expose, or offer for sale, or sell any such lamp or other appliance, unless constructed in accordance with one of such specifications, and any person keeping, exposing, or offering for sale, or selling any such lamp or other appliance not so constructed shall be liable, on conviction, to a penalty of not exceeding 5*l.* in respect of such lamp or other appliance, and to the forfeiture of the lamp or appliance.

As an appendix Mr. Spencer gives the recommendations as to lamps having metal reservoirs, wick-tubes, &c., which are already well known. (See also pages 173 to 179.)

GERMAN IMPORTS AND EXPORTS OF DYES AND COLOURS FOR THE TEN YEARS ENDING DECEMBER 1894.

Färber Zeit. 1895, 7, 84—85.

Alizarin.

Year.	Imports.	Exports.	Imports.	Exports.
	Tons.	Tons.	Million Marks.	
1885	139	4,284	0.3	9.5
1886	83	1,520	0.1	7.9
1887	55	7,985	0.1	9.6
1888	28	6,732	0.0	10.8
1889	27	7,793	0.0	12.5
1890	13	7,906	0.0	12.6
1891	79	8,160	0.1	12.9
1892	12	7,677	0.1	11.9
1893	39	8,036	0.1	11.7
1894	30	7,733	0.0	11.2

Anilin and other Coal-Tar Dyes.

1885	433	4,646	3.2	34.8
1886	504	5,702	3.4	38.8
1887	600	6,544	4.9	42.5
1888	643	6,906	3.7	40.1
1889	608	6,975	3.8	38.4
1890	621	7,280	3.2	37.9
1891	688	8,080	3.5	44.3
1892	687	10,725	3.4	52.6
1893	739	11,599	3.4	53.2
1894	741	12,308	3.2	53.2

Black-Lead and Coloured Pencils; Artists' Colours, &c.

1885	17	655	0.1	2.3
1886	17	672	0.1	2.4
1887	20	825	0.1	2.9
1888	29	863	0.1	3.0
1889	37	948	0.1	3.3
1890	39	978	0.1	3.2
1891	36	943	0.1	3.0
1892	115	948	0.2	2.8
1893	148	1,090	0.2	3.3
1894	126	1,048	0.2	3.1

*White-Lead.**

Year.	Imports.	Exports.	Imports.	Exports.
1885	3,235	16,333	1.1	5.9
1886	2,554	15,064	0.9	5.6
1887	3,138	17,599	1.1	6.0
1888	1,946	14,077	0.7	4.9
1889	1,081	12,871	0.4	4.8
1890	1,136	12,321	0.4	4.8
1891	715	11,730	0.2	4.1
1892	712	13,712	0.2	4.3
1893	932	13,412	0.3	4.0
1894	646	13,990	0.2	3.8

* Up to June 30, 1888, includes zinc oxide ("zinc white").

Dye-wood Extracts, &c.

1885	1,955	1,200	3.9	1.0
1886	5,213	1,187	3.9	0.9
1887	5,629	1,361	4.5	1.2
1888	5,092	1,482	4.2	1.3
1889	6,549	1,683	3.8	1.5
1890	4,686	1,582	3.7	1.3
1891	4,745	1,549	3.8	1.3
1892	4,327	1,520	3.5	1.3
1893	5,382	1,695	4.3	1.4
1894	4,654	1,344	3.8	1.2

Indigo.

1885	1,969	620	25.6	8.4
1886	1,492	496	18.0	6.2
1887	1,532	491	17.6	5.9
1888	1,578	562	17.4	6.5
1889	1,335	744	20.3	8.2
1890	2,008	753	19.1	7.3
1891	1,266	555	12.7	5.8
1892	1,744	620	18.7	7.0
1893	1,273	592	14.6	7.1
1894	1,507	607	18.1	7.6

Logwood.

1885	46,824	7,306	6.6	1.1
1886	43,775	7,514	6.3	1.2
1887	46,077	7,230	7.1	1.2
1888	52,105	8,020	8.3	1.4
1889	50,810	9,496	8.6	1.7
1890	52,881	10,701	8.5	1.8
1891	47,191	9,745	7.1	1.6
1892	41,663	10,205	6.2	1.6
1893	43,758	8,387	7.4	1.5
1894	45,378	9,280	8.2	1.8

—I. S.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 29th February.	
	1895.	1896.
	£	£
Metals.....	1,392,753	1,660,837
Chemicals and dyestuffs.....	629,393	917,247
Oils.....	491,087	777,985
Raw materials for non-textile industries.	1,875,618	2,746,428
Total value of all imports....	28,194,489	25,476,736

SUMMARY OF EXPORTS.

Articles.	Month ending 29th February.	
	1895.	1896.
	£	£
Metals (other than machinery)....	1,811,973	2,589,972
Chemicals and medicines.....	613,476	717,387
Miscellaneous articles.....	2,005,897	2,660,224
Total value of all exports.....	15,973,095	19,963,453

IMPORTS OF METALS FOR MONTH ENDING
29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore	3,839	7,165	16,716	53,086
Regulus	6,453	6,192	175,692	159,842
Unwrought	3,967	4,377	162,243	193,159
Iron:—				
Ore	296,968	450,081	204,023	304,876
Bolt, bar, &c.	1,756	2,618	13,148	22,017
Steel, unwrought ..	396	587	3,717	6,159
Lead, pig and sheet ..	9,855	15,874	94,985	174,132
Pyrites	44,899	48,219	72,795	86,599
Quicksilver	1,250,080	1,652,223	108,303	157,594
Silver ore .....	..	..	97,718	167,842
Tin	58,486	59,181	178,204	180,982
Zinc	3,037	6,552	41,612	85,554
Other articles .. Value £	..	..	127,697	138,033
Total value of metals	..	..	1,302,753	1,669,857

IMPORTS OF CHEMICALS AND DYE-STUFFS FOR MONTH
ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali	2,393	5,869	£ 2,256	£ 4,045
Bark (tanners, &c.) ..	8,517	12,803	3,783	4,216
Brimstone	66,550	82,740	11,948	13,486
Chemicals .....	..	..	74,961	118,884
Cochineal	824	77	6,111	403
Cutch and gambier Tons	445	3,245	11,207	65,082
Dyes:—				
Alizarin .....	..	..	16,001	25,096
Anilin and other ..	..	..	28,141	38,421
Indigo	16,751	21,058	336,090	422,505
Nitrate of potash ..	11,763	29,310	11,172	25,494
Valonia	1,976	5,149	23,140	36,729
Other articles .. Value £	..	..	107,083	161,976
Total value of chemicals	..	..	620,393	917,247

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian .. Cwt.	2,871	2,796	£ 4,664	£ 4,563
Bristles	219,381	218,220	23,823	33,746
Caoutchouc	27,212	41,396	332,019	441,862
Gum:—				
Arabic	4,760	7,951	11,698	14,115
Lac, &c.	6,951	12,588	33,074	59,470
Gutta-percha	2,872	2,024	25,151	15,981
Hides, raw:—				
Dry	24,363	27,070	51,304	67,119
Wet	39,640	37,778	77,390	80,337
Ivory	1,329	872	59,474	39,504
Manure:—				
Guano	554	2,204	3,849	14,990
Bones	9,290	7,936	41,475	32,637
Nitrate of soda ..	5,410	19,447	47,885	153,049
Phosphate of lime ..	21,810	23,131	41,135	38,952
Paraffin	61,040	35,957	62,751	36,259
Linen rags	1,052	1,708	10,625	16,604
Esparto	13,854	26,249	61,614	110,937
Pulp of wood	14,698	25,326	75,847	130,049
Rosin	110,905	122,640	24,924	28,663
Tallow and stearin ..	31,905	174,150	40,928	204,386
Tar	191	2,159	31	1,678
Wood:—				
Hewn	88,883	113,641	122,562	204,022
Sawn	34,576	64,073	81,567	150,711
Staves	4,186	4,123	22,522	40,634
Mahogany	2,184	8,835	17,149	33,141
Other articles .. Value £	..	..	600,633	793,156
Total value .....	..	..	1,875,918	2,746,128

Besides the above, drugs to the value of £8,797, were imported, as against 55,626, in February 1895.

IMPORTS OF OILS FOR MONTH ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa-nut	7,997	27,439	£ 8,767	£ 31,756
Olive	546	3,161	21,371	107,704
Palm	89,274	91,689	93,471	99,009
Petroleum	8,442,378	18,094,640	129,113	373,361
Seed	2,849	2,618	61,239	52,962
Train, &c.	917	927	16,625	15,496
Turpentine	11,176	10,698	10,745	10,810
Other articles .. Value £	..	..	62,103	83,327
Total value of oils ..	..	..	404,087	777,085

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass	7,856	11,630	£ 29,965	£ 41,660
Copper:—				
Unwrought	32,402	59,968	69,836	117,563
Wrought	18,149	38,116	48,353	100,645
Mixed metal	14,190	31,033	31,065	66,542
Hardware .....	..	..	124,487	156,149
Implements .....	..	..	77,688	104,672
Iron and steel .. Tons	157,830	237,346	1,294,758	1,728,089
Lead	2,338	2,808	29,679	37,390
Plated wares .. Value £	..	..	19,070	18,367
Telegraph wires ..	..	..	9,411	109,840
Tin	6,624	11,325	21,300	36,152
Zinc	14,351	18,840	9,367	11,738
Other articles .. Value £	..	..	16,964	60,885
Total value .....	..	..	1,811,973	2,589,075

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali	394,760	340,031	£ 90,640	£ 90,666
Bleaching materials ..	98,446	92,755	31,319	33,123
Chemical manures .. Tons	25,034	36,516	194,423	194,467
Medicines .....	..	..	75,739	85,144
Other articles .. Value £	..	..	209,355	313,927
Total value .....	..	..	613,476	717,387

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 29TH FEBRUARY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder	327,000	553,300	£ 7,326	£ 12,210
Military stores .. Value £	..	..	98,222	188,860
Candles	1,767,200	2,207,500	29,350	35,336
Caoutchouc .....	..	..	80,446	92,181
Cement	14,347	27,512	23,160	45,591
Products of coal .. Value £	..	..	105,075	174,211
Earthenware .....	..	..	120,512	139,534
Stone-ware .....	..	..	8,304	10,669
Glass:—				
Plate	92,048	150,120	4,781	8,205
Flint	6,336	7,479	13,991	16,514
Bottles	45,770	56,299	21,861	26,534
Other kinds	13,316	17,844	10,317	13,404
Leather:—				
Unwrought	9,429	9,807	88,711	99,662
Wrought .....	..	..	24,296	29,524
Seed oil	3,171	4,442	63,548	85,074
Floer cloth	2,273,600	2,359,800	73,279	92,616
Painters' materials .. Value £	..	..	101,568	135,337
Paper	60,677	74,556	97,916	116,771
Rags	2,790	4,479	17,779	23,836
Soap	38,094	55,967	40,956	56,185
Total value .....	..	..	2,005,897	2,660,224

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

3543. H. Smithurst. Improvements in or relating to pressure and vacuum gauges. Feb. 17.

3569. E. Petzholtz. Improvements in or connected with furnaces. Complete Specification. Feb. 17.

3572. S. S. Bromhead.—From Dierks and Mollmann. Improvements in sterilising apparatus. Feb. 17.

3575. A. J. Boulton.—From M. W. Judell. New or improved heating or cooling agent. Complete Specification. Feb. 17.

3668. T. Jenkins. Improvements in hydro-extractors. Complete Specification. Feb. 18.

3859. A. Ludwig.—From S. Moser. Improvements in the apparatus for evaporating vegetable and animal matter, commonly known as Ryder's evaporator. Complete Specification. Feb. 20.

4208. W. Griffiths and V. C. Read. Improvements in and in apparatus for treating feed water to prevent incrustation in boilers, applicable for treating or purifying water for other purposes. Complete Specification. Feb. 25.

4241. C. G. J. Moller and P. Pfeifer. Improvements in drying apparatus. Feb. 25.

4253. E. C. Nichols. Improvements in apparatus for compressing and storing air. Complete Specification. Feb. 25.

4266. H. J. Fraser. Improvements in evaporative and other condensers, evaporators, and the like. Feb. 25.

4328. H. H. Lake.—From D. N. Maxon. Improvements in apparatus for use in fusing refractory substances. Feb. 26.

4418. H. H. Lake.—From W. F. Jobbins and J. van Ruymbeke. Improvements in evaporating apparatus. Complete Specification. Feb. 27.

4604. E. Theisen. Improvements in apparatus for evaporating, condensing, and cooling fluids. Complete Specification. Feb. 29.

4725. W. L. Wise.—From Solvay et Cie. Improvements in apparatus for filtering, washing, and drying, suitable for the treatment of bicarbonate of soda. March 2.

5409. S. Pitt.—From La Compagnie Internationale des Procédés A. Seigle. An automatic re-ignition apparatus for hydrocarbon furnaces. March 10.

5431. S. M. Lillie. Improvements in evaporating apparatus. March 10.

5556. H. S. Young and C. J. Ellis. Improvements in filtering apparatus. March 12.

5766. La Société Anonyme dite "Blanchisserie et Teinturerie de Thaon." Improvements in apparatus for use in drying fabrics. March 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

1415. C. Pratten. Improvements in presses suitable for moulding plastic materials and subsequently dividing the same into blocks. March 4.

5103. E. C. Mills and J. G. Chamberlain. Surface condensers. March 4.

5113. P. F. Holmes. Apparatus for washing gases. March 11.

6211. M. Arndt. Apparatus for weighing gases. March 18.

10,905. B. L. de Ridder. Apparatus for sampling gases for analysis. March 18.

16,052. F. D. Cammer. Apparatus for drying by means of furnace gases and air. March 18.

18,464. J. Wood. Improvements in and connected with furnace pans, coppers, and the like. Feb. 26.

22,582. E. B. Caird and T. J. Rayner. Air-cooled condensers. March 18.

1896.

947. C. E. Mumford. Improvements in apparatus for turning malt and like materials on a kiln floor. March 11.

2925. E. B. Caird and T. J. Rayner. Surface condensers and coolers. March 18.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

3560. A. Quentin. Improvements in apparatus for burning liquid fuel. Feb. 17.

3681. W. Mackean and the Incandescent Gas Light Company, Limited. Improvements in the manufacture of mantles for incandescent gas lighting. Feb. 18.

3937. W. Rockliffe. Improved means for producing artificial light. Feb. 21.

3982. E. J. Shaw. Improvements in incandescent gas lamps or burners. Feb. 21.

4000. W. Nicholls. Improvements in the manufacture of incandescence bodies for illuminating purposes. Feb. 21.

4192. A. Morgan. Improvements in gas heating and lighting. Complete Specification. Feb. 25.

4285. J. R. Wigham. A method of burning acetylene gas or other very rich hydrocarbon gas. Feb. 26.

4345. J. H. Dunn and R. G. E. Dalrymple. See Class XI.

4402. W. B. Kirkwood. A new or improved lamp for generating and consuming acetylene gas. Feb. 27.

4419. J. C. Hunauer. An improved apparatus for making and carburetting hydrogen gas. Feb. 27.

4421. J. Anderson.—From W. Anderson. A shield for an incandescent gas mantle. Complete Specification. Feb. 27.

4471. J. C. Hall, H. C. A. Dance, and A. R. Hall. Improvements in apparatus for the manufacture of acetylene gas. Feb. 28.

4548. F. J. Stedman. Improvements in and relating to apparatus for the production of oxygen gas. Feb. 29.

4674. S. S. Bromhead.—From A. Niel. A self-regulating gas generator. Complete Specification. March 2.

4823. M. Horwitz. An improved vaporiser for liquid combustibles. March 3.

4980. W. Wheatley and G. Kros. Improvements in apparatus for the production of carburetted water-gas. March 5.

5051. R. G. Shadbolt and J. Wilson. Improvements in the method of and means for enriching coal-gas. March 6.

5085. M. W. Richardson-Bunbury and F. C. Dew. A mantle protector for incandescent gas light. March 6.

5118. H. C. B. Forester. Improvements in and apparatus for the production of consolidated fuel from fine coal or coal dust. March 6.

5133. L. Chapman. Improvements in the separation and obtainment of oxygen from atmospheric air. March 7.

5134. L. Chapman. Improvements in and in the preparation of material for use in the retorts of furnaces in obtaining oxygen from atmospheric air. March 7.

5279. G. Ragot. Improvements relating to the production of acetylene gas and to the utilisation of the same for lighting purposes. Complete Specification. March 9.

5291. A. Kitson. Improvements in apparatus for the manufacture of gas, partly applicable to other purposes. March 9.

5336. R. Lavender and W. Tice. Appliances for increasing the illuminating power of gas under combustion. Complete Specification. March 10.

5368. J. H. H. Duncan. Improvements in incandescent gas burners. March 10.

5375. E. T. Turney. Improvements relating to the generation of gas and to apparatus therefor. Complete Specification. Filed March 10. Date applied for Feb. 1, 1896, being date of application in United States.

5423. P. J. Schlicht. Improvements in and relating to art of and apparatus for producing combustion. Complete Specification. March 10.

5624. E. Farnsworth. Improvements in apparatus for the manufacture of gas. Complete Specification. Filed March 12. Date applied for Aug. 12, 1895, being date of application in United States.

5686. S. Hersey, and Kirkham, Hulett, and Chandler, Ltd. Improvements in apparatus for washing, scrubbing, and purifying gas. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

5860. G. Haycraft. Apparatus for use in the manufacture of artificial fuel. Feb. 26.

6690. A. Besson. Incandescence gas burners. March 4.

7502. W. Thomson and H. Smith. Manufacture of fuel. Feb. 26.

8746. A. R. Newman and J. M. Somerville. Manufacture of illuminating gas. March 4.

9538. S. Cutler. Improvements in fittings for water-gas washers. March 11.

15,890. E. Rohrbach. Gasifying and increasing the heating power of the gases of easily inflammable liquids. March 11.

23,235. S. Pitt.—From La Société Internationale du Procédé A. Seigle. Improvements in apparatus for treating heavy hydrocarbons by means of heat, especially applicable for distillation and the manufacture of oil-gas. March 11.

1896.

1116. F. Rossbach-Rousset. An improved process and apparatus for the production of acetylene gas for acetylene gas-lighting. Feb. 26.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

APPLICATION.

4598. A. Schmidt. Improvements in and apparatus for the dry distillation of wood, wood waste, and the like. Complete Specification. Feb. 29.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

3966. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new phthaline colouring matter. Feb. 24.

5044. I. Levinstein and Levinstein, Ltd. Manufacture or production of new colouring matters. March 6.

5668. T. R. Shillito.—From J. R. Geigy and Co. Improvements in the manufacture of greenish-blue colouring matters or dyes of the malachite green series. March 6.

5090. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of safranin azo dye-stuffs soluble in water. March 6.

5268. O. Imray.—From The Society of Chemical Industry in Basle. Process for the transformation of the thio-sulphonates of the indamines and indo phenols into thiozine colouring matters. Complete Specification. March 9.

5585. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of iodo derivatives of oxybenzoic acids. March 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

5114. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of orange to brown colouring matters. March 18.

7665. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of colouring matters. Feb. 26.

8572. S. Pitt.—From L. Cassella and Co. Producing dis- and poly-azo dye-stuffs from γ -amidonaphtholsulpho acid. March 4.

8645. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Improvements in the production of new sulphonic acids derived from naphthalene and of colouring matters therefrom. Feb. 26.

8988. P. A. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of chemical compounds and dye-stuffs derived from phenolic bodies. March 11.

8989. P. A. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of chemical compounds suitable for the production of colouring matters in bulk or on fibre. March 11.

9103. G. W. Johnson.—From Kalle and Co. Manufacture of amido bases and amido sulpho acids belonging to the naphthalene series and of colouring matters therefrom. March 11.

9454. G. W. Johnson.—From Kalle and Co. Manufacture of fast azo colouring matters especially adapted for dyeing on wool. March 11.

9645. S. Pitt.—From L. Cassella and Co. The manufacture of new azo dyes and of materials for producing the same. March 18.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

3517. J. R. Hoyle and H. Colburn. Improvements in back-washing machines for use in the treatment of wool or other fibrous substances. Feb. 17.

5532. C. E. Puller and A. Biermann. Improved process for loading silk and silk waste. Complete Specification. March 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8642. W. P. Thompson.—From R. C. L. E. de Swarte and J. M. E. Doumer. Improved process and apparatus for retting and drying flax and other textile materials. March 11.

8858. S. Simon and R. Dux. Preparation of textile materials and fabrics. March 4.

16,766. W. Fairweather.—From E. Balatsch, C. Herold, and A. Bayer. Process for cleaning by chemical means combs and other wool and hair waste stained with pitch, tar, and other colouring material. March 4.

20,501. C. Geige. A new or improved process for the manufacture of chemically prepared pent fibres applicable to various useful purposes. Feb. 26.

23,882. W. G. Heys.—From G. Malard. Improvements in scouring and degreasing wool. Feb. 26.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

3830. W. Leach. Improvements in apparatus for dyeing fibrous material. Feb. 20.

3991. H. H. Lake.—From J. C. Blundell. Improvements in and relating to yarn-dyeing machines. Complete Specification. Feb. 21.

4449. J. W. Slater and J. Parkinson. See Class XVIII. B.

4538. E. Weldon. Improvements in machinery for ageing or oxidising aniline blacks on hosiery goods. Feb. 29.

4890. A. Ashworth. Improvements in fixing metallic mordants on fibres and fabrics. March 4.

5712. J. Barnes. The production of fast colours on animal fibre by the aid of oxide of titanium. March 14.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

3662. A. D. Delsenme. A new or improved process for the purification of carbonic acid gas passing from lime kilns and designed for liquefaction. Feb. 18.

3869. J. T. Conroy, F. Hurter, and J. Brock. Improvements in the manufacture of ferrocyanides from sulphocyanides. Feb. 20.

3987. W. P. Thompson.—From C. von der Linde. An improved process for obtaining acetic acid from pyroigneous salts. Complete Specification. Feb. 21.

4340. G. Munroe and J. W. Kelly. Manufacture of oxygen, hydrochloric acid, and other products. Feb. 26.

4407. J. F. Campbell and J. Keating. Improvements in apparatus for the concentration or rectification of sulphuric acid or other acids or liquors. Feb. 27.

4489. G. Craig. Improvements in obtaining alkali salts and apparatus therefor. Feb. 28.

4725. W. L. Wise.—From Solvay et Cie. See Class I.

4743. L. G. Paul. Improvements in the manufacture of nitrites of soda and potash. March 3.

5011. P. Duggan. Improvements in or relating to saturators for use in the manufacture of sulphur of ammonia. March 5.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6711. A. R. Scott and T. Henderson. Purifying acetates. Feb. 12.

7273. H. K. Baynes and The Chemical and Electrolytic Syndicate, Lim. Apparatus for the decomposition of alkaline nitrates. March 11.

7365. M. Schmeltzer and C. Aschman. Manufacture of a sulphuric alcohol and glycerin mixture, and its application for tanning or preparing leather. Feb. 26.

8342. J. Todd. An improved method of and apparatus for treating brine in the manufacture of salt. March 11.

8381. H. Bower. Manufacture of prussiates. March 4.

8425. H. E. Newton.—From The Farb. vorm. F. Bayer and Co. The manufacture or production of chemical compounds containing sulphur. March 4.

8669. H. W. Crowther, F. C. Rossiter, and G. S. Albright. Manufacture of cyanides. March 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

4093. G. H. Grundy and G. A. Lingard. Improved method or means of decorating tiles, plates, and other articles of ceramic ware. Feb. 24.

4189. F. Albrecht. An improved oven for burning or fusing lettering, designs, colours, and the like into or upon articles of glass, earthenware, and other glazed or enamelled goods. Feb. 25.

4350. M. E. Norris. Improved methods of preparing imitation coloured, frosted, or embossed ornamental glass of all kinds, whether ordinary or ground glass be used for such purposes. Feb. 27.

4945. F. Radcliffe. Improvements in furnaces suitable for use in the manufacture of glass. March 4.

5622. C. Mayer. Improvements in and relating to pottery-ware and like glaze firing-kilns. Complete Specification. March 12.

5761. C. Riessner, H. Riessner, E. Stellmacher, and R. Kessel. An improved manufacture of ceramic products. March 14.

5772. L. A. Garchey. Manufacture of ceramic stone objects by devitrification of glass. March 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6237. E. Bohm. Enamelled or glazed bricks and tiles. March 4.

8409. H. Emery and J. Emery. An improved construction of kiln for firing articles made of or from china, earthenware, and the like. March 4.

24,263. J. Badon. A new product for use in substitution of sheet glass for windows, engraved glass, painted glass, blinds, curtains, and other purposes. Feb. 26.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

3519. W. Wardle. Bituminous cement. Feb. 17.

3597. A. Hannemann and G. Boisly. Improvements in the process of manufacture of artificial asphalt. Feb. 17.

3799. W. P. Thompson.—From La Société Anonyme la Neo-Litho. Improvements in the manufacture of artificial stone and apparatus therefor. Feb. 19.

3800. W. P. Thompson.—From La Société Anonyme la Neo-Litho. Improvements in the manufacture of artificial stone. Feb. 19.

3972. S. Neffgen. Improvements in the manufacture of artificial stone. Feb. 21.

3985. A. Clery. A new or improved cement. Complete Specification. Feb. 21.

3993. W. F. Williams. Artificial stone for building purposes. Feb. 21.

4270. K. Erdmann. Improvements in artificial stone blocks, slabs, or tiles for building purposes. Feb. 25.

4918. R. A. Chesebrough. Improvements in the art of manufacturing cement. Complete Specification. March 4.

4943. W. Ycullen. Improvements in the construction of fireproof buildings. March 4.

5386. O. Kleinberger. Improvements in building bricks. Complete Specification. March 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7622. R. Walker. Construction of artificial stone slabs, bricks, tiles, and the like. March 4.

9210. S. Jorgensen. Manufacture of slag-cements. Feb. 26.

9283. W. H. Metcalfe and F. B. Wrightson. The manufacture of an improved artificial stone and the manufacture of various articles therefrom. March 11.

10,207. S. G. Bird and J. Wright. Manufacture of cement concretes. March 18.

21,293. F. W. Golby.—From F. Schmeisser. Manufacture of cement or plaster compounds. Feb. 26.

1896.

643. A. W. Perriman and W. Owen. Improvements in or relating to the manufacture of steps, building or monumental slabs, and other articles of artificial stone, asphalt, or the like, and apparatus therefor. March 18.

2746. E. Buchholtz. Improvements in or connected with paving and paving blocks. March 11.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

3603. J. B. Torres. Improvements in or relating to the extractions of manganese from ores and the like, and preparations of compounds therefrom. Feb. 18.

3918. A. J. Boulton.—From H. Eichbaum. Improvements in or relating to the recovery or separation of metals from their ores. Feb. 20.

4073. A. J. Boulton.—From J. T. Penny and W. H. Richardson. Improvements in the process of triturating and amalgamating ores, and in apparatus therefor. Feb. 22.

4165. E. L. Oppermann. A new or improved process for amalgamating and extracting gold or other suitable metals from dry crushed ore. Feb. 25.

4326. J. H. Dickinson. Improvements in the manufacture of armour plates. Feb. 26.

4329. W. L. Holms and T. Dobbie. Method of precipitating gold and silver from cyanide solutions. Feb. 26.

4422. The Exploring and Gold Mining Association, Ltd. From S. H. Emmens. A process for recovery of zinc from blende ores. Feb. 27.

4667. F. F. Barnes and F. Campbell. Soldering of aluminium or metals alloyed with aluminium. March 2.

4776. W. H. Bailey. Improvements in and relating to furnaces for heating metal. Complete Specification. March 3.

4899. J. C. Bull. Improvements in alloys. March 4.

5071. C. W. Robinson. A new tool steel and means for producing the same. March 6.

5087. T. Parker and J. Pullman. Improvements in the treatment of sulphide ores. March 6.

5123. W. H. Duncan and R. Duncan. Improvements in extracting gold, silver, copper, and other metals from earthy matter; also in separating precious stones from the earthy matter in which they are found. March 7.

5260. F. Ellershausen. Improvement in the reduction of refractory ores. March 9.

5265. J. H. Dickinson. Improvements in the manufacture of armour plates. March 9.

5358. L. Pszezolka. Improvements in the Bessemer or Thomas process for the treatment of low qualities of crude iron. March 10.

5533. J. B. Torres. Improvements in or relating to the extraction of gold and other metals from ores and the like. March 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

4004. J. Mactear. Improvements in the extraction of precious metals from their ores or from compounds containing the same. March 4.

9081. H. C. S. Dyer. Manufacture of iron and steel by which sulphur is eliminated. March 18.

9610. W. P. Thompson.—From H. Schaaf. An improved thin liquid substance for case-hardening iron. March 18.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

3712. F. Mousterde, C. Chavant, and J. George. Improvements in electro-accumulators. Feb. 18.

4345. J. H. Dunn and R. G. E. Dalrymple. Improvements in the production of gas by means of electricity. Feb. 26.

4406. E. A. McLachlan. Improvements in and connected with electrical storage batteries. Feb. 27.

4434. F. King. Improvements in or connected with moulds for use in the manufacture of secondary battery plates or supports. Feb. 27.

4937. E. Clark, W. Clark, and F. King. Improvements in plates, grids, or supports for the elements of secondary batteries. March 4.

5098. G. B. Baldo. Improvements in electrolytic processes and apparatus therefor. Complete Specification. March 6.

5253. S. O. Cowper-Coles. Improvements in or connected with the electro-deposition of metals. March 9.

5263. H. A. V. Wirth. An improved process for the electro-plating or metallisation of wood. March 9.

5274. A. S. Smith, T. A. Smith, R. J. Smith, S. Smith, and T. Deakin. Improved apparatus for the electro-deposition of metals. March 9.

5506. P. F. Ribbe. Improvements in electric accumulators. Complete Specification. March 11.

5584. A. Cohen. Improvements relating to the use and treatment of carbon in electro-chemical or electrolytic processes, and to apparatus therefor. March 12.

5616. A. E. Peyrusson. Improved electrolytic processes and apparatus. March 12.

5673. A. S. Elmore.—From J. O. S. Elmore. Improvements in apparatus for refining metals by electrolysis. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

4660. A. Hiorus. Electro-deposition of iron on copper or other metallic surfaces. March 11.

7315. W. B. S. Barber-Starkey. Electrical storage batteries. Feb. 26.

8081. A. Schauschiff. Improvements in the active material for secondary and primary batteries. March 4.

8728. J. G. A. Rhodin. Improvements in plates for secondary voltaic batteries. March 11.

8905. C. L. R. E. Meoges. Primary and secondary galvanic batteries. March 11.

10,792. W. Elliott. An improved dry battery for electrical purposes, and material for packing same. March 11.

15,592. M. Ekenberg. Manufacture of perfumes. March 11.

24,172. A. C. Iwanowski. Improvements in or connected with galvanic batteries. Feb. 26.

1896.

475. W. C. Bersey. Electric accumulators. March 11.

780. H. Leitner. A new or improved method of manufacturing electrodes for secondary electric batteries. March 18.

1575. Siemens Brothers and Co., Limited.—From Siemens and Halske. A process for the electrolytic production of zinc from its ores. March 4.

XII.—FATS, OILS, AND SOAP MANUFACTURE

APPLICATIONS.

4137. A. G. Brookes.—From H. T. E. Kirkpatrick. A new or improved method of treating fatty acids. Feb. 24.

4138. A. G. Brookes.—From H. T. E. Kirkpatrick. A new or improved method of manufacturing fatty acids and their salts. Feb. 24.

4139. A. G. Brookes.—From H. T. E. Kirkpatrick. A new or improved method of manufacturing stearic acid. Feb. 24.

4140. A. G. Brookes.—From H. T. E. Kirkpatrick. A new or improved method of bleaching oils, fats, and similar substances. Feb. 24.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8814. W. P. Thompson.—From J. B. Okie. An improved process for making tormentil soap by the cold process. Feb. 26.

23,159. J. F. Lester and A. Riccio. Apparatus for separating oleaginous matter from a solvent. Feb. 26.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

3580. H. H. Lake.—From O. Leproux. An improved varnish, chiefly intended for protecting books from the attacks of insects. Feb. 17.

3725. R. McKenzie. Colours. Feb. 18.

3906. W. Hampe and C. Schnabel. Improvements in the manufacture of zinc oxide. Feb. 20.

4141. C. H. Owen. Artistic sugar paint. Feb. 24.

4249. W. P. Thompson.—From C. S. Bailey. Improvements in compositions or compounds for removing paint. Complete Specification. Feb. 25.

4373. J. Bradley. Improvements in the manufacture of spirit varnish. Feb. 27.

4942. A. Duval. Process for giving surfaces a phosphorescent coating. March 4.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8478. T. Lowe. Improvements in non-corrosive paint to resist the action of heat and atmospheric influence. March 4.

8915. H. Fleming. Manufacture of varnish. March 11.

24,224. L. Knoche. Improvements in the manufacture of an oil and of a varnish prepared therefrom. March 4.

1896.

2201. A. J. Boulton.—From L. P. Converse. Improvements in materials or compounds for waterproofing fabrics. March 11.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

3518. R. D. Bailey. Improvements in tanning for the production of leather. Feb. 17.

3715. J. W. Peirson and F. A. T. Moor. Improvements in the art or process of treating skins. Complete Specification. Feb. 18.

3773. J. B. Scammell and E. A. Muskett. Improvements in the manufacture of leather. Feb. 19.

3901. F. B. O. Hawes. Improvements in the treatment of leathers for their better preservation and surface preparation. Feb. 20.

4057. F. B. O. Hawes. Improvements in the manufacture of material suitable for belting, carding cloths, soles of boots, and like uses. Feb. 22.

4199. J. Hall. Improvements in machinery for treating skins, hide leather, and like substances. Feb. 25.

5644. J. A. McIntosh. An improved method of treating hides and skins, &c. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7365. M. Schmeltzer and C. Ascham. See Class VII.

8215. H. Schmiedel. Manufacture of imitation or artificial leather. March 11.

8960. O. Thiele and J. Stocker. Manufacture of artificial leather. March 11.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

4946. A. A. Yvert and C. J. Yvert. Improvements in the manufacture of superphosphates. March 4.

5495. J. S. Wallace and J. Castell-Evans. Improved processes for the production of nitrogenous and other substances. March 11.

COMPLETE SPECIFICATION ACCEPTED.

1895.

14,143. G. A. Macintire. An improved odourless liquid manure. March 11.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

3565. M. Zahn. Improvements in sugar refining. Complete Specification. Feb. 17.

3613. E. Shaw. Improvements in and relating to boiling sugar and other syrups. Feb. 18.

3890. E. Bert. Improvements in or relating to the purification of saccharine liquids or syrups. Feb. 20.

4560. D. N. Bertram. Improvements in and relating to strainers for treating paper pulp, separating fibrous materials from starch, and like purposes. Feb. 29.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

4415. E. Lofts and G. H. R. Lubbs. Improvements in or relating to brewing. Feb. 27.

4598. H. H. Lake. From J. Effront. Production of yeast. March 11.

COMPLETE SPECIFICATION ACCEPTED.

1896.

2587. A. Myers. Improvements in processes of manufacturing fermented and distilled liquors. March 11.

XVIII.—CHEMISTRY OF FOODS, SANITARY CHEMISTRY, AND DISINFECTANTS.

APPLICATIONS.

A.—Chemistry of Foods.

3833. J. Dunn and W. Dunn. Improvements in treating lentils, peas, and other leguminous vegetables to obtain new alimentary products. Feb. 20.

3933. P. Walsh. Walsh's new and improved method of curing and preserving and flavouring oxen, cattle, pigs, sheep, fowls, and fish for human food and other purposes. Feb. 21.

5218. G. M. Keevil. An improved method of preserving provisions in the fresh state. March 9.

5749. D. Finkler. A process for the preparation and extraction of albuminous substances from animal or vegetable mixtures and products. March 14.

B.—Sanitary Chemistry.

4449. J. W. Slater and J. Parkinson. Improvements in dealing with foul and waste effluents from bleach works and the like, and in means therefor. Feb. 28.

5655. J. T. Wood and J. A. Brodie. Improvements in and relating to the treatment of sewage, and in apparatus therefor. March 13.

C.—Disinfectants.

5119. W. Hanlon. A combined deodorising, disinfecting, detergent, and saponifying mixture. March 6.

5381. P. O'Dowd. Composition for utilising and disinfecting sewage matter. March 10.

5705. J. N. Spence. A new or improved insecticide. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Chemistry of Foods.

1895.

4489. A. Dubuisson. Manufacture of margarines and natural butters and apparatus therefor. March 11.

5776. A. Eckardt. A new process of torrefying coffee. March 18.

1896.

2709. B. Dunn and W. Dunn. Improvements in treating barley to obtain a new alimentary product. March 11.

3130. W. P. Thompson.—From The New Process Food Co. Improvements in and relating to granulated or powdered food extracts. March 18.

B.—Sanitary Chemistry.

1895.

8256. T. Royle. An improved method of purifying water. March 4.

C.—Disinfectants.

1895.

8575. J. J. A. Trillat. Improvements in vaporising apparatus, more especially for use in producing vapours of formic aldehyde or formal for disinfecting purposes. March 18.

9535. I. S. McDougall and J. T. McDougall. Improvements in insecticides. March 18.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATIONS.

4497. O. Tietze. Process for increasing the suppleness or pliability of paper. Feb. 28.

4560. D. N. Bertram. See Class XVI.

4713. C. F. Cross. Improvements in the manufacture of alkali cellulose. March 2.

5665. J. Bradley. Improved method of utilising the sludge or waste products from paper mills. March 13.

COMPLETE SPECIFICATION ACCEPTED.

1896.

2388. F. W. Hall. Improved apparatus for straining paper pulp and the like. March 11.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

3555. J. C. Richardson. Improvements in or relating to the manufacture of camphors or like compounds. Feb. 17.

3706. J. Y. Johnson.—From Vereinigte Chininfabriken Zimmer and Co. Improvements in the manufacture and production of a pharmaceutical product. Feb. 18.

3791. G. B. Ellis.—From La Soc. Chimique des Usines du Rhone anet. G. P. Monnet and Cartier. The manufacture of new compounds from pbenetidine and its homologues. Feb. 19.

3998. A. J. Boulton.—From G. Barthel. Improvements in or relating to a process and apparatus for the preparation of aldehydes. Complete Specification. Feb. 21.

4544. H. Archer. Digestine. Feb. 29.

4991. J. Y. Johnson.—From Vereinigte Chininfabriken Zimmer and Co. The manufacture and production of new pharmaceutical preparations. March 5.

5293. W. Gray. An improved process and apparatus for the manufacture of methyl aldehyde (formic aldehyde). March 9.

5490. O. Murray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of di-iodo-salicylic acid. March 11.

5672. E. Langheld. Ozone compounds for medicinal purposes. Complete Specification. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

5255. O. Porsch. Processes of and apparatus for making pure acetone. March 18.

1896.

21. W. Majert. Manufacture or production of vanillin. March 4.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

3765. J. Martyn. An improved method of producing photographic prints. Feb. 19.

3902. S. D. Rowland. Improvements in skiagraphy or photography by means of Röntgen's x-rays. Feb. 20.

3997. I. N. V. Bablon. Improvements in photographic plates. Feb. 21.

4023. A. W. Porter. Improvements in the manufacture of high vacuum bulbs for photographic purposes. Feb. 22.

4244. C. D. Ahrens. A method of obtaining light of any desired colour for the purposes of chromo-photography without the use of coloured glass screens. Feb. 25.

4286. C. O. Weber. Improvements in the manufacture of photographic plates of high sensitiveness to dark rays and radiations. Feb. 26.

COMPLETE SPECIFICATION ACCEPTED.

1895.

9438. F. Hrdliczka-Csiszar. Improved printing silver nitrate paper for photographic purposes and process of preparing same. March 18.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

4509. W. Greaves and E. M. Hann. Improvements in or relating to explosives. Feb. 28.

4714. M. Bals. Process for rendering amorphous phosphorus applicable as substitute for the yellow phosphorus for matches, primings, and the like. Complete Specification. March 2.

5432. O. Nagel. Improvements relating to the production of nitrocellulose compounds. March 10.

5575. A. Pain. Improvements in ships' signal lights, rockets, and similar fireworks. March 12.

5687. W. P. Thompson.—From B. T. Steber and W. E. Cook. Improvements in apparatus for making lucifer matches or the like. Complete Specification. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

9419. W. Theodorovic. Production of explosives from reduced and nitrated cellulose bodies. March 18.

2575. H. H. Lake.—From Fried Krupp Grusonwerk. An improved process and apparatus for the manufacture of explosives. March 11.

THE JOURNAL

OF THE

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A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 4.—VOL. XV.]

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NOTICES.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those Members whose names are placed in italics in the list of Council will retire from their respective offices at the forthcoming Annual General Meeting.

Dr. Edward Schunck, F.R.S., has been nominated to the office of President; and Mr. Thomas Tyrer has been nominated Vice-President under Rule 11.

Prof. A. K. Huntington, Mr. A. H. Mason, and Mr. G. N. Stoker have been nominated Vice-Presidents under Rule 8; and the Treasurer and Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the Ordinary Members of Council under Rule 18. Nomination forms for this purpose can be obtained from the General Secretary upon application.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten Members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting, to the election to take place at which it refers. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

The Annual General Meeting will be held in London on the 15th, 16th, and 17th July next. A provisional programme is enclosed with this number of the Journal. Tickets of Membership will be issued in time for the meeting, and will form, as heretofore, vouchers for visits to works and excursions.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready in the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

The prices will be as follows:—

To Members (see Rules 25 and 27) who make application with remittance, not later than June 30, 1896.....	Each copy	5s.
To Members (see Rules 25 and 27) who make later application; Libraries, Corporations, and Exchanges on the Society's List, and Past Members (see Rule 30)	Each copy	10s.
To Subscribers	"	12s. 6d.
To others.....	"	15s.

MEMORIAL TO THE LATE PROF. HUXLEY, F.R.S.

This Memorial will take the form of a statue to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science, while the surplus will be devoted to the furtherance of biological science. Donations towards the fund should be sent to Mr. G. B. Hower, Hon. Sec. Huxley Memorial Committee, Royal College of Science, South Kensington, S.W.

MEMORIAL TO THE LATE PROF. PASTEUR.

At a meeting of the Provisional Committee of the British Section of the Pasteur International Memorial, held on March 21st last, Sir Joseph Lister in the chair, it was unanimously resolved, "That application be made for subscriptions towards the erection of a monument to Pasteur in Paris from persons in the United Kingdom, India, and the Colonies, interested in science and the various industries which have been benefited by Pasteur's labours." An Executive Committee was formed consisting of Sir Joseph Lister, Sir John Evans, Sir Henry Roscoe, Dr. Thorne Thorne, and Prof. Percy Frankland (Hon. Sec.). Subscriptions may be sent to Sir John Evans, who will act as Hon. Treasurer, at the Royal Society, Burlington House, W.

ADDRESS TO PROF. CANIZZARO.

At a meeting of Council held on March 23rd it was unanimously resolved to present an address of congratulation to Prof. Canizzaro on the attainment of his seventieth year of age, which occurs on July 12th next. The drafting of the address was placed in the hands of the Hon. Foreign Secretary of the Society.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

This Congress will be opened in Paris, possibly at the Hotel "des Agriculteurs de France," on Monday, July 27th next, and will continue for about ten days. All enquiries and adhesions should be addressed to the General Secretary of the Conference, 156, Bd. Magenta, Paris.

LIST OF MEMBERS ELECTED 23rd APRIL 1896.

- Boot, John C., Brooklyn Distilling Company, Kent Avenue, Brooklyn, N.Y., U.S.A., Chemist.
 Burford, Samuel F., Eastleigh, Queen's Road, Leicester, Analytical Chemist.
 Crawford, Alex., 113, Fenchurch Street, E.C., Chemical Merchant.
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 Smith, Harold Wilson, 4, Northbrook Road, Lee, S.E., Chemical Engineer.
 Sunderland, Arthur, 2, Rothesay Road, Luton, Beds, Teacher of Chemistry.
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 Crawley, A. H., 1/o Schlader; 27, Chatsworth Avenue, Aintree, Liverpool.
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Linn., Mount Morgan, Queensland.
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Slater, Sydney H., 1/o Johannesburg, S.A.R.

Death.

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H. de Mosenenthal.	

Hon. Local Secretary: John Heron,
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The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Chairman: R. Messel. Committee: W. J. Dibdin, R. J. Friswell, D. Howard, B. E. R. Newlands, B. Redwood, and T. Tyrer.*

SESSION 1895-96.

May 4th.—Mr. E. J. Wall. "Chromatic Photography."

June 1st:—

Mr. W. Gowland. "Japanese Metallurgy." Part I.

Mr. S. Cowper-Coles. "The Electro-deposition of Zinc."

Meeting held Monday, April 13th, 1896.

MR. B. E. R. NEWLANDS IN THE CHAIR.

MOISTURE IN WOOD PULP.

BY R. W. SINDALL.

This subject very naturally divides itself into two sections, the one dealing with the question of atmospheric moisture, and the other with more practical considerations involved in sampling and testing.

The former point has been discussed at various times in the Journal of the Society, the most recent contribution on the subject being a paper by Messrs. Readman and Gemmell in 1893 (this Journal, 1893, 1005). These gentlemen studied the variation in moisture and in the weight of different wood pulps caused by altered conditions of atmospheric humidity, which conditions were obtained by artificial means, viz., the more or less complete saturation of the air from steam obtained by boiling water in an open vessel, in order that the range of humidity might be as large as possible.

The general conclusions arrived at, as the result of observations extending over a few weeks, seemed to point to an average of 10 per cent. of moisture as the amount most likely to represent the normal condition of wood pulp in an air-dry state—mechanical giving a somewhat higher figure, sulphite a lower figure.

This variation in the weight of pulp, consequent on the increase or decrease of the saturation of the air, had also received considerable attention in the laboratory of the Daily Chronicle Paper Mills during the same year, 1893; but, unfortunately, the observations recorded were not sufficiently numerous for the purpose we had in view—the discovery of some law establishing a definite relation between the air-dry weight of pulp and atmospheric moisture.

We accordingly repeated the investigation on a larger scale in the hope of (1) accurately deciding the air-dry weight of wood pulp for normal atmospheric conditions common to this country; (2) obtaining the average weight for the whole period of observation, together with the average humidity; (3) from these results to determine the law connecting these two variable quantities.

The conditions of the experiment were perfectly simple: the pulps were exposed in a room on the ground floor, with free access of air through an open window and door. No gas or fire was used during the whole period, and thus the pulp was only subject to the influence of the air in its natural state. The quantities originally weighed out were such that on reaching an approximate air-dry state the weight was about 100 grms., with two exceptions.

The following tabulated statement gives the actual condition of the pulp before daily observations were commenced:—

Pulps exposed to Air, but not absolutely dried beforehand.

Description.	Mark.	Amount Weighed out.	Conditions.	Receptacle used.
Mechanical	A. 1	300 grms. wet	Torn up fine	Wire cage.
"	A. 3	200 "	Thick sheets	"
"	B. 5	200 "	Torn up fine	Shallow tray.
Sulphate	C. 7	100 grms. dry	"	Wire cage.
Soda	D. 9	"	"	"
Sulphite dry	E. 11	"	"	"
"	E. 13	"	"	Shallow tray.
Sulphite moist	F. 14	300 grms. wet	"	Wire cage.
"	F. 16	200 "	Thick sheets	Shallow tray.

Pulps absolutely dried before being exposed to Air.

Mechanical	A. 2	200 grms. wet	Torn up fine	Wire cage.
"	A. 4	"	Thick sheets	"
"	B. 6	"	Torn up fine	"
Sulphate	C. 8	100 grms. dry	"	"
Soda	D. 10	"	"	"
Sulphite dry	E. 12	"	"	"
Sulphite moist	F. 15	200 grms. moist	"	"

In this way, the influence of the high temperature on the sensibility of the pulp to atmospheric changes could easily be studied.

It should be noticed that the same samples were used during the whole investigation—a fact which ought not to be overlooked—and, in order to check the results, the contents of each receptacle were carefully turned out every three months, the cages and trays cleared and dusted, and the counterweights tested. The dust which accumulated during the period was duly ascertained, but proved to be a negligible quantity, while the possibility of error in weighing was reduced to a minimum by the use of receptacles exactly equal in weight, and balanced during the operation of weighing by a constant counterpoise.

Before daily readings were properly commenced, the whole of the samples were freely exposed for one month, in order that the moist pulps might be deprived of all excess moisture, and that the absolute dry pulps might absorb all that was possible, after which, for 12 months, the readings were taken practically every day, and included the exact weighing of the pulps to within 0.02 grm., together with the observations of the hygrometric conditions of the air as recorded by an ordinary dry and wet bulb hygrometer.

No useful purpose would be served in giving the details of the results obtained, so that in order to avoid a multiplicity of figures, which would only tend to confusion, the following tables have been constructed, in which all the records necessary for our object are presented.

Instead of giving the figures for each of the 16 samples, the readings have been reduced to nine columns by taking the average results for duplicate pulps exposed under precisely similar conditions.

At the headings of the respective columns the word "air" may be taken to mean that the figures refer to pulps which have been allowed to get dry by simple exposure to air, while by "abs.," the contraction for "absolute," we may understand that the pulps were first dried to a constant weight at 100° C. before being placed with the samples.

With the exception of the pulps exposed in the form of thick sheets, the results recorded in every column represent the figures obtained as the mean of duplicate tests with different brands of pulp.

Table I. gives the average monthly results calculated from the daily observations taken during the period of 12 months. These results are all given in a form which at once reveals the air-dry weight of pulp containing 88 parts of absolute dry fibre—a method of expression which has its own advantages, and which will be appreciated by members who are more directly interested in this question of moisture in wood pulp, on account of the fact that the trade in this article is based upon the assumption that 88 parts of absolute dry pulp is equivalent to 100 parts of air-dry pulp, although quite recently contracts have been and are now

TABLE I.

Month.	The Air.					Mechanical.			
	Dry Bulb. ° F.	Wet Bulb. ° F.	Difference.	Dew Point. ° F.	Relative Humidity.	Air. Nos. 1, 5.	Abs. Nos. 2, 6.	Air (Sheets). No. 3.	Abs. (Sheets). No. 4.
March	48.5	46.2	2.3	43.70	83.2	105.22	102.76	104.32	101.94
April	54.6	51.96	2.66	49.3	82.1	104.26	102.29	103.17	101.45
May	54.85	51.73	3.11	48.81	80.13	103.61	102.08	102.68	101.29
June	60.81	57.92	2.88	55.48	82.9	103.92	102.59	103.67	101.81
July	66.48	63.48	3.0	60.9	82.7	103.51	102.50	102.70	101.68
August	64.64	61.3	2.74	59.0	83.9	103.92	102.84	103.05	102.18
September	58.87	56.92	1.95	55.16	87.5	104.92	103.90	104.21	103.18
October	55.2	53.4	1.8	51.72	88.24	105.17	104.63	104.66	104.13
November	52.2	50.64	1.57	49.1	89.1	105.18	104.52	104.71	104.12
December	47.4	45.6	1.78	43.7	86.6	105.45	105.35	105.22	104.50
January	38.8	37.6	1.2	36.0	89.8	105.78	105.61	105.50	104.75
February	35.0	..	..	..	..	105.02	104.80	104.56	104.31
Mean	54.70	52.43	2.27	50.26	85.1	104.66	103.65	104.00	102.94

Month.	Sulphate and Soda.		Sulphite.		No. of Readings.
	Air. Nos. 7, 9.	Abs. Nos. 8, 10.	Air. Nos. 11, 13, 14.	Abs. Nos. 12, 15.	
March	99.16	98.74	100.80	99.78	25
April	98.60	98.22	100.20	99.20	25
May	98.37	98.04	99.80	98.95	25
June	98.90	98.55	100.33	99.50	26
July	98.85	98.54	100.20	99.51	24
August	99.13	98.84	100.56	99.78	24
September	100.06	99.78	101.53	100.79	23
October	100.37	100.08	101.82	101.19	25
November	100.03	99.85	101.70	101.12	24
December	100.46	100.35	102.11	101.48	20
January	100.77	100.62	102.46	101.73	20
February	99.90	99.79	101.69	100.71	20
Mean	99.55	99.28	101.09	100.31	281

TABLE II.

Remarks.	The Air.						Mechanical.	
	Date.	Dry. ° F.	Wet. ° F.	Difference.	Dew Point. ° F.	Humidity.	Air. Nos. 1, 5.	Abs. Nos. 2, 6.
Maximum reading	Oct. 13	..	..	..	..	93.6½	106.70	106.66
Minimum reading	July 4	..	..	..	..	66.5½	101.23	100.05
Special low result obtained	June 26, 1895	..	..	..	..	51.4	99.88	99.07
Difference between maximum and minimum readings.	..	..	..	..	..	41.6	6.82	7.59
Average for month of June 1894 .....	..	60.8	57.9	2.88	55.5	82.9	103.92	102.59
Average for month of June 1895 .....	..	64.8	58.1	6.7	52.7	65.3	101.43	100.44

Remarks.	Mechanical.		Sulphate and Soda.		Sulphite.		
	Air (Sheets). No. 3.	Abs. (Sheets). No. 4.	Air. Nos. 7, 9.	Abs. Nos. 8, 10.	Air. Nos. 11, 13, 14.	Abs. Nos. 12, 15.	Air (Sheets). No. 16.
Maximum reading	107.42	106.52	102.64	102.16	104.01	103.60	103.65
Minimum reading	100.38	98.70	96.64	96.44	97.97	97.22	96.71
Special low result obtained	99.11	98.07	96.09	95.87	97.33	96.40	95.85
Difference between maximum and minimum readings.	8.31	8.45	6.55	6.29	6.71	7.20	7.80
Average for month of June 1894	103.07	101.81	98.90	98.55	100.33	99.50	99.57
Average for month of June 1895	100.38	99.45	97.11	96.71	98.35	97.32	96.72

being made on the basis of 10 per cent. and not 12 per cent. moisture.

The various points of interest to be noticed in these tables are as follows:—

(1.) In every case the susceptibility of absolutely dried pulp to changes in the atmosphere is less than that of pulp which has not been submitted to the temperature of 100° C.

(2.) That the method of exposure, sampling, and drying exercises a material influence on the air-dry weight.

(3.) That the difference between the air-dry weight of mechanical and chemical pulps is too great to allow of a universal percentage of moisture being used, even for trade purposes.

(4.) That the average percentage of moisture for this period exceeds 12 per cent.

(5.) That the difference between the maximum and minimum observations is extraordinarily large.

(6.) That the relative humidity for each month and for the whole year is very high.

In discussing these points we may first notice the conditions of the experiment in regard to the atmosphere were decidedly abnormal.

TABLE III.

Relative Humidity.	Mechanical.	Sulphate and Soda.	Sulphite.
H.	Nos. 1, 2, 3, 4, 5, 6.	Nos. 7, 8, 9, 10.	Nos. 11, 12, 13, 14, 15, 16.
	Average.	Average.	Average.
51.4	99.03	95.98	96.53
60.00	100.04	96.42	96.85
65.30	100.42	96.91	97.45
77.20	102.24½	98.60	99.30
80.13	102.41	98.21	99.30
82.10	102.78	98.41	99.74
82.70	102.58	98.70	99.69
82.90	102.84	98.78	99.80
83.20	103.55	98.95	100.50
83.90	103.17	98.98	100.03
85.10	103.81	99.42	100.60
86.60	105.13	100.41½	101.63
87.50	104.55	99.92½	101.04
88.24	104.61	100.23	100.93
89.10	104.63	100.62	101.14
90.00	105.40	100.70	101.90
93.00	106.82	102.40	103.76

These figures cannot be accepted as perfectly accurate, because a certain amount of irregularity is very apparent in the columns, but this is not surprising when we consider the conditions of the experiment. On the one hand, the relative humidity is obtained from an instrument extremely sensitive to atmospheric changes, and which, in its usual form, cannot be read exactly to more than one-half a degree temperature; while, on the other hand, the air-dry weight is a quantity which only changes slowly and is extremely sluggish in alteration. Thus, while the weight can be determined easily at any given time, the relative humidity, measured by the readings taken the same hour, may only represent the degree of saturation producing that weight of pulp within about 5°. It is this fact which renders the whole investigation a difficult task, but this liability to error is reduced to a minimum by the use of the table, because the greater number of observations are average monthly results.

The precise value which may be attached to these figures can be readily ascertained by adopting the plan of plotting out a curve having the absolute dry weight for its ordinates and the relative humidity for abscissæ—a plan which not only detects irregularities in observation, but serves for their correction and enables interpolation of figures which have not been arrived at by observation, to be accomplished for the completion of the readings.

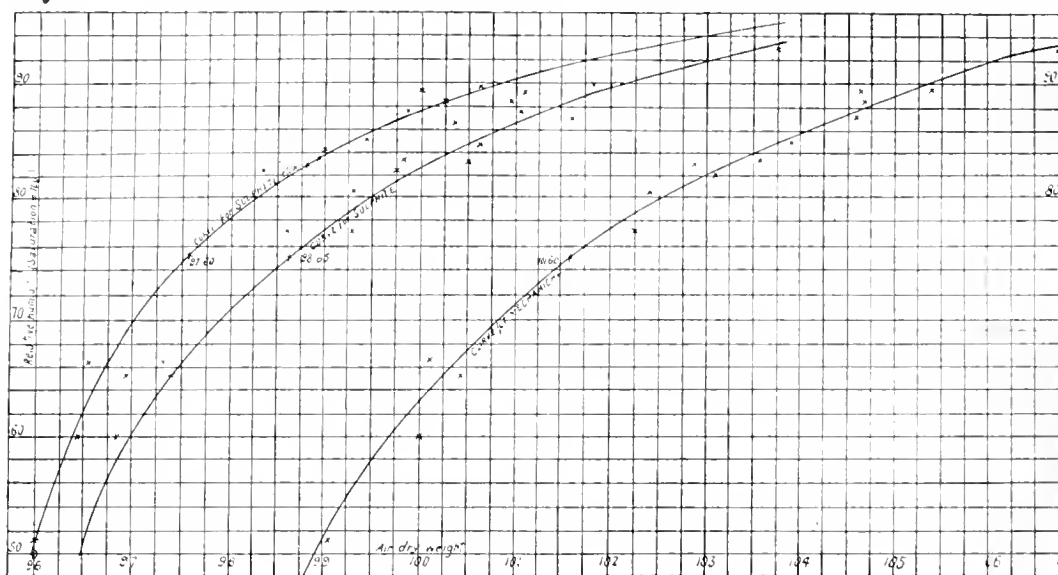
Average for 12 Months.	Official (normal), for all Years at Greenwich.	Experimental, for 1894.
Temperature of the air...	58.9	54.7
Wet-bulb thermometer ..	54.6	52.43
Difference	4.3	2.27
Calculated dew point	51.16	50.26
Relative humidity (saturation = 100).	75.20	85.10

In order to clearly indicate the relation of the air-dry weight to humidity, the tables given above must be reduced. The only difficulty which presents itself is the difference in the weight of pulp as determined on stove-dried and air-dried samples, as the method of drying the pulp to an absolute dry state before exposure influences the weight considerably. In following out the mode, however, for establishing the connection between these two qualities, we may for the present content ourselves with reducing tables I. and II. into another form showing the average results of the figures obtained, as in Table III.

The average results for the whole year, when the readings have thus been finally reduced to the smallest bulk, give as the air-dry weight of pulp which contains 88 parts of absolute dry fibre: mechanical 103.81, sulphate and soda 99.42, sulphite 100.60, the relative humidity being 85 per cent.

With the possibility of error in the degrees of humidity which has just been hinted at, it is somewhat remarkable to find that a regular curve can be drawn through the points of observation thus plotted out, in such a position that these

lie close to and evenly distributed about it—a fact which helps to confirm the accuracy of the table given above, and which must tend to enhance the value of the figures recorded. On this account, we need have no hesitation in using this



curve for the purposes mentioned at the commencement of of the paper, viz., the determination of the percentage of moisture in air-dry pulp under normal atmospheric conditions, and the discovery of some simple mathematical law connecting humidity and air-dry weight.

To do this, we require a fresh table in which the atmospheric conditions are represented by degrees of humidity increased by equal amounts, or in which the relative humidity forms a simple arithmetical progression. This is obtained from the curves drawn for the three classes of pulp, and is shown in Table IV.

TABLE IV.
Figures obtained from the Curves.

Relative Humidity H.	Air-dry Weight of Pulp.			Average difference for 5° H.	Constant r .
	Mechanical.	Sulphate and Soda.	Sulphite.		
50	98.95	95.90	96.35	0.26	..
55	99.30	96.10	96.60	0.33	1.25
60	99.70	96.35	96.95	0.42	1.27
65	100.20	96.65	97.40	0.52	1.24
70	100.80	97.05	97.95	0.68	1.30
75	101.60	97.60	98.65	0.82	1.22
80	102.50	98.30	99.50	1.13	1.35
85	103.75	99.35	100.60	1.52	1.34
90	105.25	100.80	102.20	..	..
					mean = 1.28

It is at once evident from this table that the increase in moisture does not follow the same law of arithmetical progression. The law connecting the two variable quantities, humidity and air-dry weight of wood pulp, may be expressed thus:—If the numbers representing humidity form a series in arithmetical progression, then the weight of wood pulp corresponding to those numbers produces a series of figures in geometrical progression, thus:—

$$\text{Humidity} = H, H + d, H + 2d, H + 3d, H + 4d,$$

$$\text{Weight} = W, W r, W r^2, W r^3, W r^4,$$

where $d = 5$, $r = 1.28$.

If the value of r be calculated separately for each class of pulp, the figures are 1.23, 1.31, 1.31, respectively.

The next matter which requires some consideration is the air-dry weight under normal atmospheric conditions and the percentage of natural moisture.

In this country the average normal degree of saturation, as taken at Greenwich Observatory, is 75 per cent., for which the weight of wood pulp, according to Table IV., is: mechanical, 101.60; sulphate and soda, 97.60; sulphite, 98.65; interpolated figures which agree with actual results (compare Table III.) giving as the percentage of moisture—

	Per Cent.
Mechanical.....	13.4
Sulphite.....	10.6
Sulphate and soda	9.6

For practical purposes, the percentage of moisture in air-dry mechanical pulp may be taken at 13 per cent., and in chemical pulps at 10 per cent.

This difference is too great to allow of a universal percentage of moisture being accepted for all pulps, and it is evident that it would be more desirable to adopt a different percentage for each of the two great classes of pulp as indicated.

The subject of sampling and testing for the purpose of arriving at the percentage of air-dry fibre present in a given consignment of wood pulp, is one of great importance to the paper trade.

The difficulty of determining the exact percentage is apparent when the several factors which control the result are taken into consideration, viz., (1) the large bulk of the raw material, (2) the influence of exposure to air, (3) the variation in the gross weight of the bales, (4) the differences in moisture between selected bales, (5) the method of drawing samples, and so on.

No uniform method of sampling has yet been decided on by paper-makers or analysts, owing to this fact—that each individual adopts some plan of his own as the one most likely to approximate the true percentage of air-dry pulp, without having, perhaps, any time or opportunity to compare with the methods of others.

In the ordinary routine work of the mill it is considered sufficient to make a few rough tests on the various brands of pulp, with a view of determining that the amount of air-dry fibre is, at least, fully equal to the quantity invoiced.

On the other hand, the utmost care is required in the event of a dispute arising from the possibility of an excess of moisture.

Usually 10 or 20 bales, according to the size of the consignment, are considered enough, but the more correct plan is to sample a given percentage by weight of the whole parcel, although of course such a rule may be modified by circumstances. If the pulp is a good brand, characterised by uniformity as to the gross weight and moisture of respective bales, then 20 or less may prove sufficient, even in a large delivery; whereas 60 or 70 bales may hardly be correct enough for a pulp exhibiting irregularity in moisture and weight. The analyst must be guided by the condition of the pulp.

In the selection of bales, it must be remembered that the air-dry weight of the parcel is calculated on the air-dry weight of the few bales tested. Hence it is important that these should be unbroken, clean and uniform in appearance, and taken from such parts of the stack which are not exposed to air. The difficulty of correct sampling is greatly increased if bales which have been unduly dried by air or wetted by water are chosen for this purpose. In the actual sampling of these selected bales, the most important part of the process is reached.

We propose to describe somewhat in detail the methods of testing adopted at the Daily Chronicle Paper Mills, and also some experiments carried out in the hope of determining what method may be considered as the most exact.

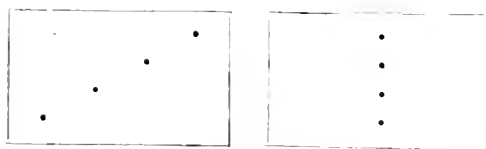
In the case of moist mechanical pulp, which arrives packed in 2-cwt. or 4-cwt. bales, the following plan has proved to be fairly reliable and quick:—

After the bales have been weighed, five sheets are sampled in each, from portions indicated in the diagram, viz., the centre sheet (3), sheets midway between the centre and the ends of the bale (2, 4), and two just beneath the extreme outside sheets (1, 5).

From each sheet small pieces are chipped out with the point of a knife, about four or five in number, and immediately dropped into a glass bottle. These pieces are chipped diagonally across the sheet, or across the length and width according to the subjoined figure:—

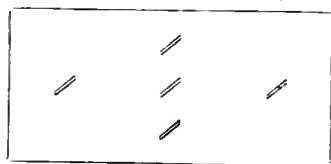


End view of the bale.



Plan of some of the sheets when sampled.

With dry sulphite packed as sheets in the bale, the five sheets are all first withdrawn from the bale, as indicated in the diagram, laid together, and small strips cut through the five, and bottled, from positions indicated, thus:—



Some very complete experiments have been carried out from time to time to determine the precise influence of the

various factors already hinted at, and as these are of interest and utility, we venture to give some of them.

The first and most important subject in connection with the question of moisture is the influence of the method of sampling.

Three experiments were carried out, and in each the actual method of sampling was different. All the experiments were repeated three or four times, and the total amount of pulp banded was about 9 tons of moist (mechanical).

The *modus operandi* for each experiment was as follows:—

(1.) Six bottles were labelled numerically in order for the reception of the samples.

(2.) The bales were carefully weighed and sampled according to a specified method, as given in Table B.

(3.) After sampling, the whole of the pulp for the test under consideration was placed in a tank and soaked overnight in hot water.

(4.) The soaked pulp was ground up in the edge runner, carefully weighed up in sacks, and again thoroughly sampled.

In Table A the conditions of each experiment are given in detail, while the methods of sampling are shown in Table B.

The object in passing the whole of the pulp from each test through the edge runner was to reduce the material into a uniform mass of particles which could be weighed and sampled in a totally distinct manner from the usual method as a further check.

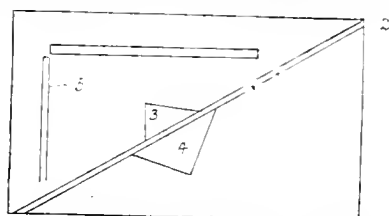
TABLE A.

Experiment I.	Experiment II.	Experiment III.
Pulp had been in stock under cover two months.	Pulps had been stacked in the open about three weeks.	Pulp was tested immediately on delivery.
Five tests made on 15 cwt. moist pulp for each.	Four tests made with 12 cwt. moist pulp for each test.	Three tests made with 20 cwt. moist pulp for each.
Brand ABC	Brand X	Brand X.

TABLE B.

No. of Bottle.	I.	II.	III.
1	Small pieces from all five sheets.	Small pieces from sheets 1, 5.	Small pieces from sheets 1, 5.
2	Narrow strips cut diagonally from all five sheets.	Small pieces from sheets 2, 4.	Small pieces from sheets 2, 4.
3	Triangular pieces from centre of middle sheet only.	Small pieces from sheet 3.	Small pieces from sheet 3.
4	Triangular pieces from all five sheets.	Diagonal strips from sheets 1, 5.	Strips across length and width of sheets 1, 5.
5	Two special strips cut at right angles from centre sheet.	Diagonal strips from sheets 2, 4.	Strips across length and width of sheets 2, 4.
6	Two special strips cut at right angles from all five sheets, as in No. 5.	Diagonal strips from sheet 3.	Strips across length and width of sheet 3.

Note.—Samples were drawn from every sack of the pulp passed through the edge-runner, and six or seven tests made for moisture in all cases.



Plan of sheets, showing method of cutting.

It is impossible to deal here with the mass of figures which such a drastic method of treatment necessarily involved. The edge-runner test may be regarded as one of special value, as it reduced the whole pulp to a uniform condition, rendering the task of sampling a comparatively easy one.

After making all allowances for packing, loss in working, &c., the method which most closely approximated the results obtained by the use of the edge runner, was the cutting of narrow strips diagonally across all five sheets. At the same time, however, the method of chipping small pieces from all the sheets gave figures so close that it proved a reliable method, although the percentage was consistently a trifle higher.

From these results it would seem desirable to adopt as a universal method of sampling, the cutting of narrow strips diagonally across five sheets in every bale tested, or taking as a representative sample small pieces chipped from these sheets as indicated above.

It is easy to show that when a parcel is delivered in good condition, with uniformity in weight and moisture in the bales, a few bales are quite sufficient for a good test. In such cases 1 per cent. of the parcel will give a percentage of air-dry pulp very near the true result. On the other hand, a pulp which shows large variations in these matters may not give a satisfactory test even with 4 or 5 per cent. The following table is a striking illustration of this fact, showing that with a good uniform pulp, a small percentage is sufficient for the test:—

Table showing Percentage of Absolute Dry Pulp.

I. Mechanical Pulp in 100-lb. Bales. Very Uniform. 25 Bales to each Test.			II. Sulphite Pulp in 100-lb. Bales. Very Variable. 20 Bales to each Test.		
34.0	34.0	33.3	78.70	79.65	76.45
33.7	33.7	33.3	77.80	74.45	75.65
34.0	33.6	33.3	79.15	78.45	77.35
33.1	33.6	33.7	78.35		
33.6					
33.60			Mean		
38.18			Air-dry per cent.		
			77.60		
			88.18		

In the first case, if the mean be assumed as the most correct percentage, then the greatest error in any test is only 0.4 per cent., whereas in the second case the error is 3 per cent.

The details of these two instances, which are cases in actual practice, are as follows:—

The mechanical pulp was invoiced as 8477 bales = 378 tons 8 cwt. 3 qrs. at 40 per cent. air-dry pulp. Every 25th bale was taken, and, in all, about 340 bales out of the 8477 were actually tested, which means 4 per cent. of the whole delivery. The table conclusively shows that for a pulp in good condition any 25 bales would have given a test sufficiently accurate—a number equivalent to $\frac{1}{3}$ per cent. of the parcel.

With the sulphite pulp, the variation in moisture and weight rendered the task of testing exceedingly unsatisfactory. This pulp was invoiced as 1,562 bales = 70 tons 13 cwt. at 86.96 per cent. dry pulp, giving 61 tons 8 cwt. 2 qrs. air-dry weight. 200 bales, or 13 per cent. of the parcel, were tested in 10 lots of 20 bales each, the air-dry weight by the lowest test being 57½ tons, and by the highest 65½ tons. In this case 1 per cent. of the parcel is quite insufficient to ensure an accurate test.

The difficulties to be overcome in this subject of sampling could be multiplied and exemplified to almost any extent, but it would not serve any further purpose to prolong the paper beyond this point, seeing that the object of the writer has been accomplished in drawing attention to methods which might advantageously be adopted as suitable for universal application in sampling, and in suggesting some ideas for the elucidation of that oft-disputed question of atmospheric moisture.

DISCUSSION.

Mr. C. BEADLE said that about five years ago he had intended to undertake the task which the author had so successfully carried out, but the obstacles seemed insurmountable. He foresaw great difficulties which would prevent him from arriving at definite conclusions. First of all he thought of comparing the amount of moisture with the conditions of the atmosphere. Then it struck him that it would be far better to arrive at the mean condition of the atmosphere of the British Isles, and to then find the amount of atmospheric moisture for each kind of pulp under those conditions, and to establish that figure as the correct one to be allowed in each case. He saw the Secretary of the Meteorological Office, Mr. Robert Scott, who pointed out that it would be absurd to attempt to establish the mean conditions of the atmosphere by taking the mean readings of the different parts of the kingdom, so he was obliged to give up the idea. With regard to the difference between allowing the pulp to air-dry, and bone-drying a pulp and then allowing it to take up moisture, the author's figures fairly confirmed those he had obtained with regard to cotton. If cotton were dried and then exposed to the atmosphere it never returned to its original air-dry weight, but was always about $\frac{3}{4}$ per cent. short of that figure. His impression was that when a pulp was heated there was something besides water given off during the heating, and that the proper way to dry pulp was to put it in a desiccator, but for all practical purposes it would be sufficient to expose the pulp to 105° C. and to take the whole loss as being due to water.

Mr. DAVID HOWARD remarked that, although not strictly to the point, it was rather interesting that the average amount of hydration of cinchona bark was almost exactly 12 per cent. air-dried, as compared with cinchona bark dried at 170°.

Mr. W. CROWDER asked what was the exact object of the experiments, and whether the pulp was bought as dry, and varied in coming over to England, and so caused disputes between the pulp makers and purchasers.

Mr. W. F. REID said that he had had a little experience on one point, namely, that when pulp had been heated previously it did not absorb so much moisture as when not previously heated. Cotton contained resinous matter as well as fatty matter; and he also made some experiments with pulp derived from resinous woods, and found that when cotton or wood fibre was heated in a water-bath the resin seemed to enter the pores of the cellulose and diminished the absorption of moisture. When cotton was previously treated with petroleum ether, he found the experiment did not produce the same result. He thought the action was due to some resinous matter which still remained in the pulp, and therefore was greater in the mechanical wood pulp than in that treated with soda. With cotton waste on a manufacturing scale, he had found as much as 12 per cent. of moisture absorbed from the atmosphere.

Dr. H. SCHLICHTER asked how much allowance should be made for cotton. On the Continent the official figure was only eight; and cotton, which was almost pure cellulose, showed a much lower figure than flax or hemp; the proportion increased in proportion to the woody matter.

Mr. C. BEADLE wished to add that he had examined cotton rags and found the average figure to be 7.3 per cent. He had recently conducted a number of trials to determine the rate at which cotton recovers atmospheric moisture on exposure to the air, some with a desiccator and some dried at 105° C., and it depended very largely on the physical division of the cotton fibre. Complete fibres of cotton gained about 7 per cent. before becoming constant in weight. If reduced to one-twentieth of their original length then the gain in weight was only about three. He was disposed to think that the length of the wood fibre, and whether intact or divided, would have a large influence upon the amount of atmospheric moisture it would ultimately contain.

Mr. R. W. SINDALL, in reply, said that the custom in the paper trade with regard to the question was that the pulp was bought on the basis of 12 per cent. of moisture in air-dry pulp, but lately the paper makers had come to

the conclusion that the best way to word contracts was that the pulp should be first absolutely dried at 100° C. and the result calculated on the basis that 88 parts of dry fibre would give 100 parts of air-dry fibre. He had tried to ascertain the average percentage, as lately the struggle of the paper makers with the pulp makers had resolved itself into an attempt at lowering the percentage. Curiously enough, the mechanical section of the Scandinavian Wood Pulp Association had accepted 10 per cent., whereas it was evidently 13 per cent. at least for mechanical. If the air-dry percentage figures had been taken instead of the mean between air-dry and absolute dry, as in Table III., it would be higher still. The other point in dispute was as to the method of sampling. It made a very material difference which way the pulps were sampled. He agreed with the remark that, owing to the presence of resinous matter, the mechanical figure was higher than the chemical, although he could not quite understand why the soda pulp, which was not such a pure form of cellulose, contained a lower percentage of moisture than sulphite. The experiments would, no doubt, have been more interesting if he had also taken unsized papers in which the fibres were reduced in length, as it might then have been seen whether the length of fibre had any influence on the weight, and he also might have dealt with the samples of cotton at the same time, but it had not occurred to him.

A STUDY OF COMPARATIVE AFFINITIES IN THE CASE OF CERTAIN SALTS OF AMMONIUM AND WOOL. PART II.

(See also this Journal, 1896, pages 3—8, and 197.)

BY WATSON SMITH.

Otto N. Witt's Process for the Recovery of Hydrochloric Acid from Ammonium Chloride by the Aid of Phosphoric Acid.—Witt patented a process (Ger. Pat. 34,395) in which he proposed to decompose ammonium chloride by heating it with phosphoric acid. Hydrochloric acid is driven off at a lower heat, and on raising the temperature considerably, ammonia is subsequently expelled, and vitreous phosphoric acid left behind, which can be used over again for attacking a further supply of ammonium chloride. Jurisch has investigated this process and found that upwards of 99 per cent. of the HCl can be expelled at 300° C., if a large excess of phosphoric acid be employed. By heating the residue subsequently to about 400° C., about 63 per cent. of the NH_3 is expelled. When employing the residue over again, 86 per cent. of the total ammonia, according to Jurisch, can be driven off.

I have also investigated the above question some three years ago (Feb. 1893), and the following are my results:—Some ammonium phosphate, $(\text{NH}_4)_2\text{HPO}_4$, was first experimented with. On heating, it was found that this compound commenced to evolve ammonia at 300° C., but that to expel all ammonia a red heat was necessary. The phosphoric acid left in the crucible was heated with a little water and some ammonium chloride. Hydrochloric acid is easily evolved.

On adopting proportions of 4 equivalents of phosphoric acid to 1 equivalent of ammonium chloride, the mixture being placed in a platinum crucible fitted with a small glass dome, headed with bent tube, and the latter being connected with a vessel containing normal soda, and this vessel again with a water-vacuum pump,—the following quantitative numbers were obtained: 72 per cent. of hydrochloric acid expelled, and on further heating to dull redness and absorbing in normal hydrochloric acid, 61.5 per cent. of ammonia. Another experiment gave 83 per cent. of hydrochloric acid and 83 per cent. of ammonia. With a slight increase still of excess of phosphoric acid, 99 per cent. of HCl was expelled, and afterwards, on ignition of the residue, 75 per cent. of the NH_3 . Using the same phosphoric acid in a further trial with another similar quantity of ammonium chloride, 90 per cent. of the HCl was expelled, and thereafter 67 per cent. of NH_3 . In this latter case, however, the singular result was obtained of a volatilisation at the high temperature employed, of some of the phosphoric acid along with ammonia. It is known,

of course, that phosphoric acid at a red heat is volatilised, and so persistently does ammonia unite with this acid in presence of a large excess thereof, that the heat necessary to expel the latter portions of that ammonia is also sufficient to volatilise phosphoric acid. The rule, then, as to the great stability of ammonia in presence of large excess of sulphuric acid also holds good in the case of ammonia in presence of large excess of phosphoric acid (see this Journal, 1896, 5 and 7). The phosphoric acid now left, after the expulsion of 67 per cent. of ammonia, was used again for acting upon a further addition of NH_4Cl , when 81 per cent. of HCl, and this time only 60 per cent. of NH_3 , were driven off. It was found that in the heating process, when the latter portions of HCl were being expelled, NH_4Cl was also apt to sublime.

For the employment of phosphoric acid—the syrupy acid—on a manufacturing scale for the decomposition of ammonium chloride in connection with the ammonia-soda industry, the difficulty arises that unless a large excess of the acid be used, only a partial decomposition ensues with a bad yield of HCl, and yet when this condition of large excess of phosphoric acid is observed, the very condition is embraced under which only partial expulsion of the ammonia left behind in combination as phosphate, can be looked for. It has been already observed that so tenaciously is this ammonia held in combination in presence of excess of phosphoric acid, that the temperature required to expel the former, also drives off some of the latter. From a technical point of view, it therefore became interesting to inquire as to the action of phosphoric acid at such temperatures upon various materials. It was found that glass was attacked, and also both zinc and iron. If glass be attacked, it is pretty certain also that fire-brick and fire-clays would not escape. Platinum even is slightly attacked, but Dr. A. F. Furst informs me that silver is invulnerable to phosphoric acid, besides being at present a great deal cheaper than platinum.

To give an idea of results obtainable by employing the same phosphoric acid upon successive portions of NH_4Cl , the following experiments may prove interesting:—

15 grms. of syrupy phosphoric acid with 2 grms. of NH_4Cl , on heating, evolved 96 per cent. of the theoretically obtainable HCl. On further heating to dull redness, 26 per cent. of the NH_3 were recovered. Further additions of NH_4Cl were then made and the process repeated 7 times—

HCl.	NH_3 .
Per Cent.	Per Cent.
(1) 96	26
(2) 100	79
(3) 85	62
(4) 80	83
(5) 92	46
(6) 100	60
(7) 100	48

Mean of the 7 results = 93 and 58 respectively.

After 12 experiments in all, the platinum crucible had lost 0.007 gm. Experiment 1 will give a good idea of the tenacity of the hold the phosphoric acid has upon the ammonia under the conditions of excess named.

To the question, "What becomes of the missing hydrochloric acid in experiments (1), (3), (4), and (5) above, in which less than 100 per cent. of HCl is shown?" I reply there is no doubt that near the point at which the latter portions of HCl are being expelled, the temperature may easily attain such a pitch that ammonia also begins to be disengaged, the result being an apparent sublimation of ammonium chloride. Thus, some of the ammonia will also be missing as NH_4Cl , though this missing ammonia is chiefly retained by the excess of phosphoric acid, and obstinately resists the action of heat to expel it. Thus, I can well imagine in a large-scale application of this method, that whilst a large excess of phosphoric acid would be necessary for a full yield of HCl from the NH_4Cl , that excess would be continually encroached upon and diminished by the increased retention and "fixation" of ammonia, if I may so term it,—the very condition necessary for the first reaction, militating against the second.

ACTION OF WOOL ON AMMONIUM SALTS.

After the investigations of Champion (Comptes rend. 72, 330), and also of Bréinl and Knecht and Appleyard (this Journal, 1889, 457), with P. Richard (this Journal, 1888, 841), it is now generally admitted that the evidence has become very strong in favour of the view that wool behaves like an amido-carboxylic acid, or at all events like a substance containing as it were the latent elements of such an amido-acid. Champion has given this acid the name "Lanuginic acid," but it is no ordinary amido-acid, as Knecht shows, since it contains sulphur, like a proteid. Of course the existence in wool of the elements and also the latent elemental conditions of an amido-acid, was at first more or less hypothetical, but by adopting this hypothesis and then experimentally following it up, the investigators have found that it has been uniformly well responded to in the affirmative. To take a case as a popular illustration with dyers of wool with whom bichromate of potash or soda is largely used as a mordant for alizarin colours, there is no doubt that the chromic acid unites with some constituent of the wool to form an insoluble or slightly soluble chromate, whilst normal chromate remains in solution. Being thus fixed, and adopting the amido-acid hypothesis, we must consider it combined with the NH_2 or basic group in such amido-acid, which we might, for lack of further precise knowledge, represent as $(\text{X}) < \text{CO} \cdot \text{OH}$.

The interesting point, however, is, that the active groups in the alizarin colours are hydroxylic, and thus of acid character, and hence would require for fixation and combination the presence in the wool substance of some free basic functions or groups. But in our chromated wool we have just seen that the basic functions (NH_2), are already engaged and neutralised by the chromic acid radical. Hence such chromated wool ought, shall we say, theoretically, to be inert or unsuitable for the fixation of such hydroxylic-colours or acid colours as Alizarin blue, galleo, &c.

This is precisely the case, as the dyer finds it, and in order to shift the chromium into its proper place, viz., into union with the $\text{CO} \cdot \text{OH}$ or acid group in the amido acid, its function must be altered from that of an acidic to that of a basic substance, a polybasic substance indeed, so that besides union with the $\text{CO} \cdot \text{OH}$ group there shall be ample basicity to spare for the attraction of those hydroxy acid substances, the alizarin colours. The dyer, consequently, wanting the chromium in what he calls the "green state," i.e. as chromic hydrate, uses tartar (cream of tartar) along with the bichromate in mordanting. It is oxidised at the expense of the chromic acid on the fibre, which is reduced to chromic hydrate. The chromic hydrate still remaining united with the wool, as a basic group, we must of necessity now regard it as united with the $\text{CO} \cdot \text{OH}$ or acid group of the amido acid (wool), and united so as to form a kind of basic salt. Upon the wool therefore is now conferred prominently basic functions, there being the NH_2 group, vacated on the one hand, and the basic chromic group on the other, and this "green mordanted wool" is thus fully prepared to receive and fix acid or hydroxy compounds of the alizarin or similar types.

P. Richard (this Journal, 1888, 841) desiring further evidence of the presence of the amido group, and noting that wool behaves towards acid colours like a base and towards basic colours like an acid, tried to diazotise the amido group present in the wool. The wool was coloured straw-yellow by this treatment, and after treatment with alkaline solutions of phenols, such as resorcinol and α -naphthol, it assumed a red colour, and there appears no doubt that by the first action a peculiarly stable diazo-compound was obtained, which by the second, became united as would have been the case with an ordinary diazo-compound, with the phenol, forming a coloured compound.

Now remembering that though a basic substance of not very strongly pronounced alkalinity, yet aniline on heating with ammonium salts such as the sulphate is able to expel the ammonia, it occurred to me that possibly the amido group in wool, if united with any degree of similarity, although to form an insoluble compound (wool), might be able to expel ammonia from ammonium salts, on application of heat. Prof. J. J. Hummel of Leeds, kindly supplied

with some pure wool, and with this I experimented as follows, and with the following results. The wool was first washed by heating up to the boiling point with distilled water, wringing out and rinsing once more in cold water. It was then dried.

A.—1. 10 grms. of this wool were placed in a flask with 10 grms. of pure ammonium sulphate and about 100 c.c. of water, the vapours evolved on boiling the mixture being passed through sulphuric acid of known strength. After two hours' heating the excess of acid was estimated, and it was found that the H_2SO_4 had been neutralised to an extent equivalent to 0.0578 grm. of NH_3 .

2. In the same flask a mixture of the same volume of water and 10 grms. of $(\text{NH}_4)_2\text{SO}_4$ alone was now boiled for two hours, when it was found that the H_2SO_4 had been neutralised to the extent of 0.017 grm. of NH_3 .

3. In the same manner, 10 grms. of the wool alone were boiled with water only for two hours. Thus it was found that 0.0017 grm. of NH_3 was liberated by decomposition of the wool itself.

Hence the ammonia liberated by the agency of the wool is $(0.0578 - 0.017 + 0.0017 \text{ grm.}) \text{NH}_3 = 0.0391 \text{ grm.}$, or 1.52 per cent. of the total NH_3 .

B.—The previous experiments were now repeated, only that boiling was continued for four hours instead of two.

	Grm. NH_3
(1.) With 10 grms. of wool.....	0.0833
(2.) With 10 grms. ammonium sulphate alone.....	0.0272
(3.) With 10 grms. wool alone.....	0.0020
The wool therefore expelled $(0.0833 - 0.0272) \text{ grm.}$	
of NH_3	0.0561
Or 2.10 per cent. of the total NH_3 .	

C.—5 grms. of wool were next heated with 5 grms. of $(\text{NH}_4)_2\text{SO}_4$ and 100 c.c. of water, and in the same apparatus and under similar conditions as before; also 5 grms. of $(\text{NH}_4)_2\text{SO}_4$ with 100 c.c. of water alone.

	Grm. NH_3
After two hours' boiling, the wool with $(\text{NH}_4)_2\text{SO}_4$ gave.....	0.0289
Whilst the $(\text{NH}_4)_2\text{SO}_4$ alone gave.....	0.0102
And the wool alone.....	0.0010
The wool therefore expelled $(0.0289 - 0.0112) \text{ grm.}$	
of NH_3	0.0177
Or 1.37 per cent. of the total NH_3 .	

D.—10 grms. of wool were now heated with 5 grms. of $(\text{NH}_4)_2\text{SO}_4$ and 100 c.c. of water, and in same apparatus and under the same conditions as before, 5 grms. $(\text{NH}_4)_2\text{SO}_4$ with 100 c.c. of water.

	Grm. NH_3
After two hours' boiling, the wool with sulphate gave.....	0.0493
Whilst the salt alone gave.....	0.0102
10 grms. of wool alone giving.....	0.0020
The wool therefore expelled $(0.0493 - 0.0122) \text{ grm.}$	0.0371
Or 2.88 per cent. of the total NH_3 in salt.	

E.—10 grms. of wool were boiled for two hours with 2.5 grms. of $(\text{NH}_4)_2\text{SO}_4$ and 100 c.c. of water, 2.5 grms. of $(\text{NH}_4)_2\text{SO}_4$ alone being also boiled with 100 c.c. of water.

	Grm. NH_3
The wool with sulphate yielded.....	0.0401
The salt alone yielded.....	0.0078
The wool alone with water yielded.....	0.0017
The wool expelled therefore $(0.0401 - 0.0095) \text{ grm.}$	
NH_3	0.0306
Or 1.75 per cent. of the total NH_3 in salt.	

F.—20 grms. of wool, boiled for two hours with 1.5 grm. of $(\text{NH}_4)_2\text{SO}_4$ and 200 c.c. of water; also 1.5 grm. of $(\text{NH}_4)_2\text{SO}_4$ alone with 200 c.c. of water for two hours.

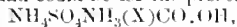
	Grm. NH_3
The wool (20 grms.) with sulphate gave.....	0.0425
The salt (1.5 grm.) alone with water gave.....	0.0040
Wool (20 grms.) alone with water gave.....	0.0033
The wool expelled therefore $(0.0425 - 0.0073) \text{ grm.}$	0.0352
Or 9.11 per cent. of the total NH_3 .	

G.—20 grms. of wool, boiled for six hours with 1.5 grm. of $(\text{NH}_4)_2\text{SO}_4$ and 200 c.c. of water; also 1.5 grm. of $(\text{NH}_4)_2\text{SO}_4$ and 200 c.c. of water; also 20 grms. of wool alone with 200 c.c. of water.

	Grm. NH_3
The wool (20 grms.) with sulphate gave.....	0.0630
The salt (1.5 grm.) alone with water gave.....	0.0078
Wool (20 grms.) alone with water gave.....	0.0075
The wool expelled therefore (0.0630 - 0.0153) grm. . .	..
Or 13.12 per cent. of the total NH_3 .	

Considering that we have here been making use of an insoluble, or almost insoluble, reagent to decompose the ammonium sulphate, I think on the whole the basicity of the amido group of the wool has given a very good account of itself, and has shown that it is decidedly capable of displacing ammonia in ammonium sulphate. I think, with regard to what follows the ammonia expulsion, that it is pretty certain we have a peculiar compound, or wool double salt, if I may so say, produced by the union of laniginic acid (wool amido acid) with bisulphate of ammonium, and it will be extremely interesting to ascertain next if this compound, which at the best is sure to be a rather unstable one, is to any extent soluble, in other words isolable.

Such a compound could be for the present formulated—



wherein (X) $< \text{NH}_2$
 CO.OH represents all that we know so far of the chemical constitutional structure of the wool compound, and in which (X) represents the remaining constituents of that compound. Knecht has already shown how firmly the elements of a basic alum unite with wool, when alum solutions are boiled therewith, free acid remaining in solution (this Journal, 1888, 622). Such an amido-acid structure further explains admirably why wool has such an attraction for dilute sulphuric acid, and at the same time is so readily attacked by the fixed alkaline hydrates, and is completely soluble in hot caustic alkalis. Knecht states that wool which had been boiled in water containing 10 per cent. of sulphuric acid (of the weight of the wool) had to be boiled nine times in succession for an hour at a time in fresh distilled water, before all the acid could be removed.

Though a feebly basic NH_2 group, yet doubtless, it is the presence of this group in the wool which accounts for the aforesaid attraction for sulphuric acid, and equally the presence of the CO.OH group accounts for the ready entrance of caustic alkalis and on heating of decomposition, and solution.

Finally, the structure represented, in conjunction with the fact I have succeeded in eliciting as to the decomposability of a salt like ammonium sulphate by wool, explain how much more safely ammoniacal liquids (ammonia soaps and ammonium carbonate solutions) may be used for the scouring and cleansing of wool and woollen fabrics, than fixed alkaline carbonates and hydrates. Nevertheless, in wool we have physical structure to consider as well as chemical structure, and this physical structure is injured by strong solutions even of ammonia on heating; very probably though unattacked at the point of the amido group, the wool substance is chemically vulnerable, to some extent, at that of the CO.OH group.

May I reiterate, in conclusion, that whilst speaking of wool as an amido acid, or behaving as one, it is very probable that, really, it would be more accurate to consider it as such a compound in a veiled state, somewhat as one would speak of glucose in a glucoside, for example. (See also E. Knecht, Fischer's Jahresber. der Chem. Tech. 1888, 1107.)

I have much pleasure in again acknowledging the able assistance of Mr. Albert Shonk in this investigation.

DISCUSSION.

Dr. R. MESSEL said that many years ago he made experiments on the point, but never found any apparatus in which he could carry out the reaction, so he gave it up. He used platinum at that time, and thought that possibly traces of fluorine were the cause of the platinum being attacked, but it was not so.

Dr. H. SCHLICHTER remarked that several points had struck him during the reading of the paper. Firstly, he did not believe that all wools behaved equally towards colouring matters. He remembered in one instance a mixture of two kinds of wool was dyed red, and it was found that the two kinds were very different under the microscope: one

was beautifully coloured, the other was not. As far as he remembered, Chevreul ascertained that the perspiration of different kinds of sheep was in many cases alkaline and in others acid, and this, taken in connection with the physical structure of the wool fibre, would explain the different behaviour towards the same colouring matter, and perhaps might be used to distinguish various kinds of wool under the microscope. Another very interesting point was as to the experiments which Knecht had made with sulphuric acid. He had always thought that wools treated by the carbonising process were not clean, but that some of the sulphuric acid remained in the fibre; and that would be a very important point in afterwards judging the quality of the wool and fabrics made from it.

Dr. S. RIDEAL said that when Mr. Watson Smith read the paper he used an expression new to him, namely, the "tenacity" of ammonia for phosphoric acid, instead of "affinity." He thought it a good word, which might be generally adopted with advantage.

The CHAIRMAN presumed that the author had made blank experiments with sulphuric acid and water, and that he had boiled the same quantity of sulphate of ammonia with water, with and without wool, to eliminate the error due to the amount of ammonia that might be given off on boiling the sulphate with water only. In a previous paper Mr. Watson Smith had strongly dwelt on the easy manner in which sulphate of ammonia suffered decomposition.

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The following have been elected to fill the vacancies, and will take office in July next:—Chairman: Charles A. Kohn. Vice-Chairman: G. Schack-Sommer. Committee: J. Campbell Brown, Eustace Carey, M. Lloyd Davies, and W. Norris Jones.

SESSION 1895-96.

May 6th, 1896:—

Mr. W. J. Orsman. "Interaction of Carbonic Oxide and Coal Dust."

Dr. G. C. Clayton. "Chlorine as a Disinfectant."

Meeting held Wednesday, April 1st, 1896.

MR. EUSTACE CAREY IN THE CHAIR.

ON POISONING BY GAS: ITS PREVENTION AND CURE.

BY DOUGLAS HERMAN.

The frequent occurrence of fatal cases of "gassing" by sulphuretted hydrogen, producer-gases, carbonic acid, &c. is my excuse for making this brief communication.

At this date, no novelty can be claimed for the means I wish to bring to your notice, of, in the first place, preventing "gassing" altogether, or, when it has already taken place, of counteracting its results; but although there is nothing new in the principles involved, I think it plainly the duty of our Society, the members of which are responsible for producing such vast quantities of noxious gases, to make known as widely as possible the best means of preventing danger resulting therefrom.

When it is necessary to enter a flue, or other place where a dangerous atmosphere may be expected, it is a very simple matter to provide the workman with a supply of fresh

air. Of course this is done in some cases by a helmet, but the same result may be practically obtained, in the case of gases which do not too painfully affect the eyes, by means of a simple respirator covering the nose and mouth, and fed with a supply of air under pressure.

I have here an extemporised "muzzle," consisting of an ordinary india-rubber respirator, from which the sponge has been removed, and which has an air-supply tube substituted for the usual holes. I have known a man to work with this respirator for 20 minutes in a hot flue, full of producer-gas. The only inconvenience he suffered arose from the rather sharp edges of the rubber, and the escape of some excess of air in too close proximity to the eyes. To obviate these inconveniences I have devised another form. An india-rubber air cushion, as used with Brin's oxygen respirator, fits comfortably on the face; the air supply is brought in on one side and the excess, together with the expired air, escapes on the top. The air-supply tube is carried over the shoulder, and is secured to the jacket by a strong safety pin. The respirator can be put on in a second, being kept in place by a strong elastic band passing round the head. The whole thing costs about 5s., the most expensive item being the air cushion, which is sold at 3s. 9d., but could doubtless be supplied cheaper if ordered in quantity.

At the glass works we have a constant supply of air under pressure, but, where this convenience does not exist, the necessary air can readily be supplied by a foot blower, or even the ordinary domestic bellows, if of somewhat larger than usual size and combined with a reservoir of some kind to give constant pressure.

Now as to the treatment of persons who have been "gassed." What is wanted is obviously an immediate supply of fresh oxygen to the lungs, and this is most easily given by means of a cylinder of compressed oxygen. With this there is no difficulty in promoting artificial respiration, since, if a tube conveying a gentle stream from the oxygen cylinder is put in the patient's mouth and the lips held tightly round it, the oxygen, under pressure, forces its way into the lungs. It can also be supplied through one of the nostrils, the other being alternately closed and opened; or by a respirator covering the nose and mouth, but a plain tube in the mouth generally answers quite as well.

There do not appear to be any after ill effects—there is little or none of the distressing headache usual in cases of "gassing." So well is this understood, that men, who have had only a slight dose of gas, walk off, of their own accord, for a few whiffs from the oxygen bottle, as they say it prevents headache.

At my suggestion oxygen has now been kept on tap for some time at various works, and I am told several lives have been saved by its means.

I cannot too strongly urge all responsible for producing poisonous gases to issue plain instructions for the use of oxygen, and to always keep a cylinder in readiness for an emergency.

In addition to its use in the case of persons who have been poisoned by gas, compressed oxygen will be found of great service in the restoration of the apparently drowned, and I would suggest its being kept on hand at Royal Humane and British police stations, &c., as is now done in France.

I append instructions for the administration of oxygen.

Turn the tap on the cylinder till the oxygen flows out in a gentle stream through the tube; then, if the patient is *conscious*, place the glass tube in his mouth and let him draw the oxygen into his lungs until he feels relief.

If the patient is *unconscious*, place the tube, from which the oxygen is gently flowing, in his mouth, close the lips round the tube, and allow the oxygen to flow gently in a continuous stream into the mouth, alternately closing and opening the nostrils with finger and thumb in order to effect alternate inflation and deflation of the lungs. It is helpful to press the chest gently when opening the nostrils. Continue the operation until the patient can breathe the oxygen for himself.

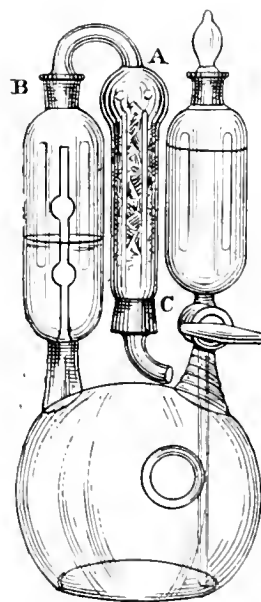
The blowing out of the cheeks indicates when sufficient pressure has been introduced into the lungs. This pressure should not be too great.

A MODIFIED FORM OF SCHRÖTTER'S APPARATUS FOR THE DETERMINATION OF CARBONIC ANHYDRIDE.

BY CHARLES A. KOHS, PH.D., B.SC.

OF the many forms of apparatus for the estimation of carbonic anhydride by loss, that devised by Schrötter is probably most widely in use. Compared with other forms, it is certainly more handy than Bunsen's apparatus, although the latter is more accurate, since it contains an absorption tube charged with dehydrated copper sulphate on pumice in addition to calcium chloride. In a modified Bunsen apparatus described by A. Christomanos (Ber. 1894, 27, 2748), the drying tube is replaced by a small wash bottle containing concentrated sulphuric acid; the advantages of the latter over calcium chloride as a drying agent are pointed out. But this modified form suffers from the same disadvantage as the ordinary Schrötter apparatus in not making any special provision for the absorption of hydrochloric acid gas which is evolved whenever hydrochloric acid is employed in the decomposition of a carbonate. This is a well recognised source of error, and it is customary to attach a tube charged with dehydrated copper sulphate on pumice to the sulphuric acid bulb of the ordinary Schrötter apparatus in order to effect the complete absorption of the hydrochloric acid gas. With this addition, very reliable results can be obtained, but the method of attachment of the additional tube is always more or less clumsy. The object of the present modification is to overcome this, and the new form has two additional advantages. The apparatus is more stable, and the copper sulphate tube A can be easily turned

(Half actual size.)



through any angle at B, so as to attach the india-rubber tubing for drawing air through the apparatus, after heating to drive out the carbonic anhydride and allowing to cool. The pumice containing the dehydrated copper sulphate is held in place by a plug of glass wool, and the ground glass stopper C below it keeps well in its place if properly greased. If necessary it can be made perfectly secure by means of platinum wire. The total weight of the apparatus when fully charged is 58–60 grms.

Mr. J. Towers, of Widnes, has undertaken the supply of the apparatus.

THE WOOD CELLULOSE INDUSTRY OF SCANDINAVIA.

BY JAMES BEVERIDGE.

THE development of this industry within recent years has been so rapid, and its bearing on the paper industry of Europe is so great, that no apology need be made for introducing the subject to this Society. Both Norway and Sweden are by nature admirably equipped for this manufacture, as both contain vast forests of spruce or white pine wood; are intersected with magnificent water-ways, and are possessed of water-falls which in the aggregate represent great wealth. Indeed such a combination of cheap wood, the means of cheap transport, and the occurrence of mechanical force in the natural waterfalls has probably no parallel in any other country in the world.

By far the greater part of the timber grown in the forests of these countries consists of Scotch and spruce firs. A little poplar and birch occur in places, where a clearing has been made, but these represent a very small proportion of the wood of the country. The Scotch fir is not used for pulp making, the bulk of it, together with the larger spruce trees, being hewn down and sawn into boards, &c. in the numerous saw mills scattered over the country. The smaller spruce trees, those having an average diameter of from 7 to 8 ins., are the most suitable, and those grown in the vales, or on good soil, are preferable to those grown on the mountain tops. Especially is this the case in the north of Sweden, where the climate and soil exert an influence on what is known as vale wood in contra-distinction to mountain-timber.

Pulp wood is usually cut during the winter, when the tree is free from sap, and when the snow lies thick on the ground. The latter facilitates transport from the forest to the water-way. The hewn trees are freed from their branches, tops, and bark with the axe, and then drawn on sledges to the river side, or in many cases upon the ice covering the rivers or lakes. The labour of hewing, barking, and driving is all done by piece-work. When the spring time comes, and the snow on the hills begins to melt, and the ice in the rivers has disappeared, the logs are tipped into the rushing torrent and may travel many miles before they are finally collected again at the pulp factory. The logs are then taken from the river and piled in the factory yard to dry, a large stock being kept for winter use, as no floating can take place then.

To prepare the wood chips for the digesters, the logs are cut into lengths of about 2 ft., and carefully barked by machinery. Any black knots thus rendered visible are bored out, and the clean pieces of wood chopped into slices diagonally across the grain; these slices are then broken up, and the resulting wood chips are carefully freed from sawdust, and separated into two or three qualities by specially designed machinery. The well-known Bache-Wiig machine is in general use for this purpose. Of 100 parts of wood, thus treated, 80 per cent. rank as first quality, 15 per cent. as second, and 5 per cent. as third quality. Some manufacturers digest these various qualities separately, producing pulps of the grades named, while others are content to treat the chips as a whole, just as they are produced by the chopping machine.

There are in common use three processes for pulping the wood, namely, the soda, the sulphate and the bisulphite methods. Each of these yields a cellulose possessed of characteristic properties. Soda pulp is considered the softest of the three, bisulphite pulp the hardest, whilst sulphate pulp stands midway in this property, between the soda and the bisulphite. In each individual process, however, the conditions of boiling can be so modified as to yield almost any desired quality of pulp, and the above classification, according to the quality of softness, is very nearly so, of pulps consuming the same quantity, or very nearly so, of bleaching powder per unit weight of fibre bleached.

Soda Process.—The prepared wood in this method is digested for five or six hours at a pressure of 110 lbs. above atmosphere, in a caustic soda lye containing about 5.0 per cent. Na_2O , the total time required to complete one digestion being about 10 hours. This includes filling, digesting, blowing off, and emptying. The soda lye is separated from

the pulp by filtration, and the soda recovered in one of the many methods in vogue, whilst the pulp is washed, disintegrated, purified, and prepared for the market in the usual way.

Sulphate Method.—This is misnamed as the reagent in the digesting fluid, which performs the work of removing the incrusting matters surrounding the fibres, is not sulphate of soda, but substantially a mixture of caustic and sulphide. Salt cake is employed to yield the sulphide, and is added to the black carbonaceous mass in the calcining furnace during the soda recovery process. Sulphide of sodium is thus formed, and precautions are taken, not only in the construction of the furnaces, but in the mode of working them, especially with regard to the exclusion of air from the fusing mass, to facilitate its formation. The ash recovered in this process is causticised in the usual way before being used in the digester.

Some practical points are worth noting in this process. Firstly, there is a larger quantity of soda salts to be dealt with per unit weight of pulp produced than in the soda process pure and simple, due to the presence of much undecomposed sulphate of soda in the lyes; secondly, the presence of sulphide causes great wear and tear in the multiple evaporating apparatus, and it has in some cases been found cheaper to abandon the latter in favour of a brick furnace, constructed on economical lines; thirdly, the bad odour of the blow-off gases prevents its use in populous districts. In other respects the digesting of the wood and other operations are carried out as in the caustic soda process, with the exception that the pressure employed is usually a little higher, viz., 120 lbs. above atmosphere.

Bisulphite Process.—This is unquestionably the simplest and cheapest method for the preparation of paper pulp from wood. The digesting fluid is cheaper than soda, no recovery plant is necessary, and, the most potent factor of all, the percentage yield of cellulose per unit weight of wood is the highest. Bisulphites of lime, soda, and magnesia are in general use, the bulk of the cellulose being, however, manufactured with bisulphite of lime. Sometimes a mixture of lime and magnesia, or lime and soda, is preferred, the normal sulphites of magnesia and soda being soluble in water. The presence of soda or magnesia in the liquors is advantageous. It is assumed, and under certain conditions doubtless true, that when digesting with pure bisulphite of lime, some of the normal sulphite of lime in solution is precipitated upon the chips of wood during the early part of the process, and that the pulp ultimately produced is not so good as when the acid contains magnesia or soda, either altogether or in part. With regard to cheapness, the bisulphite of lime necessarily ranks first, because of the low cost of lime, either as caustic or carbonate, while soda takes the next place, provided it is prepared by the double decomposition of bisulphite of lime and sulphate of soda, thus—



There is not much difference between the cost of this and bisulphite of magnesia, excepting when the sulphate of calcium or pearl hardening ($\text{CaSO}_4 + 2\text{H}_2\text{O}$) obtained can be sold at its current market value, viz., 50s. per ton. The quantity of bisulphite of lime liquor required to yield one ton of air-dry sulphite wood cellulose can now be produced in this country for not more than 12s. 6d.

The sulphurous acid is obtained mainly from the combustion of brimstone or recovered sulphur. Although pyrites abound in both Norway and Sweden, and mining operations are continually being pushed forward on an extensive scale, yet this ore is not used in the cellulose industry. Some years ago a few manufacturers tried to use it, but for some reasons, difficult to understand, the process was abandoned. At a large works in the North of Sweden, which I have recently rebuilt, I had no difficulty in designing plant for the use of pyrites, and of obtaining high-class results in the boiling operation with the acid procured from this ore. The kilns were of the ordinary type employed in vitriol works in this country. Various kinds of sulphur ovens are in use, one of the most convenient being Ekman's, which consists of a wrought-iron box, the bottom of which forms the combustion hearth.

The absorption of the sulphur dioxide and production of bisulphite is carried out in a variety of ways. Some manufacturers employ high towers, square or circular, built of wood, a system first introduced by Mitscherlich in Germany and by Franke in Sweden. These towers are filled with limestone kept wet by a down-flow of water, and the water is regulated to yield at once an acid of the desired strength. Others, again, prefer a series of smaller towers, filled with limestone, through which the kiln gases pass in succession, the weaker acid from the back towers being pumped on to the front ones. In substance, this is the system advocated by the late Mr. Flodquist. In all cases an artificial draught is desirable, if not necessary.

Those manufacturers, however, who prefer using milk of lime, must have recourse to another method, in which the SO_2 gases are either forced or sucked through weak milk of lime, contained in a series of three or more tanks, arranged on different levels, so that the liquid in the second tank in the series can be run by gravitation into the first, and that from the third into the second, fresh milk of lime being placed in the third or last tank. The kiln gases are cooled before passing through these absorbers, and the milk of lime is kept in constant motion by suitable agitators. This method is employed by many German and a few Scandinavian pulp-makers.

Bisulphite of magnesia is made, according to Ekman, by passing the sulphurous acid gases through small towers, packed loosely with "slaked" magnesia, kept moist with water. The magnesia is obtained by calcining magnesite. Fry introduced the alternative method of passing milk of magnesia of the desired strength through a high tower of large area, packed loosely with an acid-resisting material, while the kiln gases were ascending.

Bisulphite of soda prepared by the reaction previously given, in a large tank fitted with an agitator, is separated from the sulphate of lime by filtration, the pearl hardening being dried, ground, and used as a loading in the manufacture of papers of a high class. The decomposition of the bisulphite of lime by the sulphate of soda amounts to as much as 95 per cent., when using weak solutions of bisulphite, and only a moderate excess of sulphate of soda. I have worked this process to the extent of several thousands of tons of pulp, with results which justify the belief that it certainly equals, if it is not superior to, any other.

The use of dolomite is almost entirely confined to the tank or vat system of bisulphite making, the mineral being previously burnt, "slaked," and ground to a paste with water. After dilution the MgO and CaO are saturated with SO_2 , and the absorption continued till the liquor has reached the required degree of richness in sulphurous acid.

All these methods of preparing the bisulphite liquors are in use in Scandinavia, and there seems no lack of enterprise in adopting any process, which offers a slight advantage over another.

The composition of the acid has an important bearing on the quality of the pulp. The relation of the sulphurous acid to "base" is closely watched, and in most cases regulated to a nicety. As a general rule, of 100 parts of total SO_2 present in the liquor, 34 parts, or practically one-third, are combined with "base," leaving 66 parts in the free state. The percentage composition of the acid varies with the system of boiling. If the pulp boilers are heated with steam injected into their contents, the acid is stronger than when the indirect system of heating with steam coil or jacket is used; in the former case the acid contains as much as 5 per cent. of total SO_2 , of which 34 per cent. are combined with "base"; in the latter case a 4 per cent. acid at most is considered strong enough. But the strength of acid and the regulation of many other conditions depends entirely upon the quality or kind of pulp which one desires to produce.

The modifications in the wood boiling operations are almost as numerous as those pertaining to the preparation of the bisulphite or soda lyes. I have briefly touched upon this particular when speaking of the soda and sulphate processes. It is only necessary to add that in these two processes the wood digesters used are single shelled, usually upright stationary cylinders of great strength, equipped with the simplest fittings possible. They are invariably

heated with injected steam, and no vomiting arrangement for circulating the soda lye, such as is used in esparto boilers, is required. After the maximum pressure is reached it is maintained for a few hours, and then the pressure is blown off. The time given, at above 100 lb. pressure, is usually about 5 hours. The blow-off steam is utilised in doing useful heating and evaporative work.

The sulphite pulp digesters, on the other hand, are much more elaborate pieces of apparatus; they are of two types, viz., rotary and stationary. The shells of both are of the usual steel plates, and double riveted with butt joints. Owing to the corrosive action of the bisulphite liquor they must be lined internally with sheet lead, or some other acid-resisting substance, and among the latter quite a number of different sorts of linings are in use. Mitscherlich was the first to suggest, and, in fact, to use a lining of cement and bricks, and since then much ingenuity has been displayed in the combination of the materials composing the linings, and the mode of laying these materials upon the interior walls of the digester. Nearly all employ flat tiles, with Portland cement, made into a thick paste with silicate of soda and water, as mortar. Mitscherlich recommends a brick 4 ins. thick, whose sides are tongued or grooved; others prefer a thin tile 2 ins. thick by 9 ins. by 6 ins., rough on one of the flat sides and the four edges, and curved or shaped in accordance with the position they occupy inside the digester. These tiles are fixed in a double layer in such a manner that the joints of the one will cross those of the other. The whole interior surface of the boiler and neck pieces is thus covered, and when this type of lining is carefully executed it effectually prevents the acid from attacking the iron plates.

Very much could be said on the different methods of lining sulphite digesters, but the principle and practice of Mitscherlich has stood the test of time, and has been largely imitated, and, indeed, his original plans improved upon.

The fittings (by which is meant all cocks and valves fixed to these digesters) are of the best gun-metal, but in Scandinavia, as elsewhere, there has been introduced another alloy which is cheaper, and answers equally as well as any alloy of copper and tin.

In rotary boilers, whether spherical or cylindrical, the acid and wood are heated with steam injected through the trunnion ends, the injection pipe being of gun-metal; in stationary digesters the usual practice is to heat with two or more steam coils of hard lead piping placed inside. In the latter case the heating is under more perfect control than in the former, and as the process of digesting is a delicate operation the indirect system of heating is obviously preferable. As the indirect method was the first introduced the older works in Norway and Sweden still employ it.

The digesters vary considerably in size, some of the smallest yielding but 17 or 18 cwt. of dry pulp per charge, whilst of the modern boilers the largest yield from six to seven tons. Some manufacturers boil the wood slowly, as in the Mitscherlich system, whilst others prefer quick boiling. In the Mitscherlich system about 250 to 300 cub. ft. of digester capacity are required per ton of pulp per week, but in Scandinavia few, if any, employ so much. Some use from 100 to 120 cub. ft., others from 55 to 65 cub. ft. The prevailing circumstances control the duration of the digesting process to a great extent; but there is no doubt large boiler capacity, careful judicious heating, and the proper proportioning of the acid to the wood, all tend to enhance the value of the final product. The actual number of hours occupied in the digesting process is about 50 in the Mitscherlich system, in others 24, while 9 or 10 hours are all that are given in the quickest method.

The pulp, after it is removed from the digester, is separated from the waste liquor in drainers, then washed with water, broken up, purified, or freed from knots, &c., and finally felted into a thick web of dry paper on a paper machine, and cut into sheets before being packed in bales for the market. In the most modern works the apparatus used for each of these operations is of the most efficient, yet simplest, description.

The waste sulphite lyes from the wood digesters are usually run away into the rivers as useless, and as the question of river pollution has not assumed the prominence

in Scandinavia that it has in Germany, England, and other countries, this way of disposing of them can be followed with impunity. These lyes contain a few products, which in most cases can be recovered with advantage. They contain small quantities of sulphurous acid and sulphite of lime, both of which are partly recovered in many works by precipitation with lime, but the organic compounds are neglected. Mitscherlich has perfected a process for making a dextrine and other useful products from these lyes. The process is being applied in German and Austrian works. These products are sold in a syrupy condition with about 60 or 70 per cent. water, but as the quantity obtained in the manufacture of 1 ton of cellulose amounts to from 2½ to 3 tons, if sulphite makers were universally adopting this method of utilising the lyes, the market would soon be vastly over-stocked. The attention of technical chemists has been concentrated on this subject for many years, but so far they have been baffled in their efforts to extract, from the lyes, products, which would possess a value exceeding their cost of production, and at the same time, command a ready sale. The various systems of recovering the gaseous SO_2 mixed with the steam when blowing off the digesters, have been largely adopted. In principle, these consist in first cooling the gases in coils immersed in cold water, and allowing the SO_2 to pass to the limestone towers or milk of lime absorbers. Sometimes the gases are blown into cold bisulphite liquor.

Where the recovery of the sulphur (as SO_2) is carried out with care and skill, the sulphur consumed is about 10 or 11 per cent. on the air dry pulp produced. Such an excellently low result is seldom, however, obtained, the usual consumption being from 14 to 16 per cent.

Generally speaking, the modern mills of Scandinavia are well arranged. Water power being plentiful, the sites are selected to yield it cheaply by means of turbines. Very few mills are driven by steam. The power required to drive the machinery is small; 3½ horse-power actual being sufficient per ton of cellulose per week in mills producing 5,000 tons or so a year. For smaller works it is a little greater. This includes everything—acid department, wood cleaning and chopping, breakers, strainers, and all miscellaneous pumps and machinery. The fuel consumed, which in many cases is wood, depends entirely on the internal arrangements of the factory, but where coal is used for the boiling and drying and water for the motive force, 21 cwt. to the ton dry cellulose is ample, whilst 30 to 32 cwt. is sufficient in steam-driven mills.

The immediate future of this industry does not appear bright, due to over-production and the consequent fall in values. Notwithstanding this, many new factories are being projected or being established, which, by their natural position, &c., offer some advantages over the older works. Cheap wood and facilities for direct shipment are essential to the success of any modern factory. The cost of production seems to have reached its lowest limit in many districts, particularly in those showing a scarcity in the pulp-wood supply. Indeed, "the survival of the fittest" is imminent in many cases. Both Norway and Sweden have, however, vast resources with regard to this and the paper-making industry, and, as the older works die out, new ones are sure to spring up elsewhere, equipped with the most modern methods and machinery.

ON A METHOD OF CALCULATING THE AMOUNT OF STEAM REQUIRED TO DRY A TON OF PAPER OR PULP.

BY JAMES BEVERIDGE.

On the 7th of February 1894, while reading a paper before this Section of our Society on "The Manufacture of Straw Cellulose," I mentioned, under the division of "Fuel" (this Journal, 1894, 106), the principles upon which I founded a method of ascertaining, by calculation, the amount of steam (or coal) required to carry on the different operations in the manufacture of straw pulp. It will be remembered, the total fuel required to produce a ton of pulp was divided into three parts, viz., the quantity required, 1st, to boil the raw fibrous stock; 2nd, to disintegrate the fibres, &c.; and 3rd, to dry the pulp obtained on the drying machine. I now propose to touch upon the third of these divisions, and

to give in detail the formula I have used in ascertaining, by calculation, the steam required to dry paper or pulp on the Fourdrinier paper machine.

The apparatus for drying the web of paper or pulp, formed on the Fourdrinier wire, is so well known that a detailed description of it is unnecessary. Briefly stated, it consists of a series of three pairs of press rolls and then a set of polished cast-iron cylinders, of somewhat large diameter, heated internally with steam. The wet web of paper passes first of all through the press rolls, which press out the bulk of the water, and finally over the drying cylinders. These cylinders are arranged parallel to one another, and are driven by means of toothed wheels geared together. The condensed water accumulating inside of them is lifted by "buckets" fixed on the inside of the end covers, and discharged automatically through the back trunnions, while the supply of steam is admitted through the other or front trunnions, and can be regulated by taps attached thereto. When paper is being dried, the wet web is pressed tightly against the polished surface of the drying cylinders with the aid of endless belts of thick woollen or cotton felts, which travel along with it in the same direction and with the same speed. These felts are to prevent the paper from "cockling." In pulp works, however, where this system of drying is employed, felts are not used, excepting in the case of the first drying cylinder; even this arrangement is a matter of convenience rather than of necessity, the web of pulp being sufficiently thick and strong to be run taut around the drying cylinders without fear of breaking.

From this brief explanation the conditions under which the web of paper or pulp is dried will be easily understood. It is cold as it passes to the first of the drying cylinders, and is gradually raised in temperature as it travels over the others, till it reaches 212° F., when the water it contains is converted into vapour. The temperature of this vapour cannot very well be under 212° F., because the steam pressure within the cylinder is usually maintained at from 8 lb. to 10 lb. pressure above atmosphere, which will correspond to a temperature of from 236° to 240° F., and in the case of paper, the felts press the wet web against the hot iron surfaces. The wet paper thus held against the hot cylinder must nearly approach the temperature of the iron, although, for obvious reasons, it cannot exceed the boiling point of water under atmospheric pressure, excepting at the end of the range, where the web is dry. In the best paper-mill practice it is usual to avoid overheating of the cylinders with steam, to prevent too rapid drying.

The actual work done by the steam within the cylinders is obviously, first, to raise the temperature of the wet web to 212° F., and then to convert the water in the web into steam at 212° F. If, therefore, we know the initial temperature and weight of the water thus evaporated per 1 cwt. of dry paper made, the units of heat absorbed in doing this evaporation can be ascertained on well-established lines. So also, if the pressure of steam maintained within the cylinders be known, it will be easy to ascertain the amount of steam condensed in order to supply the above units of heat. If the former quantity be divided by the latter, we get the steam required to convert into steam at 212° F. that amount of water associated with 1 cwt. of dry paper in the wet web. This can be expressed in the following formula:—

$$S = \frac{x(T - t)}{T' - t} \dots\dots\dots (a)$$

in which—

S = lbs. of steam required,

x = lbs. of water to be evaporated per unit weight of dry paper made.

t = the initial temperature of the pulp or wet paper passing on to the drying cylinders.

t' = the temperature of the condensed water within the drying cylinders (*i.e.*, temperature corresponding to the steam pressure).

T = the total heat units in 1 lb. of steam at the boiling point of water under ordinary atmospheric pressure.

T' = the total heat units in 1 lb. of steam at the pressure prevailing within the drying cylinders.

The following example, based on the conditions prevailing in the trial from actual manufacturing practice given further on, will serve to illustrate the general application of the formula. Assuming $x = 261.2$ lb.; $t = 60^\circ$ F.; $t' = 236^\circ$ F.; $T = 1.179$; and $T' = 1.186$. Putting these values in their places in the formula, we have—

$$S = \frac{261.2 (1.179 - 60)}{1.186 - 236} = \frac{292282.8}{950} = 307.4$$

or 307.4 lb. of steam were required to evaporate the water associated with 1 cwt. of dry paper in the wet web.

It is obvious that during the drying, the paper itself has been raised from its initial temperature, t , to the final temperature, t' , and that the heat thus absorbed must also be calculated and added to the foregoing amount. I find the heat thus absorbed and the steam required to yield it under the conditions prevailing in this case by the well-known formula for all such instances in which simple heating is concerned, viz.:—

$$S = \frac{w s (t' - t)}{T' - t} \dots \dots (b)$$

in which w = the weight of dry paper, s its specific heat, while T' , t' and t have the same values assigned to them above given. The specific heat (s in the formula) of paper or cellulose I usually take as 0.55, which I believe near enough to cover all cases in which the composition of the paper does not vary greatly. Taking w as being equal to 112 lb., by substitution we get—

$$s = \frac{112 \times 0.55 (236 - 60)}{1.186 - 236} = \frac{10842.2}{950} = 11.41 \text{ lb.}$$

of steam for every cwt. of paper dried. The sum of this and the previous quantity, namely $11.41 + 307.4 = 318.81$ lb., represents the total theoretical amount of steam taken to dry 1 cwt. of paper or pulp. It is apparent that formulae (a) and (b) may be combined thus:—

$$S = x (T - t) + w s (t' - t) / T' - t$$

How far these quantities correspond to the amount of condensed water flowing from the drying cylinders of a Fourdrinier machine, upon which a white printing paper of good quality was being dried at a speed of 176 ft. per minute, will be seen from the following actual measurements:—

Total paper dried per hour = 1,100 lb.

Total water evaporated per hour = 2,566 lb. = 261.2 lb. per cwt. paper.

Temperature of wet web, $t = 60^\circ$ F.

Pressure of steam in drying cylinders = 8 lb. above atmosphere = 236° F.

Total water condensed within the cylinders = 3,710 lb. per hour taken by measurement as @ 62° F.

The actual steam used in this trial per cwt. of dry paper made on the reel was 377.74 lb., the difference between this and the sum of the two amounts found by the formulae being 58.9 lb. This difference, amounting to 18.6 per cent. on that found by calculation, is due to several causes, notably, moisture in the steam, and loss of heat by radiation.

The presence of moisture in the steam is inevitable, unless superheating is in use, and will exist to a greater or less extent in accordance with the arrangement and quality of the steam plant. In well-arranged works it seldom exceeds 3 per cent. of the weight of water evaporated in the steam boilers, and an allowance for this should be made to this extent in the above calculations.

After making this allowance in the foregoing figures, there is left a quantity equal to 15 per cent. nearly of the whole steam used, which is due to loss of heat by radiation, &c. It was to ascertain this loss that these formulae were originally constructed. I have found it to vary enormously in different mills, but the factors which control it are somewhat easily traced. In mills where the work of drying is constantly kept going, such as "news" mills, the machines in which are run on the same class and quality of paper during the whole week, with quick speeds and few changes and stoppages, it is reduced to a minimum, especially if the drying cylinder ends are cased in with hollow sheet-iron

covers, and the steam mains are well protected with non-conducting cement. According to my experience, this loss also varies with the quantity of paper dried. Obviously it will also vary inversely with the width of the machine, for in wide machines the free radiating surface is comparatively less to the weight of paper dried than on narrow machines.

In those mills where the steam used for drying is taken direct from the steam main, it is reduced from a high to a lower pressure by means of a reducing valve before it enters the drying cylinders. But in very many paper mills the drying is accomplished with the exhaust steam from the engine driving the paper machine. In both of these cases the steam entering the paper machine cylinders is wet, due of course to the reduction of its pressure, and any condensation occurring in the connecting pipes, between the reducing valve and drying cylinders, can be caught and measured, and if thought desirable due allowance made for it in the calculations, to arrive at a closer estimate of the loss by radiation. It has been usual for me to allow 1 per cent. of the quantities found by the formulae for every 10 lb. the steam pressure has been reduced.

The above trial closely agrees with the quantities found by calculation. It would appear that a 10 per cent. loss of steam due to radiation alone is inevitable, as the machinery in this particular case was in first-class order and every precaution taken to prevent loss of heat. It also closely agrees with the figure of 3 to 3½ lb. of steam given by Hoffmann as being required to dry one ton of paper.

Manchester Section.

ROOMS OF THE CHEMICAL CLUB, VICTORIA HOTEL.

Chairman: George E. Davis.

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Sir H. E. Roscoe.

E. Schunck.

W. Thomson.

Hon. Local Secretary:

J. Carter Bell.

Bank House, The Cliff, Higher Broughton, Manchester.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—Committee: F. H. Bowman, R. Le Neve Foster, B. W. Gerland, J. Grossmann, J. Lewkowitsch, and D. Watson.

SESSION 1895-96.

May 8th.—Discussion of all papers read during the Session already in print.

Meeting held Friday, April 10th, 1896.

MR. GEORGE E. DAVIS IN THE CHAIR.

DESCRIPTION OF A SIMPLE FEED-WATER HEATER.

BY PETER HART, F.I.C.

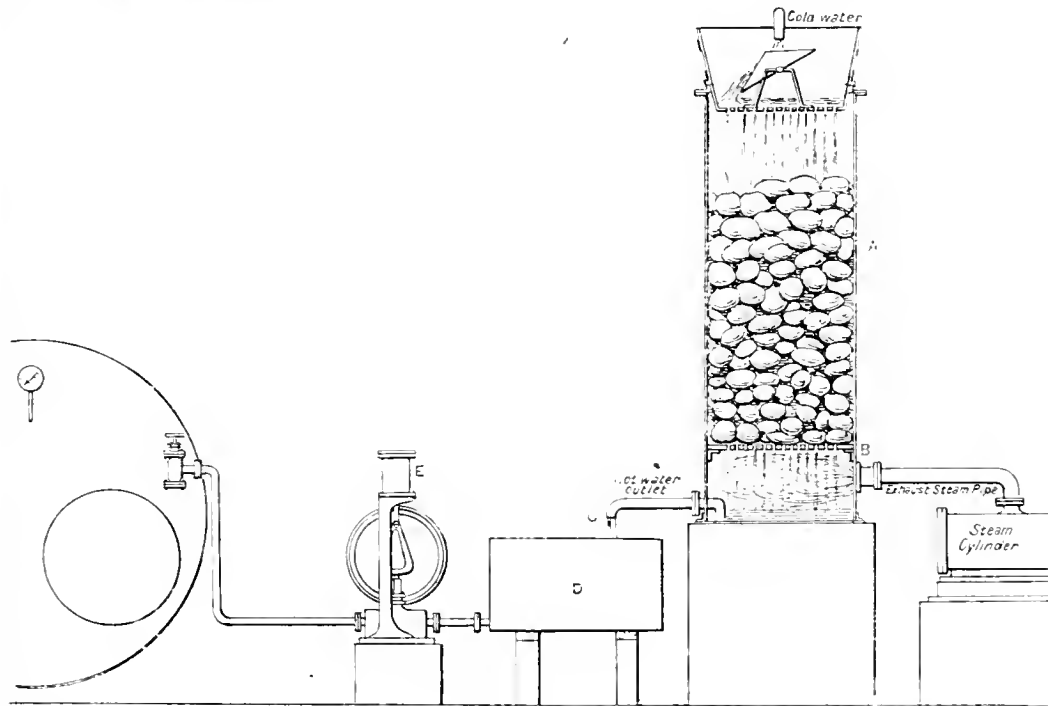
MANY small leakages of material occur in works which when looked into are found to be of greater amount than they seemed to be at the first casual glance. Exhaust steam is one of these, which might frequently be made use of for some purpose if not reconveyed into the boiler.

Like all other sulphuric acid works, the one with which I am connected uses compressed air largely for the purpose of forcing acid from the eggs to the top of the Gay-Lussac and Glover towers. The work of the two air pumps employed, working sometimes singly and sometimes together, may be taken as at least equal to one being kept constantly at work during the whole 24 hours. It occurred to me some time ago that, as these pumps are situated immediately adjacent to the boilers, it would be no difficult matter to return this steam to the boilers which supply steam not only to these engines but to the rest of the works. I have

heard of this steam being injected into the vitriol chambers but this method does not commend itself to me—holding as I do the opinion that all the input of a vitriol chamber, whether it be steam, sulphurous gas, or nitrous gas, should have a constant relative proportion to each other so far as possible during every fraction of the time they are working, and that irregular additions of any one of the constituents are calculated to disturb their working.

Of course there remained the choice of a great number of makes of apparatus for this purpose, but many of them

were not constructed on sound scientific principles, and, further, were very expensive. It occurred to me that one might be constructed combining the action of the well-known condensing or hydrochloric acid tower together with Siemens' regenerator, treating the steam as a gas soluble in water, which it is, using surface-furnishing material of a nature to absorb heat. Eventually the idea settled down into the shape shown in the drawing. A is a portion of an old boiler flue, 3 ft. diameter and 10 ft. high, the lower end of which has been securely



closed. About 18 in. from the bottom rests a cast-iron grid, with wide slits supported on projections attached to the interior of the cylinder, but which are not shown in the drawing; the upper space above this, to within a short distance of the top, is filled with boulder stones such as are commonly found in brick-clay or may be seen on most Lancashire shores. These should be selected as round as possible and of such size that the mass if so shaped would form a sphere of about 2 or 3 ins. diameter. Above this is seated a portion of a liquor cask of such a size that it will project some 6 or 8 in. into the iron cylinder and yet allow a ring of unfilled space of about 1 in. all round; this is kept in position by means of several wooden wedges attached to the cask. This cask has its bottom perforated with numerous $\frac{1}{2}$ -in. holes, and inside it is mounted the well-known oscillating box, commonly known as the "tumbling box" or "tumbling tub." The drawing now explains itself: the water, being turned on into the oscillator, is thrown over the bottom of the cask, through the holes in which it is distributed over the mass of stone packing, finally reaching the space below the grid; but during its passage down it has met the ascending hot exhaust steam, which enters at B, and having become heated by means of this, runs out at C into the cistern D, and thence, taken in hand by the pump E, is finally forced into the boiler. The advantage of the boulder-stone packing is that it absorbs a large quantity of heat, and if the pumps should be stopped for a time the water still runs out hot, taking its heat from that stored up in the packing; it acts thus as a regulator. The temperature of the water in the cisterns averages 160° F., and as about 7,000 gallons per day are put through it, this means a considerable saving. In our case I calculate it into nearly 3 tons of coal per week—not a large sum, but still a good

return for such a small outlay. I need scarcely say that water of 160° F. cannot be easily injected into the boiler, and that a pump must be used, and this in its turn must be placed, as shown, at a lower level than the cistern, in order that the water may flow into the pump by gravity. I cannot say that the dimensions given are the best; they were arrived at more by intuition than practice. In fact, the apparatus has turned out too small, for though it will deal effectually with the exhaust steam from one pump, if two are working its limit of efficiency is soon reached, and steam escapes at the top; this of course only means more cubic content of packing, to be attained by a taller or wider tower.

THE FUNCTIONS OF ALBUMIN AS A FIXING AGENT FOR PIGMENTS ON COTTON.

BY R. J. FLINTOFF, F.C.S., ETC.

The present communication is a result of experiments made to determine the properties of some insoluble azo-colours printed on cotton as pigments, and therefore a few words with reference to these experiments are necessary.

Many beautiful and fast shades are produced on cotton by passing cloth prepared with a solution of β -naphthol through aqueous solutions of some diazo-compounds. It seemed desirable to prepare some of these insoluble oxy-azo bodies, to print them on cotton in conjunction with albumen, and note the characteristics of the colours so produced.

The pigments were prepared by precipitation from aqueous solutions by mixing solutions of sodium β -naphthol and a diazo-compound.

The following table gives the necessary data respecting the nature of the pigments prepared and the colours they produced on cotton-cloth:—

Colour of Pigment.	Constitution.	Prepared from		Shade produced by Printing on Cotton in conjunction with Albumin.
		Naphthol.	Diazo-Compound of	
1. Brilliant Red.....	$\text{C}_6\text{H}_4\text{N}_2\text{NO}_2\text{C}_6\text{H}_4\text{OH}$	Beta.....	Para-nitraniline.....	Orange.
2. Ruby.....	$\text{C}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_4\text{OH}$	Beta.....	Alpha-naphthylamine.....	Heliotrope.
3. Dark Chocolate.....	$\text{C}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_4\text{OH}$	Beta.....	Benzidine.....	Drab.

It was found necessary to precipitate these compounds from very dilute solutions, otherwise the precipitates formed were in a state of such fine division that filtration was impossible. After allowing the precipitates to drain on a cloth filter for a week they contained about 50 per cent. moisture, and by exposure to a temperature of 100°C . could be dried completely and ground to a fine powder.

By the addition of oleine to the solution of sodium- β -naphthate and of acetate of sodium to the diazo-solution, somewhat brighter shades were produced, but in this case the precipitate dried to a horny, adhesive mass.

I do not think these pigments will be of much interest to the calico printer; they may, however, find some application in certain resist or discharge styles, notably in the case of aniline black. Two printing pastes containing the same percentage of colouring matter, only to the one an addition of a solution of albumin was made, were printed on the same fent with the same roller at the same time and dried. At once the colour containing the albumin appeared to be the more intense of the two, and after ageing through the Mather and Platt machine the phenomenon was even more pronounced.

I have only been able to find one explanation respecting the part played by albumin in the fixing of pigments, which states the property of albumin to be one of "occlusion."

I understand this to mean that the albumin, when coagulated, surrounds the small particles of pigment and fibre, binding them together.

Now there can be no doubt that this property is entirely inadequate to give a rational explanation of the effect above described.

From the data so far collected, one would probably conclude that the oxy-azo pigment and the albumen had chemically combined and formed a compound of greater colouring power than the pigment alone. Yet this is the more surprising when it is remembered that the pigment exists in the printing colour in a state of suspension and not solution, and, therefore, for chemical union to take place with such relatively large masses would justify the assumption that a strong affinity exists between these bodies.

Generally in the production of colour lakes on the fibre the compounds necessary for their formation are mixed in a soluble form in some suitable medium and then rendered insoluble by combination being effected in some after process. This method of procedure insures evenness of shade and facilitates the more complete combination of the component parts of the coloured body.

In fact, in many cases it would be a total impossibility to obtain a colour lake on the fibre possessing the required qualities without first rendering the colouring matter soluble in some suitable medium. Yet in the above case the particles of pigment are in very much larger masses and aggregates, and therefore the combination of two inert substances under such conditions appears very remarkable. Again, these colours possess a rather doubtful salt, forming group hydroxyl.

It has been pointed out that the sulpho-group is a lake-producer in conjunction with albumen, yet we know that the isolated hydroxyl group has only feeble lake-forming properties, and therefore its combination with albumen would be the more unexpected.

Experiments were now devised to ascertain the truth of this theory, and for the purpose a yellow pigment (lead chromate) was considered suitable, because, being a normal salt, lake formation would be impossible. Yet here we had the same phenomenon. The fibre on analysis gave traces of lead sulphide, which had evidently resulted from the presence of sulphur in the albumen, and therefore this

might possibly account for the darker shade. On account of this objectionable property of any lead salt, it seemed desirable to repeat the experiment with pigments produced by a combination of any adjectival colouring matter containing the orthodihydroxy group and the oxides of the metals chromium, aluminium, and calcium, whereby any possibility of black sulphur compounds being produced would be entirely eliminated. Again the result was the same, and consequently the theory of lake formation had to be abandoned, and the explanation sought for on other grounds.

If we take some cloth on which has been printed two mixtures, one containing a pigment alone and the other a pigment *plus* albumen, the proportion of pigment in each case being the same, and the same quantity of each mixture being on the fibre, then, on holding the cloth to the light, and viewing the light through the cloth, we shall find that in one case much more light is transmitted than in the other, and on examination it is found that the one containing the albumen is the more opaque. Therefore in this case more light should be reflected and we should have a darker colour.

Again, by examination under the microscope it is found that the albumin pigment presents a far more even and solid surface; this also will tend to increase its reflecting properties. But in the other case the small particles of pigment are readily seen sticking to the fibre, and the general effect is entirely lacking in the solid and smooth appearance characterising the former. The phenomenon, then, is purely an optical one, and depends upon the fact that in one case the actual quantity of light rays reflected is greater than the other.

Finally, I say the functions of albumin are twofold, viz., the well-known one of "occlusion," and the other of being able to increase the opacity of the layer of colour, at the same time to increase its reflecting power and thereby to apparently increase the colour of the body. This function I have named "intensification." The property of intensification is not confined to albumin, but is possessed by many substances capable of holding pigments in a homogeneous state in suspension and also of forming a suitable medium for their even distribution over the surface of the cotton fabric.

ON THE PREPARATION OF WATER FREE FROM AMMONIA.

BY JOSEPH BARNES, F.I.C.

THE preparation of water free from ammonia, either by fractional distillation or by the process of long boiling with carbonate of soda, as recommended by the "Water Committee" of the Society of Public Analysts, is always a somewhat tedious operation. The well-known destructive action of the halogens chlorine and bromine on ammonia does not appear to have been made use of for ridding distilled water of this impurity. These agents, however, afford us a means of preparing water absolutely free from ammonia in a very simple and expeditious manner. If a small quantity of bromine is added to ordinary distilled water and the latter boiled for a few minutes, all traces of ammonia will be destroyed. The same result is obtained by allowing the action to go on for several hours in the cold. Much more rapid, however, is the action of an alkaline hypobromite, which will destroy every trace of ammonia in the space of a few minutes in the cold. Water which has been treated either with bromine or a hypobromite cannot be used for Nesslerising purposes until all remaining traces of these reagents have been removed or destroyed, otherwise

there will be a destruction of ammonia in the standard solution used for comparison; potassium iodide effectually serves this purpose, and the method resolves itself into the following simple operations:—

One or two litres of ordinary distilled water are placed in a stoppered bottle and a little bromine vapour is then poured into it. After shaking, the water should be just perceptibly tinted, and should give a blue coloration when dropped on iodide and starch paper. One drop of a strong solution of caustic soda is now added and the bottle again shaken and placed on one side for ten minutes. Finally, one or two drops of a solution of potassium iodide are added, and the water will then be found to be free from ammonia and suitable for Nesslerising purposes.

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SESSION 1895-96.

May 6th.—Mr. L. Archbutt, F.I.C. "An Evaporation Test for Cylinder Oils."

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Meeting held in Glasgow on Tuesday, April 7th, 1896.

DR. JOHN CLARK IN THE CHAIR.

ESTIMATION OF ANTIMONY IN ORES AND METALS, &c.

BY JOHN CLARK, F.I.C.

There is probably no mineral the valuation of which is in such an unsatisfactory condition as that of antimony ore. To a large extent this is the fault of the consumer or smelter, who insists on the antimony being estimated by dry assay, which usually means fusion with soda carbon and iron. Carnot has pointed out (*Annales de Mines* 1892, Vol. 1, p. 303) that this method is very inaccurate, the results being rarely within 8 or 9 per cent. of the truth; and after many experiments he has abandoned dry methods on account of the volatility of the antimony. I can confirm what Carnot says as to the inaccuracy of estimating antimony by dry assay, but in my experiments I found that the loss of antimony was frequently more than counterbalanced by the sulphur and iron which the antimony contained.

Thus, an ore which gave by wet assay 46.80 per cent. of antimony, yielded by dry assay 49.0 per cent., and a well-known analyst found 52 per cent. by dry assay in a duplicate sample. To get rid of the difficulties connected with dry assay, Carnot dissolves from 2 to 5 grms. of the ore in HCl, precipitates with tin, and collects the antimony on a weighed filter, by which means he says he obtains a result within 1 per cent. of the truth. He admits, however, that when the ore contains lead, that metal is partly precipitated on the tin, and this he says may be estimated by treating the weighed metal with polysulphide of sodium, which dissolves the antimony and leaves the lead as PbS. When arsenic is present it is also precipitated with the antimony, but, according to Carnot, no method of estimating the quantity has been devised.

The difficulty of the arsenic can easily be overcome by dissolving the ore in a mixture of HCl and FeCl₃, and distilling off the arsenic, as I have shown on a former occasion (*this Journal*, 1891, 444), and if the antimony is precipitated with iron instead of tin, none of the lead comes down with the antimony; but the metal obtained in this way, especially when working with 5 grms. of ore, is apt to contain impurities derived from the iron, and to oxidise to a considerable extent in the process of drying, but it can be purified and obtained in the compact condition by fusing the precipitate with cream of tartar and borax. It is necessary, however, to stamp the flux into the bottom of the crucible and place the precipitate in a small opening in the centre, as otherwise the loss of antimony is very great. The ore above referred to, when treated in this way, gave 44.8 per cent. of antimony, the difference being due to volatilisation.

when it is mixed with Rochelle salt rendered alkaline and titrated with $\frac{N}{10}$ iodine in presence of a considerable excess of bicarbonate of soda.

The following results were obtained in this way:—

(a.) Antimony prepared from tartar emetic:—

Antimony taken.	Antimony found.	Antimony per Cent.
Grm.	Grm.	
0.2	0.1998	99.90
0.2	0.1998	99.90

(b.) White metal giving 7.38 per cent. of antimony by another process:—

White Metal taken.	Antimony found.	Antimony per Cent.
Grm.	Grm.	
0.5	0.0372	7.44
0.5	0.0372	7.44

(c.) Alloy containing about 80 per cent. of lead:—

Alloy taken.	Antimony found.	Antimony per Cent.
Grm.	Grm.	
0.5	0.0686	13.92
0.5	0.0689	13.98

In presence of copper the antimony by this process comes out low. This seems to be due to the cuprous salt and its tendency to oxidise and become a carrier of oxygen to the antimony, as I observed in my experiments with mixtures of copper and antimony that when the last traces of free iodine were removed with sulphite of sodium the blue colour reappeared after a few seconds, indicating a fresh liberation of iodine, which does not take place when copper is absent. When copper is present it is therefore necessary to remove the copper before titrating antimony with iodine, and this can be most readily effected by converting the metals into sulphides and dissolving out the sulphide of antimony with caustic potash or caustic soda.

Separation of Antimony and Arsenic.—Antimony can also be estimated in mixed sulphides of arsenic, antimony, and tin by dissolving the sulphides in HCl and iodine, but in this case it is necessary to distil off the arsenic by boiling down repeatedly with a considerable volume of strong HCl to about one third of the bulk. The residual liquid which contains the antimony and tin when present is then filtered to remove separated sulphur and titrated with $\frac{N}{10}$ iodine after conversion into alkaline tartrate.

Known quantities of tartar emetic and arsenious acid converted into sulphides and dissolved in HCl and iodine gave the following results after boiling down three times with 50 c.c. strong HCl:—

Tartar Emetic taken.	Arsenious Acid taken.	Iodine used.	Tartar Emetic found.	Tartar Emetic.
Grm.	Grm.	C.c.		Per Cent.
0.5	None.	30.7	..	100.00
titrated direct.				
0.2	0.14	12.3	0.2063	100.15
0.1	0.07	6.1	0.09964	99.64

The arsenic which is volatilised can be distilled into water, but it cannot be titrated direct as it contains more or less iodine, and when diluted sufficiently with water to prevent volatilisation and boiled to get rid of iodine, the arsenic is partially oxidised to arsenic acid, and therefore not suitable for titration with iodine in an alkaline solution without reduction.

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Meeting held at the College of Pharmacy,
Monday, March 16th, 1896.

MR. A. H. MASON IN THE CHAIR.

Professor V. COBLENTZ contributed and explained apparatus for determination of molecular weights by the lowering of the freezing point and boiling points, after Beckmann.

THE SULPHURIC ACID PROCESS OF REFINING LIXIVIATION SULPHIDES.

BY FREDERIC P. DEWEY.

THE time is fast approaching when more chemistry must be used in the extraction of the precious metals in the United States. The chief objections to chemical methods are the technical skill required in the management, the higher grade of labour necessary, and the time required to turn out product, thus locking up large amounts of capital; but these difficulties are becoming less applicable all the time. Then, too, the wonderful success attained in this country in extracting the precious metals by smelting the lead has retarded the application of chemical methods.

The chemical process of extracting silver by lixiviating or leaching its ores with solution of sodium hyposulphite was introduced by von Patera in 1858, and has been variously improved, notably by the substitution of the calcium salt for the sodium salt. This process, however, had some serious disadvantages, the two most important being the necessity for a high degree of chlorination and the recovery of the precious metals in the form of sulphides.

In order to get a satisfactory extraction it was necessary to chlorinate thoroughly, and this was not always possible, particularly in the presence of lime. Mr. E. H. Russell discovered, however, that the addition of a copper salt to the sodium hyposulphite solution, resulting in the formation of a cupreous sodium hyposulphite, largely increased the solvent power of the solution for the ordinary silver minerals in ores, so that it was not necessary to roast with salt so carefully or so thoroughly; or, with equal care in roasting, Russell's "extra solution," as it is called, will take out more silver than a plain hyposulphite solution. In other words, the use of the double hyposulphite increased the extraction of silver by the leaching process.

The Russell process can be applied to some ores without roasting, but in general the ores are roasted with salt. They are then charged into large vats and leached with water to extract soluble salts; they are then treated with a succession of hyposulphite solutions of varying compositions and strengths, according to the character of the ore, and are finally washed with water to displace the hyposulphite solution. The tailings are then run to waste. The

various solutions carrying the precious metals are gathered up in large vats and precipitated with sodium sulphide. This produces a precipitate of sulphides of gold, silver, copper, and a little lead. Most of the lead of the solutions is generally precipitated by a previous treatment with sodium carbonate.

The Russell process has been applied with marked success to the tailings of other processes, such as amalgamation and the old process of lixiviation with plain hypsulphite. Under favourable circumstances tailings can be lixiviated for 1.50 dols. to 2.00 dols. per ton.

The actual extraction of the silver by the Russell process reaches a high percentage of the total silver present in the ore. In one instance a mill treating nearly 23,000 tons a year averaged nearly 94 per cent. for the whole year. With tailings the extraction is not so high, being from 50 per cent. to 70 per cent.

Having brought the extraction of the silver from the ore up to a satisfactory figure there remains the question of dealing with the sulphide precipitate. For a long time this was admittedly the weakest point in the leaching process. After going through all the operations of crushing, roasting, leaching, and precipitating, the best we can say is that we have a rich concentrate which requires further treatment to convert the precious metals into saleable forms.

It is true these concentrates are often very rich and may carry a higher silver percentage than the bullion produced by many amalgamating mills, or even by amalgamating the same ores; but the silver, as well as the other metals, are chemically combined with sulphur, and they are also in bad physical condition, being dry powders, which are very susceptible to loss in handling, while their sampling and assaying present unusual difficulties.

The improvement in leaching introduced by the Russell process and the success of this process has stimulated the development of processes for refining the sulphides. In the early days several processes of dealing with the sulphides were proposed and some of them tried more or less; but the business finally settled down to sending the sulphides to the smelters for treatment, although this was well known to be troublesome and expensive. In 1891 Mr. C. A. Stetefeldt introduced, at the Marsac Mill, Park City, Utah, an unpatented process, which was built up out of the general fund of information available. This process consisted in matting the sulphides, grinding, roasting, grinding again and dissolving the copper out in dilute sulphuric acid, then melting the silver and crystallizing the bluestone. It did not yield fine bullion, but the bullion had to be refined as well as parted; besides, there was some loss. This process was thoroughly tried at the Marsac Refinery and then a year's run was made, the net result of which was that it did not prove sufficiently better than sending the sulphides to smelters.

In 1893 the Dewey-Walter Refining Company undertook the refining of the Daly sulphides in the Marsac Refinery by the sulphuric acid process, upon which a United States patent has been issued to the writer. Naturally difficulties were encountered in starting a new process, and much of 1893 was taken up in getting the process into smooth working order; but in 1894 a run was started in which all the regular sulphides produced by the Marsac Mill in 1894 were refined, and thus a complete set of statistics of the operation of the process was obtained.

Broadly speaking, the process consists of six main operations:—

First. Boiling the sulphides with strong sulphuric acid in an iron pot.

Second. Dissolving out the sulphates of copper and silver in a lead-lined tank, leaving a residue containing the gold and lead of the sulphides and also rich in silver.

Third. Precipitating the silver out of the filtered solutions by copper plates.

Fourth. Sweetening, drying, pressing, and melting the cement silver.

Fifth. Treatment of the solutions after the removal of the silver to crystallize the sulphate of copper and recover the excess of acid for re-use.

Sixth. Treatment of the gold-bearing residues.

The 1894 run of the Marsac Leacher produced 116, 519½ lb. of regular sulphides which were treated by this

process. For convenience they were divided into 25 lots mostly from 4,500 to 5,500 lb. in weight. As reported by the assayer of the Daly Mining Company, these lots varied in composition as follows:—

Composition, Daly Sulphides for 1894.

	Ag.	Au.	Cu.	Pb.
	Oz. Per Ton.	Oz. Per Ton.	Per Cent.	Per Cent.
Maximum ..	11,127.0	14.8	32.9	0.2
Minimum...	7,835.0	7.6	20.3	0.6
Average	9,877.4	11.225	27.17	0.33

The totals were—

Silver.....	572,544.4 oz.
Gold.....	646.1 „
Copper.....	31,585.3 lb.
Lead.....	355.86 „

The plant required is simple and all of it is well known. It is easily managed and no especial skilled labour is required. It consists of two ordinary iron pots such as are used in parting bullion; a series of 21 lead-lined tanks for dissolving, filtering the solutions, precipitating the silver and filtering off and sweetening the cement silver, together with crystallisers to recover the bluestone, and evaporators to concentrate the mother-liquors for re-use in the pot, a dryer and press for the cement silver, furnace for melting the bullion, four storage tanks for acid, and pumps for handling the liquids. The large pot for boiling the sulphides is 46 in. in diameter and 3 ft. deep. It is hung by its rim on a cast-iron plate and is enclosed in brickwork over a fire-box. It stands 14 ft. from the floor and is provided with a suitable hood and stack to take off the fumes. A smaller pot is used for boiling the residues. The tanks are arranged in steps to allow the descent of the solutions from the one to the other by gravity.

The process consists in boiling the sulphides in strong sulphuric acid to convert the sulphides into sulphates. The sulphate of silver is soluble in strong sulphuric acid, but the anhydrous sulphate of copper is practically insoluble. Owing to the large percentage of copper, averaging 27 per cent. in 1894, in the sulphides, a large quantity of insoluble sulphate is produced and this is one of the most serious difficulties of the process. After boiling, the charge is removed to the dissolving tank in which is put wash-water and weak solutions. Here the copper sulphate goes into solution along with the silver. The solution is filtered into the precipitating tanks where the silver is precipitated by metallic copper, after which the solutions are concentrated and go to the crystallisers to recover the bluestone. Periodically the cement silver is removed to the filter, sweetened, dried, pressed, and melted. The mother-liquors are concentrated, crystallised, and the recovered acid finally sent back to the pot. The residue in the dissolving tank is taken out, washed somewhat and re-boiled in acid to remove as much as possible of the silver that it contains.

Practical Operations.—A charge of about 975 lb. is put into the pot in the morning with about 1,000 lb. of 66° acid and thoroughly mixed and the charge heated. At first the reaction is rather violent, SO₂ is copiously evolved and the fumes carry much sulphur which gives them a yellowish colour. At this stage a steam jet may be required to increase the draught. After a while the reaction settles down and the normal charge boils quietly until near the end. As soon as the charge gets stiff, more acid, about 100 lb. is added, until about 3,000 lb. have been added. Toward the end, evaporated acid is used. As the boiling goes forward, anhydrous sulphate of copper is formed in large quantities which separate, forming a granular mass. This necessitates frequent stirring of the charge, and this in turn is hard on the pots. A network of cracks develops and finally the acid finds its way through, when the pot must be replaced. In the 1894 run nine pots were used, two of which were short lived. Better results have been obtained since.

The progress of the operation can be watched by taking out a small sample of the charge, treating with water and adding HCl to the solution, but this is not necessary after getting familiar with the process, since the colour changes

from black to brown or dark grey. About 90 per cent. of the total acid used is added before the charge begins to show soluble silver salts. Then the charge foams violently and must be constantly stirred while the fire must be lowered. In about an hour the foaming is over and the charge is finished. This usually occurs in the afternoon of the day after starting. On the second morning the charge is warmed up, generally with the addition of some acid and, as it is rather thick, it is ladled out into a trough which delivers it to the dissolving tank. The pot is then started on a new charge.

The dissolving tank is filled with cold water within 6 or 8 in. of the top and tightly covered, since the introduction of the charge generates much heat. After the charge is in, the cover is raised and the solution is stirred with a paddle and boiled with steam, after which it is settled and drawn into the filters. The first tankful of solution contains most of the copper. It is run into a small precipitating tank and kept separate from the rest of the solution. The charge now resembles thick white mud and is washed from 8 to 10 times with weak acid solutions to remove the silver, after which the residue is thrown into a filter. The residue varies very much, running from 5,000 to 19,000 oz. Ag. per ton and 50 to 100 oz. Au, the balance being mainly sulphate of lead.

The filters are 3 in.—4 in. of clean quartz sand on a foundation of lead plates, cocoa-matting and asbestos cloth, resting on lead strips, giving a space below. It is impracticable to settle all the very fine residue in the dissolving tank so some of it passes over into the filters and chokes them up. In about two weeks the filters must be washed by a stream of water from below and the muddy water pumped off the top.

The solution has a reducing action and immediately a separation of metallic silver begins in the dissolving tank, often with the formation of beautiful growths upon the surface of the liquid, and this reaction continues in the filters. By this reaction, metallic Ag is found in the first residue and some 10,000 oz. may accumulate in the filters during a year's run.

From the filters the solution goes to the precipitating tanks where the Ag is precipitated by copper, cathode plates from an electrolytic refinery being used. The first or copper solutions require a long time to precipitate, sometimes 18 hours, but ordinary solution is precipitated in 4—5 hours. During precipitation the solution is stirred by air and heated by steam. When the precipitating tank is cold and the hot solution of silver sulphate runs in, there may be a separation of silver sulphate, which may go into solution again as the solution is heated up, but some of it may also remain with the cement silver and be removed in washing the silver, in which case the wash water must be treated with copper.

When about 20,000 oz. of cement silver have accumulated in the precipitating tanks, it is removed to the sweetening tank and washed with hot water and then with acidulated hot water until the ammonia test shows no copper, which takes about 15 hours. The wash water runs through a guard tank containing scrap iron and then to waste.

The sweetened silver is put into sheet-iron pans, and dried about 24 hours in a steam dryer, pressed into cakes, dried again, and melted. In 1894 the melting was done in crucibles holding about 2,400 oz. or two bars; about a pound and a half each of borax and nitre were used to a crucible. The melted silver was poured into heated and greased light cast-steel moulds. After pouring, a little sugar was thrown on the liquid silver, and the mould covered by a tight-fitting cast-iron cover. This gives a very smooth surface to the bar. When cool the bars are hammered up and marked. The average fineness for 1894 was 999.4 silver with no gold. 446 bars were shipped, of which 401 were 999.5 fine and 45 were 999.0 fine.

The bluestone solution is concentrated to about 35° to 37° B., and run into ordinary crystallisers provided with lead strips, and allowed to stand two days or more, when it is pumped back to the evaporators, and run up to 42° B. It goes back to the crystallisers, and a crop of crystals containing iron and but little bluestone obtained. The solution goes back to the evaporator. The crystallisers are filled

with cold water, which dissolves most of the iron and only a little of the copper. This solution goes through the guard tank to waste. These bluestone crystals are very small, but it answers as well in the leacher in preparing extra solution. The mother-liquor is brought up to 50°—52° B., and then allowed to stand in a crystalliser several days to separate iron. It is then pumped to storage tanks for use in the pot. While concentrating considerable iron separates in the evaporators. Periodically this is washed out, and the solution run to waste through the guard tank.

After boiling five charges of sulphides, about 750 lb. of wet residue is obtained. This is put into the pot and boiled with a little more than its own weight of acid, after which it is washed and the final residue dried. This residue is very complex in composition, although it is mainly sulphates of silver and lead. There appears to be some acid sulphate, for the sulphuric acid present is far more than sufficient to form normal sulphates, and yet the sample is so dry that the excess of acid cannot all be free; it contains the gold of the sulphides. During 1894 this residue was shipped away to the smelters for treatment, but at the present time it is being melted on a hearth.

Supplies.—Sulphuric acid is received at the refinery in iron tank-cars holding 40,000—50,000 lb. It is stored in two lead-lined wooden tanks holding about 54,000 lb., and is elevated by a montejus to two iron receivers above the level of the pots, from which it is drawn to the feed pots. In the 1894 run, 389,459 lb. were used, being an average of 3.34 lb. per lb. of sulphides treated, or 0.68 lb. per oz. of silver. Copper to precipitate the silver is used in the form of cathode plates, and 16,832.5 lb. were used, 1 lb. of copper precipitating 2.7 lb. of silver or 33.1 troy oz. The ordinary local coal is used, and 159,000 lb. were used in the 1894 run.

The regular labour required was a superintendent and two men with an extra man to assist the superintendent in melting bullion. Occasionally some extra labour was required, particularly in shipping residue, and making the annual clean-up. Mechanics were also required for special work occasionally, but the lead-burning was done by one of the regular men.

Returns.—It is a well-known fact that, in assaying, some of the precious metals pass into the slag, and some are absorbed by the cupel, causing a loss in the determination. In the case of ordinary ores, this quantity per ton is generally small, although the percentage of the total silver is large. In the case of rich materials, however, the percentage is low, while the actual quantity per ton becomes considerable, and when the rich material carries copper, the loss of silver per ton becomes quite respectable. In our business transactions, the sulphides are always settled for upon an assay corrected for slag and cupel absorption which shows from 100 to 200 or even more oz. per ton more than the ordinary uncorrected assay shows. Even on the corrected assay, the actual amount of silver returned by the refinery on the year's work was 2,073.81 oz. more than the assays called for, showing very plainly that even the corrected assays do not show all the silver really present. This silver was divided as follows:—

116,519.5 lb. sulphides contained 572,544.45 fine oz. of silver.

Product Returned.

	Fine Ounces of Silver.	Per Cent. of Total Silver.
Fine bullion, free from gold	551,329.89	96.29
Residue	15,773.41	2.76
Clennings	5,328.87	0.93
On hand	2,191.00	0.38
Total	574,623.17	100.36
Plus clean up	2,073.81	0.36

It is regarded as an extraordinary showing for a chemical process on the large scale to recover more than the best assay possible calls for.

As to the recovery of gold, I cannot see any reason why it should not equal the silver recovery, but the figures upon the point are not satisfactory. The actual return of gold

for the year was 606.9 oz. The original assays of the Daly Mining Company called for 654.8 oz., but their re-assay on some of the samples reduced this to 616.1. This left an apparent shortage in the returns of 39.2 oz. The same samples were assayed by Mr. Chas. Earle under my direction, and while the silver results showed a satisfactory agreement with the Daly assays, yet his gold determinations called for only 602.9 oz., showing a plus clean up on the year's work of 4 oz. After the close of the year's business a general sample was prepared by taking proportionate weights of each of the check samples of the 25 lots. The Daly Company's assay of this sample called for 616.9 oz., and showed a plus clean up of 1 oz. Mr. Earle is no longer with me, so I cannot add his figures on this sample. There are especial difficulties in determining such small quantities of gold in the presence of so much silver.

The conditions of the process are such that I do not see how we could gain so much on the silver and lose on the gold, so that I am satisfied that the process practically recovers all the gold that goes into the operations, although the assays may not always show this.

The bluestone produced amounts to 175,809 lb. or 3.63 lb. per pound of copper, including the copper in the sulphides and the copper used to precipitate the silver. About 125,000 lb. of bluestone were used by the leacher in preparing extra solution, leaving 50,000 lb. to be sold to outside parties. No particular care is taken to prepare fine large crystals of bluestone, and it is not necessary to purify the solutions from iron except as above described. Most of the bluestone derived goes to the leacher, and the size of the crystals is of no moment whatever, while the small amount of iron present does no harm. The best grade showed 0.34 per cent. of protoxide of iron, the medium 0.69 per cent., and the worst, of which only a small quantity was produced, 3.87 per cent.

The following table summarises the statistics for the year:—

THE 1894 RUN OF THE MARSAC REFINERY, WORKING BY THE DEWEY-WALTER PROCESS OF BOILING RUSSELL SULPHIDES IN STRONG SULPHURIC ACID.

First charge of 1894 sulphides to pot, February 20, 1894.

" " 1895 " " " 27, 1895.	
Sulphides treated.....	116,519.5 lb.
" contained silver by corrected assay	572,544.45 oz.
" " copper	31,585.3 lb.
" " lead	385.6 "
" " silver av. oz. per ton ...	9,827.44 "
" " copper av. per cent.	27.1 "
" " lead av. per cent.	0.33 "
Acid used.....	389,459.0 lb.
" per lb. sulphides	3.34 "
" " oz. silver	0.68 "
Coal	159,000.0 "
Copper used to precipitate silver	16,832.5 "
Total copper.....	48,417.8 "
One lb. copper precipitated silver	2.27 "
Bluestone produced.....	175,809.0 "
" " per lb. copper.....	3.63 "

Regular labour—superintendent and two men.

Extra labour—one man at bullion melting to assist superintendent, labourers for clean up and shipping residue, &c., mechanics for special work occasionally.

116,519.5 lb. sulphides contained 572,544.45 fine oz. of silver.

Product Returned.

	Fine Ounces of Silver.	Per Cent. of Total Silver.
Fine bullion, free from gold.....	551,329.89	96.29
Residue	15,773.41	2.76
Claimings	5,328.87	0.93
On hand	2,191.00	0.38
Total.....	574,623.16	100.36
Plus clean up.....	2,073.84	0.36

All weights of sulphides and products, excepting one covering less than 200 oz., and all the assays are the originals made by the Daly Mining Company.

The advantages of this process are the phenomenal percentage of silver removed, and that it is an entirely liquid one from beginning to end, so that there is no loss from handling dry products. There is no roasting to cause loss. A large percentage of the silver is recovered as very fine bars, ready to enter the market. It is so simple and so easily carried out, and the plant is so small and inexpensive, that it can be installed at individual leaching works.

Finally, the cost of operating is small; in fact, the value of the bluestone recovered returns a large proportion of the operating expenses.

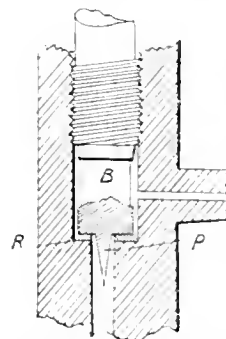
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I.—PLANT, APPARATUS, AND MACHINERY.

Autoclave of A. Pfungst, Report on the, by Noetting and Freyss. H. Groscheintz. Bull. Soc. Ind. Mulhouse, 1895, 261—262.

REFERRING to the report (Bull. Soc. Ind. Mulhouse, 1895, 88—91; this Journal, 1895, 769), the author points out that he devised a stopcock for an autoclave in Wurtz's laboratory similar to that described by Pfungst, but which was subsequently modified as follows:—Instead of the screw B



* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Luck, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

terminating in a flat plate, it ends in a point P, which passes through a hole in the washer R. By this means the tube can be unscrewed under all conditions, to enable gas to escape between the point P and the washer.—T. A. L.

PATENTS.

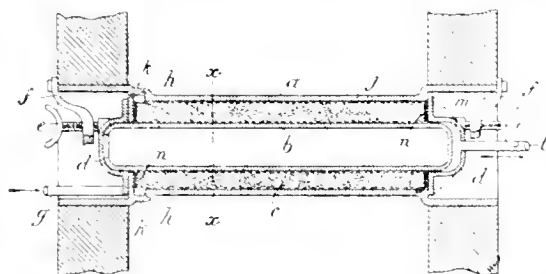
Fluids, Cooling and otherwise Treating: Improvements in or relating to Apparatus and Processes for. J. Klein, Frankenthal, Rheinpfalz, Germany. Eng. Pat. 2452, Feb. 1, 1895.

THIS is an apparatus for cooling or otherwise treating fluids, provided with natural, ventilating, or any other draught. It consists of two or more upright or nearly upright dividing elements placed over each other and made of separate cooling-walls consisting of strips of board or laths, laid in close proximity one above the other, so that the air has free access to them on all sides, and the fluid descends only very slowly.

The fluid to be treated trickles down over the surface of the laths, and is thus made to expose a very large surface to the cooling, or other action, of air, or gas, passing through the spaces between the laths.—R. B. P.

Retort [Annular] for Chemical Processes, An Improved. E. L. Pease, Stockton-on-Tees, and Ashmore, Benson, Pease and Co., Ltd., Stockton-on-Tees. Eng. Pat. 2946, Feb. 11, 1895.

THE retort consists of a combined inner and outer casing *b, a*, the annular space between them forming the chamber *c*, in which the material to be treated is placed. Asbestos packing, *n*, is preferably provided at each end to render the retort steam-tight. The inner cylindrical casing is supported by the retort lids *d*, which are held in their places by



set screws *e* working through resistance bars *f*. A jacket or envelope of perforated material is employed, and may be corrugated, or the casing may have ribs or ridges. Steam or air is passed alternately through the tube *g* to a passage *h*, and, after passing through the materials (heated to a high temperature in the retort), arrives at the cavity *m* and escapes through the tube *l*. In one modification, the discharge pipe *l* returns through the centre of the inner cylinder and discharges at the same end as the inlet for air or steam; in another modification, the inner casing is supported at one end within a closed end of the outer casing. The claim is for "A retort consisting of an annular chamber formed between an inner and outer casing adapted by their construction and arrangement of parts, to pass steam or air through the material contained in the chamber with equal or uniform penetration of the mass."—R. S.

Filtering Liquids, Improvements in and relating to Apparatus for. H. H. Lake, London. From A. A. Pindstoffe, Copenhagen. Eng. Pat. 6028, March 22, 1895.

IN this apparatus the filtering medium (sand or the like) is arranged between two vertical concentric cylinders of fine wire gauze.

The liquid to be filtered is admitted to the inside of the inner gauze cylinder, and flows outwards through the filtering medium into an outer containing casing provided with an exit pipe.

It is claimed that by this arrangement the difficulty experienced with filters in which the filtering medium is in a horizontal layer—namely, that it becomes clogged with sediment—is obviated.—R. B. P.

Asbestos Filters, Improvements in. C. D. Abel, London. From B. Blumenfeld, Vienna. Eng. Pat. 24,887, Dec. 28, 1895.

THIS invention relates to improvements on the filter described in Eng. Pat. 5377, 1890 (this Journal, 1890, 796), in which the filtering layer of asbestos is formed on the outer surfaces of the porous walls of flat, hollow bodies that are enclosed, in greater or less number, within a filtering chamber, with which communicates a supply-pipe for water to be filtered. The first improvement consists of washing devices for cleansing the filter elements from the accumulated deposit. Two forms are described:—1st. Jet pipes are arranged between the filter elements, and are connected together by cross pipes, to which are fixed the water-pressure pipes working through stuffing boxes in the casing. The tube-rinsing frame thus formed receives an up-and-down motion, as by means of a rack and pinion. 2nd. Jet pipes are carried by a tubular shaft mounted in bearings in the filter casing and connected to the water-pressure supply, the shaft receiving a reciprocating rotary motion for causing the jet pipes to swing up and down over the surfaces of the filter elements. The second improvement consists in providing the inlet and outlet branches at the base of the collecting chamber with the hand wheels of the valves arranged all at the same height for convenience of working.—R. S.

Non-corrosive Compositions for Coating Boilers and the like to Resist the Action of Heat and Atmospheric Influence, Improvements in. T. Lowe, Nottingham. Eng. Pat. 8478, April 30, 1895.

THE composition consists of a mixture, formed preferably in the following proportions:—Water, 15 per cent.; gas tar, 5 per cent.; oak extract, 30 per cent.; carbon blacking, 10 per cent.; and plumbago, 40 per cent.—R. S.

Furnace Pans, Coppers, and the like, Improvements in and connected with. J. Wood, Ipswich. Eng. Pat. 18,464, Oct. 3, 1895.

RELATES to removably arranging furnace pans, coppers, and the like, instead of cementing them in as usual, whereby easy access may be had to the flues, &c. There is provided a metal, earthenware, or other suitable bushing, lining, or flange around the orifice in the brickwork or masonry for the reception of the flange or rim of the pan, &c., arrangements being made for forming a tight joint, and also, by means of handles or other devices, for facilitating the removal of the pan, &c. when desired.—R. S.

Pumping Gritty Fluids, Improvements in the Method of and Apparatus for. W. Jordan, London. From The International Contract Company, Syracuse, U.S.A. Eng. Pat. 18,825, Oct. 8, 1895.

THE apparatus is especially intended for use in dredging operations, where it would be placed in a boat floating in the water, the suction pipe being arranged to draw the mud from the bottom of the water. The drawings illustrate apparatus intended for this purpose. The principal improvements are: (1st) Cleansing the walls of the pumping cylinder by discharging a film of water past the edge of the piston during the forcing stroke; (2nd) Forcing water into both of two connected cylinders above the pistons with a pressure exceeding the resistance below the same; (3rd) Actuating the two pistons alternately by water pressure or by mechanical agency, and providing special constructions for the valves and pipe connections to prevent concussion in the pipes or the settling of the sand therein; (4th) Arranging a force pump with a suction pipe immersed just below the surface of the water, to obtain clean water for use in actuating the pistons; (5th) Using two vertical cylinders, and passing the clean water alternately into them by means of a shut valve; (6th) Discharging the clean water from the upper end of each cylinder back to the water level; (7th) Preventing the clogging of the suction pipe by employing a sieve around the nozzle thereof, and automatically supplying its upper end with clean water.—R. S.

Refrigerating or Cooling Machines, Improvements in or relating to. W. P. Thompson, London. From A. T. Ballantine, Cleveland, Ohio, U.S.A. Eng. Pat. 20,922, Nov. 5, 1895.

This invention relates to refrigeration or cooling machines, in which refrigeration is produced by allowing a volatile liquid, such as anhydrous ammonia, to expand into gas in a refrigerating coil, from which the gas is continuously removed by means of a pump.

The inventor states that it is impossible by the means hitherto employed, automatically, to keep the refrigerating coil always full of gas only, which is indispensable. The essential part of the invention consists of a feed valve, controlled by an elastic diaphragm, loaded by means of a weighted lever. The pressure in the refrigeration coil acts upon the feed valve through the diaphragm, and allows a jet of ammonia to enter the coil when the pressure falls to a certain extent, and then closes it again as the pressure rises through the expansion of the ammonia into gas.—R. B. P.

Generating and Applying Vapours, Improvements in the Method of and Apparatus for. O. S. Rhodes, East Stroudsburg, U.S.A. Eng. Pat. 23,701, Dec. 10, 1895.

The apparatus consists of a combination of a furnace, boiler, and engine. The furnace is surmounted by the boiler, and has an engine cylinder on each side of it. The boiler consists of a vertical outer shell, up which the furnace gases pass to the stack, and containing three tubular supports connected together and provided with projecting horizontal tubes closed at their outer ends. These supports open above into a receptacle, also contained within the casing, which, as well as the supports and projecting tubes, is filled with a suitable heating liquid, preferably of high boiling point, as a fixed oil. Within the receptacle is a closed chamber containing a volatile liquid, as ether, the vapour of which is to be used in the engine, and which is heated by the oil, &c. in the outer receptacle. The supply pipe for the volatile liquid passes up the centre of the central tubular support above mentioned, while the vapour given off passes down two tubes which reach nearly to the top of the closed chamber and extend down the central tubular support, and thence pass to pipes having valves leading to the engine cylinders. The engine cylinders themselves have jackets through which the boiler liquid circulates. The exhaust from the engines passes to a condenser, and is then forced by a pump back to the closed chamber.—R. S.

Mill for the Grinding and Emulsification of Vaccine Material, Flesh, Drugs, and other Substances, An Improved. M. J. F. Schutte, Haarlem. Eng. Pat. 23,760, Dec. 11, 1895.

This invention consists of a special arrangement of pestle and mortar, formed of hard substance, as of porcelain or of glass. The mortar is carried within a frame, having gearing to allow the pestle to be rotated by hand or by power, and is shaped so that it and the pestle accurately fit one another. In one form the pestle is somewhat conical, ending in a blunt cone, and provided on its surface with spiral channels wider at the top than on the under surface, where they gradually disappear. In another form the pestle has a hemispherical end, and touches the mortar only at such end, the sides of the pestle and mortar above that part being coned in opposite directions, while the spiral channels on the pestle only reach to about half of the hemisphere. In the case of vaccine material, the latter is mixed with a suitable quantity of glycerin and distilled water, and placed in the mortar, and in a short time perfectly emulsified. The upright carrying the pestle is so constructed that it and the pestle may be removed from the mortar.—R. S.

Vapour Condensers, and Apparatus for Destroying Noxious Fumes, Recovering By-Products from Distillation and like Purposes, Improvements in. S. G. Merrick, Philadelphia, U.S.A., and H. L. Washburn, New York, U.S.A. Eng. Pat. 25,001, Dec. 31, 1895.

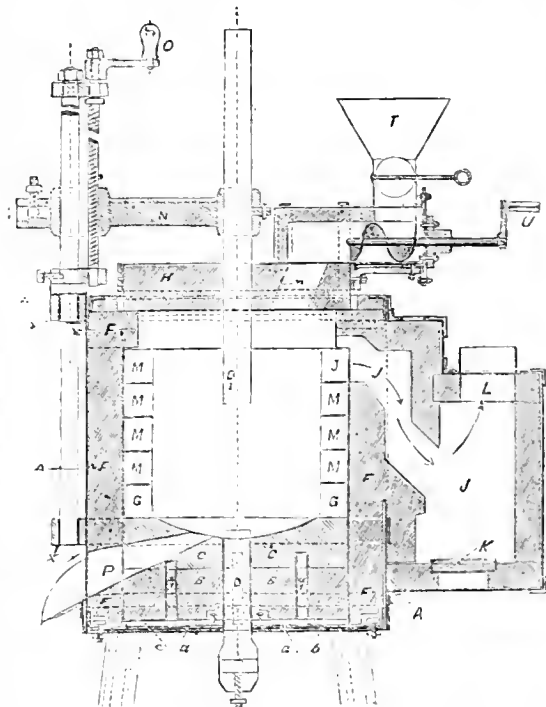
A METALLIC casing is divided by a vertical partition into two compartments, each of which is charged with suitable

absorbent liquid to, say, two-thirds its height. A horizontal shaft, driven by power, passes completely through the centres of both compartments, and carries a series of coiled pipes, having at the ends which are in the chamber receiving the gases, &c. from the stills or other source of supply, bell-shaped mouths so formed that when they strike the surface of the liquid during rotation they shall be parallel to that surface. Each time one of these mouths strikes the liquid surface a portion of the gas or fumes is entrapped, and forced by the water through the coil to the second chamber, where it escapes if uncondensed, and may be led away or returned to the first chamber.—R. S.

II.—FUEL, GAS, AND LIGHT.

Electric Furnace for 1,000 Amperes. J. Pfleger. Zeits. f. Elektrochem. 2, 367—368.

This furnace, which is crucible-shaped, may either be lined entirely with magnesite (M) or with magnesite above and with graphite (G and C) below. The current is led in by thick carbon rods. The negative carbon (D) is fixed underneath. The positive carbon D passes through the lid H and can be moved up and down by the winch N O; this serves to vary the length of the arc according to the available E.M.F. Materials are fed in through the funnel



T. The gases evolved during the process travel through the canal J as shown by the arrows, and pass out through the aperture L either into the open air or to the chimney. Any solid matters carried with the gases are deposited in the canal J and can be removed by withdrawing the slider K. The fused materials are withdrawn through the hole P, which is otherwise closed by a carbon stopper. The furnace should be mounted so that the negative carbon can be got at and renewed. A sheet, c, of asbestos, 9 mm. thick, is introduced between the plate b and the iron plate a. The mechanism of the winch is insulated at the points x x x.—D. E. J.

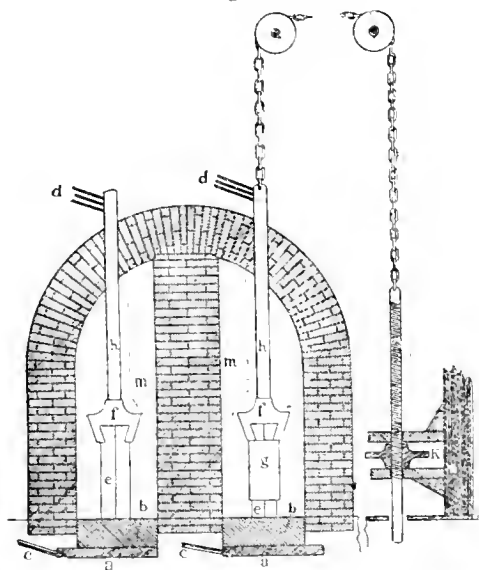
Calcium Carbide, The Manufacture of. J. T. Morehead and G. de Chalmot. J. Amer. Chem. Soc. 18, [4], 311—331.

By means of the plant herein described, the Willson Aluminium Company produce calcium carbide, the dynamos

being worked by water-power—a 300-h.p. wheel under 28 feet fall.

The furnace employed at the Spray (N.C.) Works is shown in section in Fig. 1. It is of brick, the front being

Fig. 1.



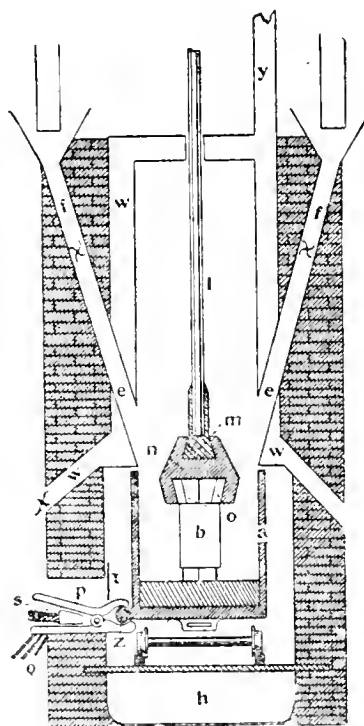
closed by four iron doors one above another, and measures $2\frac{1}{2}$ by 3 feet inside at the base. The lower electrode is an iron plate *a*, covered with 8 ins. of carbon *b*, composed of pieces of carbon pencil, or a mixture of coke and coal tar, and connected with the dynamos by 16 copper cables, *c*, of $\frac{3}{4}$ in. in diameter. The upper electrode, *d*, consists of a copper bar 3 ins. square, *h*, carrying the carbon holder *f*, to which are attached the carbon pencils *e*. There are six of these, each 4 ins. square and 36 ins. long, arranged in pairs and cut so as to dovetail into the holder, and are surrounded by an iron jacket, *g*, to prevent undue wasting by oxidation. 16 cables complete the electrical circuit, and the whole electrode, being suspended by a chain passing over pulleys, can be raised or lowered at will by means of the hand wheel, *K*, working on the screw, *i*, at some distance away from the furnace. The attendant watches the volt- and ammeter, and regulates the screw accordingly, and the height of the piece of carbide formed in the furnace can be gauged by measuring the descent of the screw.

For the Niagara Falls Works the improved furnaces shown in Figs. 2 and 3 have been constructed. In order to allow of continuous working, an iron car, *a*, running on a track and forming with its interior layer of carbon the electrode, is substituted for the bottom of the furnace. The upper electrode contains double the number of carbon pencils in the older form, and is about twice as heavy, necessitating the use of a stronger bar, made up of two outer slabs of iron, 6 ins. by 1 in., and a central one of copper, 6 ins. by $1\frac{1}{2}$ ins. The holder is divided into two pieces, *m* and *n*, dovetailing into one another, so that the lower can be slid on to the upper from the car. As sometimes an arc will be started between the group of pencils and the holder, resulting in the partial fusion of the latter, a lining of removable iron plates, *q* (Fig. 2), is interposed between them. Connection between the dynamo cables *Q* and the car is made by means of a clamp *p*, which can be tightened round the projection *Z*, by means of the screw *s* (Fig. 2).

The car being run into the furnace, the upper electrode set in position, and the current switched on, the mixture of coke and lime is fed into the car through the shoots *e*, which extend the whole length of the car, the supply being regulated by the rate of motion of the 4-bladed feed-rods *f*. Automatic stoking, to fill up the holes made in the loose material by the evolved gas, is effected by means of a rod *g* (Fig. 3), attached to the car and moved backwards

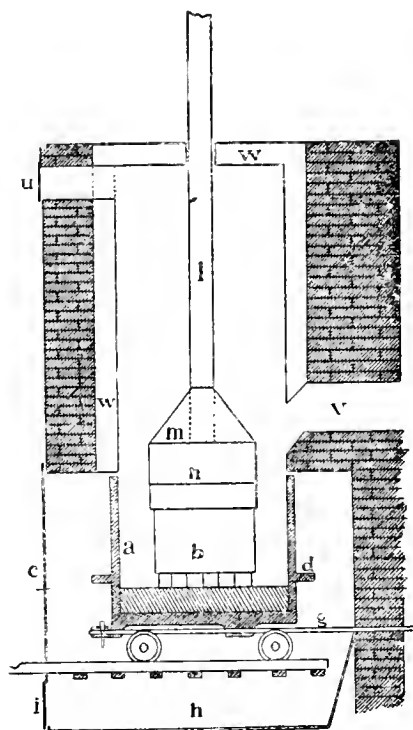
and forwards for a couple of inches 20 times a minute, pulling the car with it. This motion also increases the efficiency of the arc by preventing its tendency to become localised.

Fig. 2.



The rod *g*, may also be used for making the connection with the dynamo cables, and is then composed of an iron and a copper bar.

Fig. 3.



The furnace is entirely closed, the door *c* (Fig. 3) being shut at the outset, and the safety door *n*, is also closed as soon as the issue of flames indicates that the furnace is filled with carbon monoxide. The gases escape through a chimney *V*, at the side, and therefore the top portions of the upper electrode are not exposed to the heat, the temperature being also kept down by the circulation of cold air through the jacket *W*, from the intake *X* (Fig. 2), to the chimney *y*.

The arc is kept steady by being covered by the coke and lime for a height of a foot around the pencils, the latter being raised by the attendant at the hand wheel when the voltage becomes low. The operation goes on for several hours, and results in the formation of a conical block of calcium carbide, about 2½ ft. in height, occupying the space between the electrodes, but never quite filling up the whole furnace room, there being always a certain amount of lime and coke left intact and in a loose condition, so that it is easily separated from the carbide and may be returned to the furnace. Covering the carbide block is a thin crust consisting chiefly of carbon, but also of carbide and lime, and seldom exceeding 7 per cent. of the weight of the block or yielding more than ½ eb. ft. of gas per lb. The carbide is crystalline, the crystals being more perfect with an excess of coke, low voltage, and slow cooling. Carbide of average quality (about 5 eb. ft. of gas per lb.) is often coloured red, especially if high voltage is used; the low qualities are often grey or blackish, with streaks of graphite.

The coke used should contain about 7, with a maximum of 10 per cent. of ash, or the effect on the quality of the carbide is prejudicial. It should be ground fine enough to pass through a 50-mesh sieve. The lime need not be so fine, but the coarsest pieces must pass through a 10-mesh sieve, or the carbide will be of inferior quality. The lime should not contain more than 3 per cent. of magnesia at the outside, this substance being especially detrimental, probably by forming a film between the carbon and the lime, and so preventing combination. In the lime used at the Willson Works only 1½ per cent. is present, and 1 per cent. of other impurities.

Intimate mixture of the lime and carbon is necessary for the attainment of good results. The uncombined mixture in the furnace may be used over again, but as the impurities and ash from the combined portions are left behind therein, an admixture of charcoal is advisable. Being red hot on leaving the furnace, the mixture will lose much of its carbon if left in the air, and should therefore be used up again as quickly as possible or stored in iron bins. The loss of carbon is greater in open furnaces and with slaked lime, water-gas being evolved in the latter case.

To preserve the carbon pencils of the electrode from wasting, it is advisable to protect them in open furnaces by a surrounding cover of iron, packed with a mixture of coke and pitch; they will then last about 100 hours with intermittent working with a 1,700–2,000-ampère current, or 200–300 hours if the operation is continuous, the waste chiefly occurring after the current is shut off and the pencils exposed. About 8,500 lb. of carbide can be made with one set in the open furnaces.

The gas-producing power of the carbide is tested by breaking up a block and placing about 1 to 3 oz. of average sample in a dry bottle. Water is dropped in through a funnel and the evolved gas conveyed to a meter through cooling tubes.

The lime in the mixture is roughly determined by boiling 2½ grms. with hydrochloric acid and titrating the solution; the coke, by filtration from hydrochloric solution, and weighing.

The practical limit to the height of the carbide blocks is reached at about 2½ ft., the loss of voltage, averaging 6 volts per foot of carbide, beginning thenceforward to reduce the efficiency of the furnace.

Tables are given showing the strength of current, horse-power, and time employed for various runs, together with the loss of voltage, the yield of carbide per horse-power per 24 hours, and the production of gas on the same basis, both with unslaked and air-slaked lime. The averages—

	Net Production per H.P. in 24 Hours.	Cubic Feet of Gas per Lb.	Cubic Feet of Gas per H.P. in 24 Hours.
Unslaked lime	9.75	4.97	48.33
Slaked lime	7.51	5.27	39.52

show to the advantage of the former, which, besides, is less bulky, and the unused mixture cools faster when removed from the furnace. On the other hand, unslaked lime has to be ground, and requires more stoking to keep the mixture up against the pencils when in the furnace.

To obtain a carbide yielding about 5 eb. ft. of gas per lb. (which is found to produce the largest amount of gas per horse-power), the mixture should consist of 64–65 parts of carbon per 100 parts of lime, rather more if the voltage is increased and *vice versa*. A large proportion of carbon gives purer carbide, but also more coating. The yield of carbide varies in inverse ratio to the quality, the extremes of a series of experiments made with slaked lime and with a current of 65 volts and 1,700–2,000 ampères being 7.10 lb., yielding 5.80 eb. ft., and 10.52 lb., yielding 4.23 eb. ft. of gas per lb. The best yield of gas per horse-power was obtained with a 100-volt current and 1,760–2,000 ampères with a 6-pencil electrode, it being found that higher ampérage causes the pencils to waste quickly, and also entails greater loss of voltage. On the other hand, high voltage lowers the quality of the carbide and makes a thin block, the action of the current not spreading out so far into the mixture as when the voltage is about 65.

Although theoretically 0.563 lb. of carbon and 0.875 lb. of calcium should yield 1 lb. of carbide, it is found, on the average of 10 experiments, that the proportions are higher in practice, viz., 1.228 lb. of CaO and 0.837 of C, both substances being volatilised or burned to some extent in the furnace, the carbon suffering the greater loss. If properly stoked and the arc kept covered, the consumption of material is lessened, and it is anticipated that the new furnace (Figs. 2 and 3) will give better results than those mentioned above.

Of other carbonaceous materials suitable for use in making carbide, charcoal yields a very pure product, but is costly and easily carried away by the evolved gas, some 10 per cent. extra having to be used on this account. Both soft coal and anthracite gave carbide, producing much smaller amounts of gas per horse-power in 24 hours than obtained by the use of coke, the superiority of this material and carbon over anthracite being probably due to their porosity facilitating that volatilisation of the carbon which is perhaps essential to the reaction.—C. S.

PATENTS.

Water, Producing Gases from, An Improved Process of and Apparatus for. J. H. Dunn and J. Parsons, both of London. Eng. Pat. 1707, Jan. 21, 1895.

The inventors propose to resolve water into its constituent gases by the action upon it of an electric current, the latter passing between the opposing ends of a pair of carbons, or other conductors, arranged after the manner of those of an arc lamp.

The carbons pass through insulating stuffing boxes, placed diametrically opposite one another, along the sides of a cylindrical vessel horizontally disposed. This vessel contains sufficient water to completely cover the carbons, and the level of the water is kept uniform throughout the process.

When the current passes, oxygen and hydrogen are evolved, from the positive and negative conductors respectively, and the gases are received into the bell-shaped ends of two tubes, which pass through the cylinder, and reach nearly to the ends of the conductors; the tubes lead to two gas-holders.

The heat produced by the current causes steam to be given off from the water, and this steam may be conducted away by a third tube; or, the exit tubes being closed by suitably placed cocks, it may be confined, until it attains a useful pressure.—E. R. B.

Water-Gas Carburettors, Improvements in Fittings for. S. Cutler, London. Eng. Pat. 4505, March 2, 1895.

In certain of the processes for carburetting water-gas, oil is sprayed upon the highly-heated refractory and non-porous internal surfaces of the carburettor in order to effect the vaporisation of the oil. To increase the area of such surface, the inventor places rolled, pressed, or cast steel bars of square, rectangular, oval, triangular, or corrugated section, in tiers, within the carburettor, each tier being "placed angularly" to those above and below it.—E. R. B.

Artificial Fuel, Improvements in Apparatus for Use in Manufacture of. G. Hayercraft, Pontardulais, Glamorgan. Eng. Pat. 5860, March 20, 1895.

To ensure regularity in the mixing of fine coal and pitch which are to be made into briquettes, the small coal is fed from a hopper on to the higher end of an inclined tray, which is hinged to the upright that supports the hopper. The pitch is similarly fed from a hopper on to a shorter inclined tray overlying the coal tray for a portion of the length of this latter. The pitch tray is hinged to the upright supporting the pitch hopper. The free ends of the trays hang in a stirrup which is pendent from a revolving crank, so that the trays are jiggled in order to facilitate the flow of the materials from the hoppers, and to ensure the intermixture of the pitch and coal when the former flows on to the latter in the lower tray. The mixture is finally discharged into the pug-mill.—A. G. B.

Gas for Lighting Purposes, Improvements in the Method of and Means for the Economical Use of. T. Rowan, London. Eng. Pat. 6027, March 22, 1895.

THE apparatus proposed is essentially a regenerative Argand burner, having a ring, the gas orifices of which are spaced at about 0.5 diameter apart, centre to centre (this would give about one-third the number of orifices present, in an ordinary Argand burner of like diameter). There are two chimneys, and the air, which is to support the combustion of the flame, passes down, between the outer and inner chimneys, becoming warmed. The cylindrical space between the chimneys, is closed at the bottom, and the warmed air finds exit by apertures, in the gallery supporting the inner chimney, and is, by them, conducted into a conical chamber, which surrounds the burner ring. This chamber is open at the top, and warmed air is therefore supplied, to either side of the ring of minute flames which arise from the burner.

It is claimed that the heated air has an attenuating effect on the flames, causing them to spread out and become more filmy, occupying, thus, the blank spaces intervening between the flames; and that the careful regulation of the heated air supply results in great economy as to illuminating effect produced. Thus, it is stated that, with an ordinary Argand burner, protected by a single chimney, and having a ring, 1 inch in diameter, provided with 36 gas orifices, and a single chimney burning 5 cb. ft. per hour, of 16 candle-power gas, a light of about 12 caudles is obtained, while, under like conditions, the patentee's burner gives a lighting effect of 35 caudles.

Several modifications of the structure of the burners are mentioned and also methods of telescoping the chimneys, with the object of controlling the draught more efficiently. There are also provided means whereby the gas is not allowed to become too hot before it reaches the place where combustion takes place.—E. R. B.

Carburetting Air and Gases, Improvements in. L. M. Bullier, Paris. Eng. Pat. 1953, Jan. 28, 1895.

THE single claim of this inventor is as follows:—"The admixture of acetylene with gases generally, for imparting or increasing illuminating power, substantially as specified." Apparently the rendering luminous of non-illuminant gas—such as air—is a feature to be specially noted; the inventor remarking in this connection: "I would observe that, although I have mentioned the application of acetylene to water-gas by way of example, it should be understood that the invention is applicable for carburetting air and non-

illuminating gases of every description, as well as for increasing the illuminating power of ordinary lighting gas."

—E. R. B.

Carbides or Acetylides of the Earth Metals and Alkali-Earth Metals, and Oxides or Salts of those Metals, Process for the Manufacture of. L. M. Bullier, Paris. Eng. Pat. 2820, Feb. 8, 1895.

By heating 56 parts of quicklime mixed with 36 parts of sugar-charcoal, wood-charcoal, lamp-black, or other variety of carbon, in an electric furnace, such as that of Moissan, a fluid product is obtained, which forms, upon cooling, a dark-coloured crystalline mass, corresponding to the formula C_2Ca . Similarly may be obtained the carbides of Ba and of Sr, as also those of Ce, Th, La, and other rare earth-metals.

Upon submitting the carbides, so obtained, to the action of water, acetylene is evolved, and the hydrated oxides of the various metals remain as by-products, 1 kilo. of C_2Ca yielding 300–350 litres of C_2H_2 .

Carbonates "or any other salt of the metal" may be substituted for the oxide: and, by treating the residual hydroxides with suitable acids, the inventor claims that the by-products of the manufacture may be recovered, in the form of useful substances.—E. R. B.

Acetylene and other Gases rich in Carbon, Improved Method of rendering suitable, for Lighting and Heating Purposes. L. M. Bullier, Paris. Eng. Pat. 6101, March 23, 1895.

THIS patentee now states (but see preceding abstracts) that, though acetylene may, theoretically, be diluted with air to give an illuminant, yet that, in practice, such mixtures are dangerously explosive, and, even when burnt under pressure, liable to fire back and to cause serious accidents. He therefore proposes to dilute acetylene with inert gas, and especially recommends, for the purpose, nitrogen, which latter may be prepared by any suitable process. A mixture of equal parts of acetylene and nitrogen "gives good results for lighting purposes."

The patentee remarks that, "the illuminating power of the acetylene is in fact much greater when that gas is diluted with an incombustible gas than when it is diluted with combustible gases, the lighting power of acetylene when mixed with a combustible gas being, theoretically, inversely proportional to the quantity of heat given off by the combustion of the combustible gas."

According to the patentee, the object of the dilution of the acetylene is to increase the surface of contact, between the oxygen of the air and the acetylene gas about to be burnt.

—E. R. B.

Filtering Water from Washed Coal or like Mineral, Means for, and for Recovering Coal or like Mineral from such Water, Improvements in. C. Craig, W. Craig, and G. K. Craig, Sacriston, Durham. Eng. Pat. 6365, March 28, 1895.

BETWEEN the washing machine and the waggens into which the coal is to be loaded is interposed a filtering or draining apparatus, which consists of a receptacle into which the washed coal and the washing water are discharged. The bottom of the receptacle has a central door, and is covered with coke-breeze to the depth of about one foot to serve as a filtering material. An axial screw shaft, with attached guides, carries radial arms which serve as harrows, and are designed to bring the coal to the basal opening when the shaft is revolved; the coal can be thus directly loaded into waggons, for the screw thread on the shaft causes the harrows to descend at each revolution. Better filtration than has been previously attained is claimed for this apparatus.—A. G. B.

Carbonic Acid Gas, The Separation of, from the Products of Combustion or other Mixed and Less Soluble Gases, An Improved Process and Apparatus for. H. S. Elworthy, Baudra, Bombay, India, and P. D. Henderson, London. Eng. Pat. 7284, April 9, 1895.

COMBUSTION gases are passed through an oxidising furnace, to convert carbon monoxide into dioxide, then through a scrubber to remove sulphur dioxide, and they are then taken

to a gas-holder or direct to a compressor, whence they are forced into a strong iron vessel charged with water, which absorbs the carbonic acid, and gives it off again on release of pressure, or on being run into a suitable separator. The combustion gases may be enriched by passing some carbonic acid gas through the furnace along with the air, which, by producing incomplete combustion, yields gases rich in carbon monoxide, giving after oxidation, gases containing from 30 to 35 per cent. of carbonic acid.

A strong horizontal cylinder is fitted internally so that the water forced in at one end under pressure (the gases being admitted at the opposite end) may in its course have an up-and-down movement. To aid the intimate contact of gases and the water, discs of wire gauze are secured between the partitions to a revolving shaft. The separator, to which the gas-charged water is taken, is a closed cylindrical vertical chamber, with safety-valve, &c. A transverse perforated plate is fixed near the top, and another similar plate near the bottom, the space between being filled with flint. The water rushes into the upper part through a jet, as spray, against the sides of the vessel and the perforated plate, and the gas, which is rapidly discharged, may be taken, through a drier if desired, to a gas-holder.—E. S.

Furnaces Suitable for Consuming House, Trade, and other Refuse, Improvements in. J. B. Allott and J. McCulure Paton, Nottingham. Eng. Pat. 8748, May 2, 1895.

See under XVIII. B., page 289.

Liquid Fuel, An Uninflammable Burner or Wick Cap for. C. Bourbott, Berlin, Germany. Eng. Pat. 479, Jan. 7, 1896.

THE wick cap consists in an annular metal piece surrounded by asbestos which is of the right width to exactly cover the space in which the annular wick of the lamp is held. The

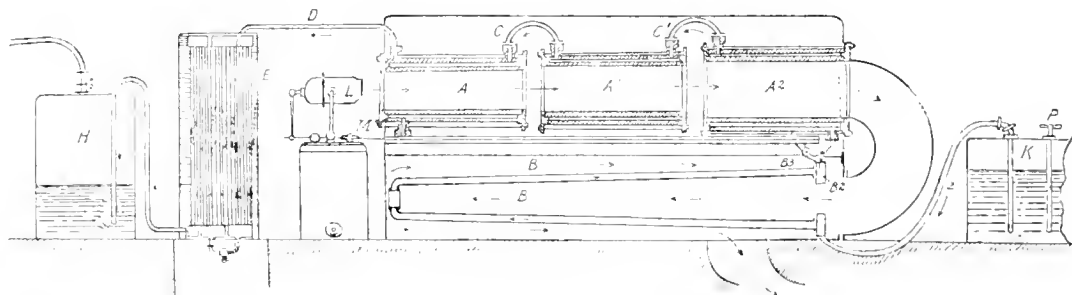
cap is best held in position by a spring attached to a bridge of the cap and a bridge in the burner tube. The oil sucked up by the wick saturates the asbestos and there burns, thus heating the embedded metal, which is in this way maintained at a temperature high enough to gasify the oil and to thus obviate smell. To extinguish the lamp, the wick is turned down until it is no longer in contact with the asbestos. A similar cap may be applied to a flat-flame burner.—A. G. B.

Treating Liquids by means of Heat [Oil-Gas, and Conversion of Heavy into Light Petroleum], Improvements in Apparatus for. S. Pitt, Sutton, Surrey. From La Société Internationale des Procédés Adolphe Seigle, Levallois Perret, France. Eng. Pat. 18,518, Oct. 3, 1895.

THE proposed apparatus affords means whereby any liquid may be submitted to a series of heatings, thus assisting the latter in giving rise to new liquid or gaseous products. It is useful therefore for the production of oil-gas, and by its means also, the heavy petroleum may be converted into light ones.

The apparatus consists essentially, as shown in the figure, of a series of shell-like elements, A, A¹, A², which together form the wall of a combustion flue. Through the flue, there extends the flame of a liquid fuel burner L, the fuel supply of which is regulated automatically, by the variations of a pyrometer, M. R, B, are two further flues, the one enclosed within the other, and it is by their means that the heated gases of combustion are conducted away, in the directions indicated by the arrows.

Liquid, to be subjected to treatment by heat, is pumped by the action of P, from the reservoir K, through 2, into the hollow wall of the inner flue of B, thence, by B², it passes to the hollow walls of the elements, A², A¹, and A



traversing them successively, by means of the connecting tubes C¹ and C. E is a surface cooler, and U, a washer containing water, and through them the gas manufactured successively passes, having left the heating part of the apparatus, *vide* D.

The shells or elements, A, A¹, A², are of somewhat complicated structure, the space between the inner and outer walls of each being divided, by longitudinal partitions, into as many chambers as there are partitions; the liquid to be heated has to traverse all of these chambers, so that its course is to and fro in the wall of each element, until it arrives in that one of the chambers which contains the exit tube leading to the next element.—E. R. B.

Fine Fuel, Burning, Improvements in and connected with Apparatus for. W. M. Russell, R. E. Lester, and W. M. Ernst, New York, U.S.A. Eng. Pat. 23,391, Dec. 10 1895.

THE specification includes 13 claims, which are for the mechanical details of an arrangement whereby pulverised fuel is reduced to a very fine state of division and fed together with air through a nozzle into the combustion chamber. The chief novelties in the arrangement are in the construction of the pulveriser and the nozzle. The former embraces a casing and a series of rotating bars within it, so arranged as to toss the fuel about and to gradually pass it from the intake to the outlet. The fuel

becomes very finely pulverised during this treatment, and the powder becomes mixed with air drawn into the casing by the motion of the bats. The nozzle is arranged to spread the outgoing fuel into a thin sheet, and is provided with means for increasing and diminishing its outlet, so that the rapidity with which the fuel is fed into the furnace may be varied.—A. G. B.

Pulverulent and Small Fuel Furnaces, Improvements in and relating to. M. Seipp, Berlin, Germany. Eng. Pat. 771, Jan. 11, 1896.

THE air for the combustion of the small coal is drawn by the chimney draught through a screw wheel, such as is frequently used for measuring air, and past a feed roller at the bottom of a hopper containing the fuel. This roller is revolved by suitable gearing from the air-supply wheel, and the small coal contained in the cavities on its surface is blown forward by the air, each cavity being emptied as it is exposed to the blast, and filled when it comes in contact with the fuel. The air and fuel pass through a pipe, a portion of which is set across the furnace in order that a preliminary heating and gasification of the fuel may be effected. The pipe opens into channels in the furnace walls, down which the air and fuel travel, entering the furnace at the bottom. By shaping the furnace like a funnel, the speed of travel of the air and fuel is progressively diminished, so that the heavier particles fall back into the

combustion zone, and do not escape unburnt. By this invention, it is claimed, the air can be supplied at a rate appropriate to the requirement of the fuel, and thus complete and smokeless combustion can be ensured.

—A. G. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Asphalt from Petroleum, Artificial Production of. C. F. Mabery and J. H. Byerley. Amer. Chem. J. 18, 141—150.

By a modification in the final process of distilling the heavier fractions (tar) of petroleum, F. H. Byerley has succeeded in obtaining as residue, various grades of asphalt instead of the coke usually produced. The process consists in introducing a current of air through a number of pipes into the liquid, the decomposing action of the air being minimised by lowering the rate of distillation, which is prolonged to about four or five days. The temperature is first raised to 450° F., and later to 650° F., at which point it is maintained throughout. The distillates are divided into two portions, both of which are refined for burning oils after removal, by steaming, of the sulphur they contain (0.04 to 0.15 per cent.).

The air appears to act mechanically, by preserving the tar from coking on the walls of the still; and chemically, by oxidising sulphur and hydrogen, rather than by forming oxygen compounds in the oil.

Four chief products are formed—liquid asphalt, roofing asphalt, paving asphalt, and "Byerlyte" or varnish asphalt. In percentage composition they differ but little from each other, the carbon content ranging from 86.22 in the first-named to 87.44 in the varnish asphalt. Sulphur is present to the extent of from 0.3 to 0.4 per cent.; hydrogen between 10.90 and 9.30 per cent.; and oxygen from 1.90 to 2.40 per cent.

The varnish asphalt resembles the natural bitumen "Gilsonite," and is suitable for the same industrial purposes. It softens at 230°, and begins to flow at 260° F. In carbon bisulphide it is completely soluble, but less so (62.45 per cent.) in petroleum spirit, 75—110°, and petroleum distillate (59.37 per cent.), 200—250°.

The nature of the decomposition of petroleum distillate, technically known as "cracking," has also received attention at the authors' hands. So far, they have ascertained that the action begins near 250°, but the point varies with oils from different sources, or even from different depths in the same well, considerable fluctuations in the absorption of bromine being exhibited by the various oils examined.

—C. S.

Acetone, Determination of, in Wood Spirit and Crude Acetone. M. Klar. Die Chem. Ind. 1896, 19, 73.

See under XXIII., page 299.

Asphaltum, Use of Acetone in the Technical Analysis of. S. F. Peckham. J. Franklin Inst. 141, [843], 219.

See under XXIII., page 298.

Petroleum Industry, Uniform Methods of Testing. Review of Methods based on the Degree of Refinement by means of Caustic Lyes. K. Charitshkoff. Chem. Rev. a. d. Fett u. Harz Ind. 1895, [33], 57.

See under XXIII., page 297.

Crude Cresol, Approximate Valuation of. A. Schneider. Pharm. Centralhalle, 36, 552.

See under XXIII., page 298.

IV.—COLOURING MATTERS AND DYES.

Litmus, Commercial, Note on. D. Riany Brown. Pharm. Journ. 1896, 56, 181.

THERE appears to be little published information concerning the preparation of litmus, but the process is probably somewhat as follows:—Lichens of various species, *Roccella*,

Varioluria, *Lecanora*, are made into a paste with water, and fermented in the presence of ammonia, as in the preparation of archil. When the mixture has a purple tint, stale urine and potassium carbonate are added and fermentation allowed to proceed until the blue colour produced is of the correct tint. It is stated that the best product is obtained in about 40 days. The blue liquor is mixed with chalk, gypsum, or sand, and sometimes alum, to give it consistency. It is then moulded into pieces of the desired dimensions, and more or less thoroughly dried.

The author considers that the addition of chalk, &c., as thickening agents is a doubtful proceeding, and is probably attended with loss of colouring matter from the formation of an insoluble lake; he suggests that it would be advisable to place litmus in the market in the form of a liquid extract, or to acidify the solution, precipitate the colouring matter with excess of alcohol, and offer the product in the dry state.

Indigo is sometimes added during the process of manufacture to improve the colour of the product; it should be regarded as an adulterant, though Wartha suggests that its presence might result from the fermentation of the lichens at the expense of the added urine.

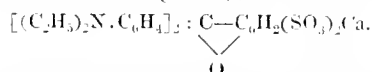
The author estimates the colouring matter—azolitmin—in commercial litmus by exhausting the finely powdered substance with boiling water, evaporating this to a small bulk, and after acidifying with acetic acid, the evaporation is continued nearly to dryness. The object of adding acetic acid is to form potassium and ammonium acetates, which are both soluble in alcohol. A large excess of 85 per cent. alcohol is added to the acidified solution, which precipitates the azolitmin; after standing for 12 hours, the precipitate is collected, and, when dry, is washed through with the smallest quantity of boiling water into alcohol. After standing over-night the precipitate is filtered off, dried, and weighed. In order to check the results the powdered sample was heated on a water-bath with excess of acetic acid, and extracted with warm alcohol; the residue, insoluble in alcohol, was extracted with boiling water, and, after evaporating to a small bulk was precipitated with an excess of alcohol. The precipitate was collected, again exhausted with warm alcohol, dried, and weighed. The products were free from inorganic matter.

Sample.	Per Cent. Moisture.	Per Cent. Insoluble in Boiling Water.	Per Cent. Azolitmin.	
			First Assay.	Second Assay.
1	2.8	84.3	5.21	5.00
2	4.0	73.6	5.81	5.83
3	2.0	83.3	4.92	5.02
4	1.2	89.8	3.40	3.30
5	6.4	60.0	13.55	13.10
6	1.6	87.9	4.79	4.75
7	2.0	86.4	4.31	4.46
8	1.8	83.6	3.82	3.70
9	10.1	46.0	14.22	13.98

—J. L. B.

Sulphonated Colouring Matters derived from Triphenylmethane [Patent Blue]. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1895, 231—236.

PATENT blue forms an exception to the rule previously advanced by the author (Bull. Soc. Ind. Mulhouse, 1895, 93; this Journal, 1895, 28 and 741), that colourless sulphonated di- and triamidotriphenyl carbinols only become colouring matters when the carbinol hydroxyl is replaced by an acid radicle. The author describes certain reactions of Patent blue, and gives the following formula for the colourless product obtained from the dyestuff by the prolonged action of cold caustic soda (15° B.):—



When this product is acidified with acetic acid and oxidised with lead peroxide it gives tetra-ethylbenzidine, melting at 85° C., together with a green base which dyes silk an unstable grass-green. Similar reactions are given

by the unsulphonated Patent blue base, which in alcoholic solution will dye silk, wool, or tanned cotton. Patent blue does not conform to Rosenstiehl's rule (Bull. Soc. Ind. Mulhouse, 1894, 194; this Journal, 1895, 25) with respect to the position and character of the substituting groups, and whilst the colouring power is due to the presence of the phenolic hydroxyl, it appears that this need not necessarily be attached to the methane carbon, nor even occupy, in one of the benzene rings, a para-position.—T. A. L.

Patent Blue, Constitution of. A. Rosenstiehl. Bull. Soc. Ind. Mulhouse, 1895, 239—242.

The author, replying to Prud'homme (preceding abstract), considers that the hydroxyl group in the meta-position in Patent blue cannot be the cause of the colour, in spite of its acid properties, since it may be replaced by the methoxyl group or by chlorine, without materially altering the characteristic properties of the colour. He is of opinion that the group $C_6H_2[(SO_3)_2Ca]OH$ functions as a negative radicle in opposition to the carbinol hydroxyl, and condenses with it, with elimination of water under the action of acids. This constitution is in accordance with the behaviour of Patent blue and would account for its stability to alkalis, but it must be remembered that the formulæ brought forward are speculative, and have not been experimentally verified.—T. A. L.

Nitrotetramethyldiamidotriphenylmethanes, Reduction of. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1895, 237—239.

The principal subject-matter of this communication has already been abstracted (Comptes rend. 121, 1895, 891—893; this Journal, 1896, 108). The author now states further, that only the *p*-nitro-derivatives, as might have been expected, give the hydroxylamine reduction, and that this method serves as a test for the position of a nitro-group in di- or triphenylmethanes.—T. A. L.

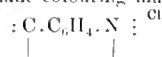
Colouring Matters of the Rosaniline Series. Ch. Friedel and de Bechi. Sealed communication deposited July 25, 1884; opened Sept. 25, 1895. Bull. Soc. Ind. Mulhouse, 1895, 269—270.

By heating carbon tetrachloride with dimethylaniline and gradually adding aluminium chloride, a bronzy mass is obtained, which dissolves in water with a violet colour. The product is the hydrochloride of hexamethyl-*p*-rosaniline, which was also obtained by Fischer (Ber. 1884, 98) by condensing dimethylaniline with *o*-formic ether $CH(OC_2H_5)_2$. Diethyl- and dibenzylaniline can be condensed with carbon tetrachloride in a similar manner, and the former especially gives a very valuable violet. Hexamethyl-*p*-rosaniline is blue, and insoluble in water. If the carbon tetrachloride be replaced by chloroform, leuco bases of the colouring matters are obtained, which, on oxidation with lead peroxide, give the colouring matters themselves.

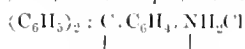
—T. A. L.

Triphenylmethane Colouring Matters, Relation between the Colour and Constitution of the. W. Vauel. J. Prakt. Chem. 53, 1896, 47—48.

In the triphenylmethane colouring matters, the group—



is the chromogen, and, for example, the compound—



is an orange colouring matter which, by the introduction of further amido groups into the para position of the other phenyl groups, yields a more or less coloured body, dependent also upon whether these amido groups are acetylated or alkylated. These substituting groups, however, exercise a similar retarding effect when the product is brominated, although the results are not entirely comparable. When a second amido group is introduced into the molecule, an attraction takes place between it and the acid radicle of the chromogen group.

An alkylated amido group is less strongly attracted, whilst an acetylated group is scarcely attracted at all. When, however, the second or third amido group is attached to an acid radicle, there is no longer any attraction, and, as in the case of the acetylated group, no effect is produced upon the colour—as, for example, in the case of magenta, benzaldehyde green, &c., in the form of their secondary and tertiary salts. The ammonium halogen group acts in a similar manner. In these cases also the behaviour on bromination is not a strictly comparable one, since the secondary and tertiary salts can be substituted by bromine. The same is also true of an amido group in the meta position, which has little effect on the character of the colouring matter, but nevertheless the product can still be substituted by bromine.

—T. A. L.

Nitrobenzene, Electrolytic Reduction of. K. Elbs. Zeits. f. Elektrochem. 1896, 2, 472.

See under XI. A., page 276.

Aniline in Presence of Small Quantities of Toluidine, and Toluidine in Presence of Small Quantities of Aniline, Estimation of. P. Dobrimer and W. Schranz. Zeits. Anal. Chem. 34, 734.

See under XXIII., page 298.

Moisture in Aniline, Ortho- and Paratoluidine, Estimation of. P. Dobrimer and W. Schranz. Zeits. Anal. Chem. 34, 740.

See under XXIII., page 298.

Hydroquinone, Electrolysis of. L. Liebmann. Zeits. Elektrochem. 1896, 497.

See under XI. A., page 277.

Autoclave of A. Pfungst, Report on the, by Noetting and Freyss. H. Groscheintz. Bull. Soc. Ind. Mulhouse, 1895, 261.

See under I., page 260.

PATENTS.

Dyestuffs [Azine Reds], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5796, March 19, 1895.

The colouring matters are obtained by condensing amido-azo-*p*-toluene with phenyl- or tolyl-(1.4)-naphthylamine sulphonic acid in presence of a solvent, such as phenol, alcohol, glacial acetic acid, glycerol, or *p*-toluidine, converting the monosulphonic acids into easily soluble disulphonic acids by suitable sulphonating agents, and finally, alkylating the disulphonic acids by heating the alkaline solution with methyl iodide to 120°—150° C. The following typical example gives the quantities employed:—A mixture of 31.3 kilos. of *p*-tolyl-(1.4)-naphthylamine sulphonic acid and 50—60 kilos. of phenol heated on the water-bath, has gradually added to it 33 kilos. of amido-azo-*p*-toluene, and the whole is heated until a sample dissolves in concentrated sulphuric acid to a pure green solution. Dilute soda lye is then added to remove the phenol, the sodium salt of the monosulphonic acid being simultaneously precipitated. After filtering from the phenol solution, the residue is dissolved in a large quantity of water, the solution filtered, and the *p*-tolyleurhodine sulphonic acid is precipitated with hydrochloric acid. It is purified by boiling with alcohol, in which the pure acid is nearly insoluble, and, after drying, 1 kilo. is stirred into 6 kilos. of sulphuric acid (66° B.) and heated on the water-bath until a sample dissolved in dilute ammonia, is no longer precipitated by acetic acid. The melt is then poured into ice-water, when the disulphonic acid separates. It is purified by dissolving in soda-lye and pouring into brine and caustic soda. The sodium salt produced, separates as a light yellow crystalline mass, which is filter-pressed and dried. In order to alkylate it, 55.5 kilos. of the sodium salt, 14 kilos. of sodium acetate, 150 litres of water, 150 kilos. of methyl alcohol, and 18 kilos. of methyl iodide are heated in an autoclave for three hours to 120°—

130° C. When the action is complete, the alcohol is distilled off and an excess of soda-lye added, when the sodium salt of *p*-tolylmethyleurhodine disulphonic acid separates out. It is purified by repeatedly dissolving it and salting out with salt and soda-lye. The colouring matter produces bluish-red shades on wool, which dye evenly and are fast to light. The corresponding colouring matter from phenyl-(1,4)-naphthylamine sulphonic acid and amido-azo-*p*-toluene gives somewhat yellower shades.—T. A. L.

Colouring Matters [Azine Reds], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5861, March 20, 1895.

THE process relates to the production of dyestuffs by oxidising a non-alkylated *o*-diamine together with α -naphthylamine or an alkyl derivative thereof, and subsequently sulphonating the product if necessary. A solution of 17.9 kilos. of α -naphthylamine hydrochloride, 15 kilos. of ethyl-*o*-tolylenediamine and 50 kilos. of hydrochloric acid in about 1,500 litres of water, is gradually stirred into 26.3 kilos. of sodium bichromate dissolved in 100 litres of water. The separation of the dyestuff is completed by adding zinc chloride and salt. In order to purify the product, it is repeatedly extracted with boiling water, the united filtrates being made slightly alkaline with ammonia to precipitate an impurity, and, after acidulation with hydrochloric acid, the pure dyestuff is precipitated by zinc chloride and salt. It forms a brick-red-coloured powder, and produces scarlet-red shades on tanned cotton. A dyestuff giving rather yellower shades is obtained by oxidising ethyl-*o*-tolylene diamine and benzyl- α -naphthylamine.—T. A. L.

Dyestuffs [Azine], The Manufacture or Production of, and Materials therefor. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 6176, March 25, 1895.

IN Eng. Pat. 9610 of 1894 (this Journal, 1895, 478) it was shown that by heating salts of *m*-tolylenediamine with primary aromatic amines only the amido group para to the methyl is substituted, the other remaining intact. The resulting compounds are termed alaryl-*m*-tolylenediamines, the term "alaryl" being applied to phenyl, tolyl, and the like, whilst "alkyl" denotes a radicle, such as methyl, ethyl, or benzyl, &c. New alarylamidobenzyl-*o*-toluidines have been obtained by the action of benzyl chloride or bromide on the alaryl-*m*-tolylenediamines, either alone or in solution, and these products yield valuable azine dyestuffs when condensed with nitroso or azo compounds, quinone imides, or the like, or else when oxidised together with *p*-diamines. Similar or analogous colouring matters are also produced by heating primary, secondary, or tertiary aromatic amines of the benzene or naphthalene series with azo compounds obtained by combining diazo compounds with alarylbenzyl-*m*-tolylenediamines, or else by oxidising primary, secondary, or tertiary amines of the benzene or naphthalene series together with the alarylbenzyltriamidotoluenes obtained by reducing the azo compounds above referred to. All these colouring matters may be regarded as benzyl derivatives of the corresponding colouring matters obtained from alaryl-*m*-tolylenediamines. Like these dyestuffs, they are fast to light and alkalis, but are superior to them in brilliancy. The following are two typical examples:—A colouring matter dyeing tanned cotton similar to Rhodamine S is obtained by dissolving 29 kilos. of phenyl-*p*-amidobenzyl-*o*-toluidine in 100 litres of alcohol, gradually adding 29 kilos. of nitrosomethyl-*o*-toluidine hydrochloride and heating until the latter has disappeared. On cooling, the dyestuff crystallises out, and is purified by washing with alcohol. A dyestuff giving bluish-red shades on mordanted cotton is formed by heating together 7.2 kilos. of *p*-sulphobenzene-azophenylbenzyl-*m*-tolylenediamine, 1.4 kilos. of α -naphthylamine, and 20 kilos. of phenol at 90°–110° C., until the melt is a pure red. Warm dilute soda-lye is then added in excess, and, after cooling, the dyestuff is pressed off. The press cakes are dissolved in hot water containing hydrochloric acid, and, after filtering, hydrochloric acid is added to the solution.

On cooling, the colouring matter which crystallises out is filter-pressed and dried.—T. A. L.

Substituted Fluoresceins, Manufacture of Dyestuffs from. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brünig," Hoechst a M., Germany. Eng. Pat. 7170, April 8, 1895.

WHEN tetrabromfluorescein is strongly heated with concentrated sulphuric acid, it yields, as already pointed out by Bayer (Annalen, 183), a bromocerulein. The yield, however, is small, but may be increased, as the patentees have discovered, by the use of fuming sulphuric acid according to the following method:—A mixture of 1 kilo. of eosine and 5 kilos. of fuming sulphuric acid containing 20 per cent. of anhydride is heated for three-quarters of an hour to 125–130° C., after which, sufficient water or ice having been added to convert the anhydride into sulphuric acid, the melt is again heated to 150° C. for 2–3 hours. After this time it is poured into water and either used as a paste or converted into the sodium salt, when it can be salted out, filter-pressed, and dried. The colouring matter dyes chromed wool a bluish-green, and it also dissolves in an alkaline alcoholic solution with this colour, which is fast to light.—T. A. L.

Azo Colouring Matters, Manufacture of, Dyeing Unmordanted Cotton in Acid, Neutral, or Alkaline Bath. J. Imray, London. From "La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis" and D. A. Rosenstiel, Paris, France. Eng. Pat. 7237, April 9, 1895.

THE colouring matters are obtained from azoxyamines by conversion into tetrazo compounds and subsequent combination with naphthalene derivatives, such as amidonaphthol sulphonic acid G, acid H, dihydroxynaphthalene sulphonic acid S or chromotrope acid. A modification of the method consists in diazotising the corresponding oitramine, combining it with a naphthalene derivative, and reducing the product, which dyes wool but not cotton, with an alkaline reducing agent, such as glucose, arsenious acid, or sodium sulphide. The dyestuff obtained is identical with that obtained according to the first-described method. A solution of 11.4 kilos. of *p*-azoxyaniline, melting at 187°–189° C. in 100 litres of boiling water and 25 kilos. of hydrochloric acid (20° B.), is diluted to 600 litres with water and ice, and diazotised with 7 kilos. of sodium nitrite in 21 litres of water. The tetrazo solution produced is then run into 150 litres of water, containing 23.9 kilos. of amidonaphthol sulphonic acid G and 21 kilos. of sodium carbonate, and cooled with ice. A black colouring matter can be separated by adding 15 kilos. of salt. The same product is also obtained as follows:—The diazo solution from 13.8 kilos. of *p*-nitraniline is combined with 23.9 kilos. of amidonaphthol sulphonic acid G, dissolved in 150 litres of water with 21 kilos. of sodium carbonate. The resulting colouring matter dyes wool brown, but will not dye cotton. In order to convert it into a cotton-colouring matter, the solution, after the combination is complete as above, has added to it 100 litres of caustic soda-lye of 40° B. and 13 kilos. of glucose dissolved in 100 litres of water, the whole being then heated to 40° C. for four hours with constant agitation. When the reduction is complete the colouring matter is salted out. The products obtained from the *p*-azoxyamines give violet, blue, and black shades, whilst the *m*-azoxyamines give browns; thus *m*-azoxy-*o*-toluidine, after combination with amidonaphthol sulphonic acid G, gives a brownish-red colouring matter, dyeing unmordanted cotton from an acid, neutral, or alkaline bath.

—T. A. L.

New Substantive Dyestuffs, Manufacture of [Cotton Blues]. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brünig," Hoechst a M., Germany. Eng. Pat. 7549, April 13, 1895.

THIS is an extension of Eng. Pat. 14,134 of 1894 (this Journal, 1895, 650), and has reference to the production of dyestuffs from the 1,4,3'- and 1,4,2'-naphthol disulphonic acids. The improvement consists in combining equimolecular proportions of one of these acids and tetrazotised

benzidine, tolidine, dianisidine, diphenetidine, &c., and coupling the intermediate compound so formed with one molecular proportion of a phenol, an amine, or their sulphonic acids. The diazo solution from 12.2 kilos. of dianisidine is run into a solution of 18 kilos. of 1.1.2'-naphthol sodium disulphonate. After 12 hours, 12.5 kilos. of sodium amidonaphthol sulphonic acid G are added, the mixture is stirred for some hours, then heated and the dyestuff salted out. It dyes un mordanted cotton a blackish-blue, and can be diazotised on the fibre and developed with *m*-phenylene- or *m*-tolylenediamine. By substituting acid H for the acid G, a pure greenish-blue dyestuff is obtained.—T. A. L.

Colouring Matters. The Manufacture of [Safranines]. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 7665, April 16, 1895.

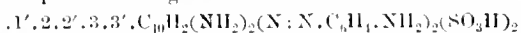
It has been already shown that the oxidation of an alkylated *o*-toluidine together with a primary aromatic amine and a *p*-diamine containing at least one unsubstituted amido group, gives rise to new safranin colouring matters. According to the present invention, the same dyestuffs are obtained by alkylating safranines derived from *o*-toluidine, the following being a typical example:—A mixture of 36 kilos. of tolusafranine (by oxidising one molecular proportion of *p*-amido-*o*-toluidine and two molecular proportions of *o*-toluidine), 100 kilos. of alcohol, and 22 kilos. of ethyl bromide is heated for 10 hours to 180° C. The alcohol having been distilled off, the residue is dissolved in water and the alkylated tolusafranine salted out. It dyes tanned cotton similar shades to that given by the dyestuff obtained by oxidising equimolecular proportions of *p*-amido-ethyl-*o*-toluidine, ethyl-*o*-toluidine, and *o*-toluidine.—T. A. L.

Direct-dyeing Colouring Matters, Manufacture of [Blue-Blacks]. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 7969, April 22, 1895.

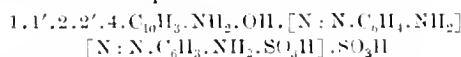
This is an extension of Eng. Pat. 4018 of 1895 (this Journal, 1896, 110), the patentees showing that the process referred to in the previous patent may be applied to a series of tetrazo compounds having the following general formula:—



in which X and Y signify amido or hydroxyl groups. The following example illustrates the method employed:—The tetrazo compound, prepared in the usual way from 11 kilos. of the product having the formula—



is slowly added to an alkaline solution of 6.1 kilos. of *m*-tolylenediamine. The colouring matter, which separates as a dark precipitate, is filtered off and dried. It dissolves to a dark violet solution in water, and dyes un mordanted cotton from a salt or soap bath a deep black. A similar dyestuff can be obtained by combining the tetrazo compound from 14 kilos. of the product—



and 3.5 kilos. of sodium nitrite, with the same quantity of tolylenediamine.—T. A. L.

Dis- and Polyazo Dyestuffs [Cotton Blacks] from γ -Amidonaphthol sulphonic Acid, Producing. S. Pitt, Sutton. From L. Cassella and Co., Frankfurt a. M., Germany. Eng. Pat. 8572, April 30, 1895.

This invention relates to new combinations of colouring matters from γ -amidonaphthol sulphonic acid, several of which have already been described in Eng. Pat. 16,699 of 1889, 19,330 of 1890, 9529 of 1894, and 25,018 of 1894 (this Journal, 1890, 935; 1891, 917; 1895, 478 and 1041). In addition to the components mentioned in the two last specifications it has been found that the following give valuable products: the dihydroxynaphthalene sulphonic acids and those mono-azo dyestuffs from the peri-amidonaphthol sulphonic acids which are formed in acid solution and still react with diazo compounds in alkaline solution.

The tetrazo compound from 21.2 kilos. of tolidine is combined in an alkaline solution with 24 kilos. of γ -amidonaphthol sulphonic acid, and the intermediate compound, after rediazotisation, is added to a solution of 32 kilos. of 1.1'.3.3'-dihydroxynaphthalene disulphonic acid kept alkaline. The formation of the second intermediate compound is complete in a short time, when 10.8 kilos. of *m*-phenylenediamine are added and the mixture is heated to 40° C. The dyestuff is finally salted out and dyes un mordanted cotton black. The following method is another modification of the process:—27 kilos. of *p*-amido-benzene-azo-amidocresol ether are diazotised by means of 60 kilos. of hydrochloric acid and 14 kilos. of sodium nitrite. When the solution is no longer turned bluish-black but greyish-brown by soda, the formation of the tetrazo compound is complete, and it is then rapidly mixed at 0° C. with 24 kilos. of γ -amidonaphthol sulphonic acid and 60 kilos. of sodium carbonate, 11 kilos. of *m*-phenylenediamine being added immediately afterwards. After about 12 hours, the mixture is heated to 60°–70° C. and the dyestuff is salted out. It gives bluish-black shades on un mordanted cotton.—T. A. L.

New Sulphonic Acids derived from Naphtholine and of Colouring Matters [Red, Violet, and Blue] therefrom, Improvements in the Production of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 8645, May 1, 1895.

THE 2.3.3'-amidonaphthol sulphonic acid of Eng. Pat. 15,176 of 1889 (this Journal, 1890, 855) can be converted into the following new acids:—2.3.3'.1'-amidonaphthol disulphonic acid, 2.3.3'.1'-naphthylenediamine disulphonic acid, 2.3.1'.3'-diamidonaphthol sulphonic acid, and 2.3-azimido-1'.3'-naphthol sulphonic acid. (1.) A solution of 10 kilos. of 2.3.3'-amidonaphthol sulphonic acid in 30 kilos. of fuming sulphuric acid (25 per cent. SO₃) is heated on the water-bath until a sample no longer gives a yellow precipitate on the addition of sodium nitrite. The melt is then poured into water and the lime or sodium salt prepared in the usual manner. The acid yields an easily soluble diazo compound, which gives a red solution with an excess of soda. When combined with tetrazodiphenyl it forms a violet-red and with diazobenzene a brownish-red dyestuff. (2.) On heating 100 kilos. of the 2.3.3'-amidonaphthol sulphonic acid and 200 kilos. of 30 per cent. ammonia liquor to 185°–190° C. for eight hours, 2.3.3'.1'-naphthylenediamine disulphonic acid is formed, which can be separated by boiling off the excess of ammonia and acidulating the melt with hydrochloric acid. This acid only combines with one molecular proportion of sodium nitrite, being converted into an azimide, but the new product will combine with diazo compounds to form azo colouring matters. (3.) The action of caustic soda on 2.3.3'.1'-naphthylenediamine disulphonic acid at 190°–200° C. causes the substitution of the hydroxyl group for a sulphonic acid group, the resulting compound being 2.3.1'.3'-diamidonaphthol sulphonic acid. (4.) When the foregoing acid is treated with sodium nitrite in an acid solution, an azimido compound is obtained. All these new acids are capable of combining with diazo and tetrazo compounds, the former yielding wool and the latter un mordanted cotton dyestuffs, all of which give deep shades and are fast to washing and light. The shades vary, according to the components employed, from yellowish-red to dark violet-blue.—T. A. L.

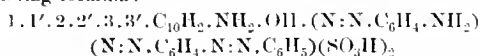
Polyazo Colouring Matters [Cotton Blacks], Manufacture of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 9431, May 13, 1895.

THESE colouring matters are derivatives of diazo compounds having the following typical constitution:—



in which X and Y represent amido or hydroxyl groups, whilst R is the radicle of an aromatic diazo compound not containing a diazotisable amido group. These compounds may be obtained by reacting on an amidonaphthol, dihydroxynaphthalene, or naphthylenediamine sulphonic acid

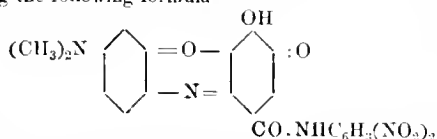
with one molecular proportion of an aromatic diazo compound and one molecular proportion of *p*-nitrodiarobenzene and subsequent reduction by means of alkaline sulphides. For instance, 32 kilos. of the combination product from acid H, amidoarobenzene and *p*-nitraniline having the following formula:—



is diazotised with 3.5 kilos. of sodium nitrite and the dark blue solution of the diazo compound is run into a solution of 5.5 kilos. of *m*-tolylenediamine kept alkaline by sodium carbonate. After agitation for some time, the whole is heated on the water-bath and the colouring matter filtered, pressed and dried. It is easily soluble in water, and dyes unmordanted cotton black. By substituting the equivalent quantity of β -naphthol for the tolylenediamine, a colouring matter dyeing blue-black shades is produced.—T. A. L.

Nitrated Orazine Colouring Matters [Bright Greens and Greenish-Blues] Dyeing with Mordants, Manufacture of. C. D. Abel, London. From L. Durand Huguenin and Co., Basle, Switzerland. Eng. Pat. 24,842, Dec. 27, 1895.

THE blue colouring matter of Eng. Pat. 583 of 1891 (this Journal, 1891, 359), obtained by the action of aniline on the condensation product of nitrosodimethylaniline hydrochloride and tannin-anilide, and subsequent sulphonation, can, according to the present specification, be re-nitrated, yielding green mordant colouring matters. The following method is employed for the nitration:—20 kilos. of the condensation product, after having been converted into the anilide, are gradually stirred into 100 kilos. of a 92 per cent. sulphuric acid. The melt is then raised to 80°—85° C., until a sample dissolves in dilute alkali. After cooling to 0° C., 2·4 kilos. of nitric acid (86·6 per cent.) and 6 kilos. of sulphuric acid (96 per cent.) are added below 10° C., and in about 10—12 hours the melt is poured into water, which precipitates the new nitro acid. This, after conversion into the ammonium salt, is soluble in water with a bluish-green colour, whilst the solution in concentrated sulphuric acid is crimson-red. Other nitrated oxazines are obtained by the action of 1.2.4-chlorodinitrobenzene or picryl chloride on the condensation product of nitrosodialkylated aniline hydrochloride or dialkylated amido-azobenzene hydrochloride with gallamic acid. 21 kilos. of the condensation product in 1 litre of water, 2 litres of alcohol, and 5·3 kilos. of sodium carbonate are mixed with 10 kilos. of chlorodinitrobenzene. After heating on the water-bath for three hours the new product separates as a crystalline mass, having the following formula—



This product, unlike the oxazine of Eng. Pat. 11,848 of 1889 (this Journal, 1890, 610), cannot be sulphonated, but it can be converted into a bisulphite compound by heating 5 kilos. of it with 20 kilos. of alcohol and 20 kilos. of a 40 per cent. bisulphite solution on the water-bath for some time, when the bisulphite compound separates as a shining green mass, which dyes mordanted cotton violet to blue shades. The dinitro derivative can also be converted into an anilide by heating it with twice its weight of aniline on the water-bath for half an hour. This product can be sulphonated, and the resulting sulphonic acid, after conversion into the ammonium or sodium salt, dyes chromed wool bright green, whilst unmordanted wool is dyed a greenish-blue. Similar results are obtained with picryl chloride.

—T, A, L,

Colouring Matters, Dyeing Wool Green-Black to Blue-Black, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 698, Jan. 10, 1896.

THE unsymmetrical diazo colouring matters of Eng. Pat. 15,457 of 1895 (this Journal, 1895, 1042), which dye animal

fibre violet-black to blue-black, can, when heated together with certain condensing agents, be converted into colouring matters dyeing bluer or greener shades. The transformation is carried out in an aqueous solution in open or closed vessels, preferably by the action of zinc chloride on the colouring-matter acid, or if this be a salt, then the condensation may be effected by means of a mineral acid or an organic acid, such as oxalic, acetic, benzoic, phthalic acid, &c. It is of course unnecessary to isolate the colouring matter obtained according to the former patent, and the two processes may be combined. The following example illustrates the method employed:—5 kilos. of the colouring matter obtained by the successive combination of 1, 1', 3', 3'-naphthylenediamine disulphonic acid with diazobenzene and *p*-nitrodiazobenzene dissolved in 100 litres of water, is mixed with 5 kilos. of acetic acid, and the whole is heated on the water-bath for 8 hours, or until the desired shade has been obtained. After neutralisation with sodium carbonate, the new colouring matter is salted out, filtered-pressed, and dried. It dissolves in water with a bluish-green colour and dyes wool greenish-black from an acid bath.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Textile Fabric from Glass and Silk. V. Schlumberger.
Bull. Soc. Ind. Mulhouse, 1895, 267—268.

THE article contains a description of a material composed of alternate wefts of silk and glass on a silk warp. The glass is spun at the rate of 1,500 metres a minute from a rod heated in a blow-pipe to 1,200° C., and wound on to a fly-wheel rotating at 400 revolutions per minute. When this is full the fibre is wound directly on to the shuttle spindle, or else for certain purposes cut into equal lengths. The material is woven on a Jacquard hand loom, the warp being of silk or cotton and the weft alternately glass and silk. Very pleasing effects are produced, but as the price of the material is very high (100 francs per metre), its application is limited.

—T. A. L.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Blood Albumin, Decolorisation of. J. Persoz. Sealed communication deposited June 12, 1885; opened Sept. 25, 1895. Bull. Soc. Ind. Mulhouse, 1895, 271—272.

WHEN ox-blood serum is treated with one-fifth its volume of hydrogen peroxide (12 vols.) in a 'very faintly acid solution,' it is gradually decolorised, and after 24 hours' standing has an appearance similar to egg albumin. The liquid is odorless and will keep for some time in contact with the air without alteration. It coagulates to a perfectly white mass and at a lower temperature than serum diluted to the same volume with ordinary water, more especially when exposed to direct sunlight. The concentration of the liquid is of importance, and decolorisation takes place more rapidly in serum acidulated with acetic acid; moreover, the coagulating point can be considerably lowered. Presence of ammonia, on the other hand, retards the action; the liquor remains brownish and is malodorous. The hydrogen peroxide employed contained small quantities of hydrochloric and much sulphuric acid, so that it was necessary to nearly neutralise with ammonia and subsequently add ammonium acetate in order that the acidity should be due to acetic acid only. The author suggests that the excess of sulphuric acid should be removed by baryta in order not to introduce any large quantity of ammonium sulphate into the serum.—T. A. L.

Colours on Wool, Fastness to Light and to Street-Mud.
G. Dommergue. Rev. de Chim. Ind. 1896, **7**, 39—40.

Fastness to Light.—Determined by exposing the dyed patterns for periods of one, two, and three months respectively. The following observations are recorded:—

The blue least affected by light, is Prussian blue. Indigo-extract blue fades regularly, and is completely destroyed after three months' exposure. Composite blues (mixtures of Methyl and Acid greens and violets, employed in France under the name of *Indigo substitutes*) fade into dull greys.

The Alkali and Nicholson blues in full shades are fast, as are also blacks (presumably from logwood), on the chromium mordant.

The *green* from Indigo and Pierie acid is changed into a dull grey after three months' exposure.

Old Fastie *yellow* completely disappears in three months.

Acid Magenta, Orchil, and the Methyl violets are also destroyed.

The following colouring matters are moderately fast:—Quinoline yellow, Flavamine S (M.L.B.); Indian yellow (Monnet); Naphthol yellow (B.A.S.F.); Erythrin (B.A.S.F.) (these become slightly darker on exposure); Pierie acid (becomes darker and orange).

Naphthol yellow S (B.A.S.F.), Orange Q (Poirier), Crocein orange (Bayer), Amaranth and Bordeaux R and B (M.L.B.), the Xylidine ponceaux, Crocein scarlets, and Cochineal scarlet are fast.

Fastness to Street-Mud.—The mud of the streets has an alkaline reaction.

The following colouring matters are not affected by it:—

(*Reds*) Brasilen (Brazilwood), Amaranth, Bordeaux B and R, the Ponceaux, Roccellin, Erythrin (presumably the azo dyestuff of this name), and Crocein orange; (*blues*) Indigo, Alizarin blue, Induline, and Blue-black (the two last are not fast to rubbing); (*yellows*) Naphthol yellow S, Indian yellow, and the orange azo-colouring matters.—E. B.

Moleskin, Half-Moleskin, and Buckskin, Printed, Manufacture of. B Maslowski. *Färber Zeit.* 1896, 7, 97–98.

UNDER the above names a kind of dyed and printed material is manufactured for garments in Russia. The raw goods are passed under an emery wheel on both sides to remove irregularities, and shaved, either on one or both sides, according to the manner in which they are to be printed. They are next "boiled" in one of three ways:—(1.) The pieces are packed in a keir, and boiled with water for from 6 to 8 hours at 1 atm. pressure, after which they are sewa together, spread out, and washed first with warm water and then with cold. Finally they are pressed and dried. (2.) The pieces are drawn flat through warm water, pressed, and laid away in packs in vats, where they are covered with warm water and weighted with loaded boards; they remain in these vats for three days, during which time the water must be kept at 30–35° C., and must cover the goods. The thick moleskins are then washed with warm water in a jigger, and the lighter goods are passed through warm water several times and then through cold water. As before, pressing and drying are the final processes. (3.) The goods are sent through two or three tumblers containing warm water in which some soda (200 grms. per piece of 70 metres) is dissolved, and are there left rolled up for 24 hours. They are then handled in warm water containing soda, and are spread out and washed and dried.

After this boiling process the goods are ready for printing, a variety of recipes for which is given.—A. G. B.

Calf-Leather Dyeing. F. Kast. *Färber Zeit.* 1896, 7, 98–100.

CALF is among leathers what silk is among textile fibres, for it is readily dyed of all shades. There are, however, certain difficulties which many manufacturers never overcome, and important amongst these are those which arise from improper preparation of the leather. In small works the preliminary softening is effected by a short soaking in sufficient lukewarm water to cover the leather, followed by an hour's pounding with oak stamps; water at 40° C. is then run into the vat, and the goods are thoroughly handled for some time; the turbid water is drained off, and the stamping and handling repeated until the right degree of slipperiness has been attained. Tumblers replace the stamps in larger works. After the softening process the leathers are made up into pairs, one leather being stretched grain downwards on a glass or zinc table, and another stretched on the top of this one with the grain upwards; this affords an opportunity for striking out certain blemishes, and is also conducive to economy of dyestuff, since the flesh sides are not exposed in the dye-bath.

The water for the dye-bath should be acidified with acetic acid to avoid the hardening effect of calcareous matters on

the leather. For light shades, alum or bichromate of potash are the mordants; for medium tones, a purer acetate of iron is used; whilst pyrolignite of iron (about 15° B.), nitrate of iron (30° B.), or sulphate of iron (30° B.) serve for the darker shades. Alum is but little used. Bichromate of potash is applied to the extent of 10–20 grms. per pair of leathers, the whole being generally added at once; the leather is well handled in the bath for 10 minutes, and transferred to a fresh bath, to which a small portion of the dyestuff has been added; into a second fresh bath the remainder of the dyestuff is introduced, and the dyeing is completed therein. If a smaller proportion of bichromate is being used, the dyeing can be completed in the first bath. When iron mordants are used, acetic acid must be present in the mordant bath, and it is advantageous to use the feeblest iron salts for grounding. A dilute iron mordant (the purer acetate at 2° B. or pyrolignite at about 10° B.) saddens gradually, whilst a stronger liquor is very active and "goes quickly on," so that uneven dyeing easily results. Cold-washing after the iron mordant is to be avoided, since the leather is thereby hardened. The foregoing mordants are for basic dyestuffs, acid dyestuffs not being amenable to such treatment.

The following list of leather dyes is given:—

Basic.	Acid.
Auramine.	Quinoline yellow.
Phosphine N.	Naphthol yellow.
Phila-lephia yellow.	Carbureum.
Leather yellow.	India yellow.
Aniline yellow.	Azo acid yellow.
Phosphine P.H.	Orange II.
New phosphine.	Mandarin G extra.
Phosphine superfl.	Ponceau BO extra.
Thioflavine T.	Ponceau 3 R B.
Xanthine.	Scarlet for leather.
Camelle.	Ponceau B extra.
Leather red.	Pure blue.
Grenadine.	China blue.
Camelia B.	Bavarian blue.
Russia-leather red.	Fast blue for leather.
Bismarck brown.	Acid green.
Manchester brown P.S.	Guinea green.
Vesuvine.	Fast brown O.
Cachou brown D.	Fast brown 3 B.
Leather brown A and B.	Eosin.
Malachite green.	Erythrosin.
Diamond green.	Phloxin.
Methylene blue.	Rhodamine.
Methylene dark blue B.R.N.	Nigrosin.
Coal black.	
Leather black.	
Leather black 452.	

—A. G. B.

PATENTS.

"Kaki" Dye. An Improved. J. Puxbury, Manchester. From E. A. Mitchell, Madras, India. Eng. Pat. 7498, April 13, 1895.

THE following recipe is given for obtaining a kaki dye of an average shade for cotton or woollen goods. About 2 lb. of myrabolans or divi-divi, 2 oz. of sulphate of zinc or copper, 1, 2, or more oz. of tanning bark, catechu and redwood, and 10–30 or more grains of ferrous sulphate, according to the shade required, are mixed with 6 galls. of boiling water and soaked for two hours. Subsequently a solution of 6 oz. of potassium bichromate in 6 galls. of boiling water is added to render the dye fast. The shade depends upon the proportion of metallic sulphates present, and copper sulphate alone may be used for the lighter, whilst ferrous sulphate produces the darker shades.

—T. A. L.

Dyeing Apparatus, Improvements in. E. E. Middleton, F. P. Middleton, and A. T. Middleton, Adlington. Eng. Pat. 2860, Feb. 9, 1895.

IMPROVEMENTS in Obermeier's apparatus for dyeing eops under hydraulic pressure are here introduced. Instead of the cases being open at the ends and sides, they are formed closed, leaving only two sides open. Planed frames are fixed upon the edges of the open sides, and these fit into slides in the vat. By means of a thin strip of india-rubber

attached to the frame or the slide, a perfect joint is obtained, so that on pumping in the dye-liquor through the case containing the cops, none of this liquor can pass out of the vat, except through the cops.—J. J. K.

Washing and Dyeing Machinery for Piece Goods, Improvements in or in connection with. J. Hudson and H. P. Richardson, Leeds. Eng. Pat. 7058, April 6, 1895.

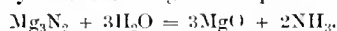
An invention for automatically stopping a machine in which the fabric passes between squeezing rollers in case the piece becomes doubled or folded between the rollers.

—R. B. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Metals; Nitrides of the, Direct Production of, from Atmospheric Nitrogen, and the Formation of Ammonia. A. Rossel and L. Frauck. Chem. Zeit. 1896, 20, 38.

RICKMAN, in 1878, produced small quantities of ammonia by the action of air on an incandescent mixture of carbon and potash (Ber. 1879, 12, 2389). Briegleb and Genther (Ann. Chem. Pharm. 123, 228) showed that pure nitrogen, acting on magnesium at a red heat, formed Mg_3N_2 ; Mallet (Jahresber. Chem. 1878, 241) proved that prolonged ignition of magnesium in air yielded a nitride as well as an oxide; and Winkler (Ber. 1890, 23, 121a) found that the admixture of an indifferent substance with magnesium, by hindering oxidation, favoured the formation of nitride. It is now observed that when finely-divided calcium carbide is heated with magnesium powder in an open crucible, at a low red heat, the calcium compound forms lime and carbon dioxide with the oxygen of the air, and nearly the whole of the magnesium is found, on cooling in air, to be converted into the nitride. The magnesium nitride is acted upon by water according to the equation—



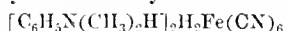
Aluminium, zinc, and iron also take up nitrogen from the air under similar conditions.—W. G. M.

Barium and Calcium Ferrocyanides, Use of Organic Bases in Preparation of. P. H. Walker. J. Amer. Chem. Soc. 1895, 17, 927–931.

The author prepares these salts through the medium of organic bases in the following manner:—

Strychnine is converted into the acetate and the calculated quantity of potassium ferrocyanide added to the solution. The mixture is kept in a warm place, stirred frequently, and the white crystalline strychnine ferrocyanide which separates, is filtered and washed, and decomposed with excess of ammonia, whereby ammonium ferrocyanide is formed and strychnine precipitated, which latter can be used over again. The solution of ammonium ferrocyanide is boiled with the calculated quantity of barium hydroxide until free of ammonia. The solution, on cooling, deposits crystalline barium ferrocyanide.

It was found that the most favourable results were obtained by the use of dimethylaniline. A solution of dimethylaniline hydrochloride was treated with potassium ferrocyanide, and the precipitate washed with the least possible amount of water, then with alcohol, finally with ether. Dimethylaniline ferrocyanide—



so prepared is a white crystalline substance somewhat soluble in water. This salt is then mixed with a solution of barium hydroxide and vigorously shaken. The barium ferrocyanide immediately crystallises out and can be filtered from the liquid, the dimethylaniline being recovered by shaking the filtrate with ether, which simultaneously brings about the separation of more ferrocyanide.

Calcium ferrocyanide may be prepared by shaking dimethylaniline ferrocyanide with milk of lime, allowing the mixture to stand for some time, and then shaking with ether. The ethereal solution of dimethylaniline is separated and the solution containing the ferrocyanide

evaporated to a small bulk in a flask, carbon dioxide passed through, again boiled, filtered, and evaporated to a small volume. Alcohol is then added, which causes the separation of pale yellow crystals of calcium ferrocyanide.

The author appends the following note:—

Since strychnine ferrocyanide is almost insoluble in water, and is easily filtered, it may possibly be used for the separation of iron and aluminium.

The solution containing ferric and aluminium salts is treated with excess of strychnine ferrocyanide. The Prussian blue thus formed can be filtered, and the aluminium present in the filtrate precipitated with ammonia.—J. L. B.

Sulphuric Acid Manufacture, Recent Improvements in. F. J. Falding. Eng. and Mining J. 1896, 61, 257.

The charge for burners, in a large number of acid systems, has without any structural changes whatever been raised from 750–800 lb. of 50 per cent. pyrites, to 1,150–1,200 lb., an increase of about 50 per cent.; or from 850 lb. of 40 per cent. ore to 1,300–1,400 lb., an increased capacity of about 60 per cent. of ore burned, or about 50 per cent. of actual sulphur burned. Similar results have been obtained with brimstone as the raw material. The only change mentioned is increased circulation of gases, &c., by the use of fans.

The chamber process has been improved, and in the United States the average throughout the year at a number of works is 12 cu. ft. of chamber space to each pound of sulphur burned. This is an average increase of working capacity of 50–80 per cent.

By combining improvements in the capacity of both burners and chambers, an increase of about 50 per cent. on the ordinary output is obtainable.

The author suggests that the proper use of fans would render possible the economical use of the various tower condensers which have been proposed. —A. S.

Vitriol, Determination of Arsenic in Concentrated. G. Hattensauer. Zeits. Ang. Chem. 1896, 139.

See under XXIII., page 295.

Persulphates, Analysis of. F. Ulzer. Mitt. tech. Gewerbe-Museums, 1895, 11–12, 310–311.

See under XXIII., page 295.

PATENTS.

Cyanides, Manufacture or Production of, Improvements in Means to be employed in the. J. W. Swan, Bromley, and J. A. Kendall, Streatham. Eng. Pat. 3509, Feb. 18, 1895.

To obtain potassium cyanide, a mixture of charcoal and tungsten, or charcoal that has been soaked in solution of potassium tungstate and then dried, is placed in a cylinder of nickel, cobalt, or fine iron, enclosed within an earthenware jacket, set on a slight incline in a furnace, and strongly heated. The cylinder has at the end opposite to the charging end, a continuation pipe of platinum, entering a case or receiver. Potassium carbonate is fused in a platinum vessel, and run into a funnel tube entering the front part of the cylinder in a controlled stream. Hydrogen gas is passed continuously into and through the space between the cylinder and its jacket, in order to protect the former from corrosion. Nitrogen or ammoniacal gas is passed through the inner vessel. The cyanide, as it forms, distils into the receiver; but the residue in the cylinder at the end of the operation may be lixiviated to recover any cyanide present. Tungsten may be replaced in the described mixture by titanium, molybdenum, chromium, manganese, uranium, or their compounds.—E. S.

Acetates, Improvements in Purifying. A. R. Scott and T. Henderson, Glasgow. Eng. Pat. 6711, April 2, 1895.

SOLUTION of impure sodium acetate (for instance) is boiled with addition of sodium hypochlorite until the colour is nearly discharged. After cooling and settling, the solution is decanted from the sediment, to obtain crystals of the acetate of great purity.—E. S.

Chlorine, Improvements in the Manufacture of, and in the Treatment of By-Products of the said Manufacture. J. Raschen and J. Brock, Liverpool. Eng. Pat. 7287, April 9, 1895.

THREE equivalents of sodium chloride are mixed with one equivalent of sodium nitrate, and an excess of sulphuric acid is added to the mixture, heat being applied to complete the reaction. The gases evolved, nitrosyl chloride, chlorine, and hydrochloric acid, are passed through strong sulphuric acid. Chlorine and hydrochloric acid escape, and are separated by passage through water, the chlorine being collected for utilisation in the manufacture of bleaching powder or otherwise. The nitroso sulphuric acid formed by the action of the sulphuric acid upon the nitrosyl chloride, is treated with sodium chloride, when nitro-yl chloride and hydrochloric acid are given off. Hydrogen preferably, or water-gas, is added to the gaseous mixture, which is then passed over platinised asbestos, heated in a tube or vessel through which an inert gas has been sent to displace oxygen. The ammonia, hydrochloric acid, and aqueous vapour produced, are conducted into a chamber maintained at about 100° C., wherein ammonium chloride condenses. The moist hydrochloric acid may be condensed in a coke tower, and may be mixed with nitric acid to produce nitrosyl chloride for re-use as described.—E. S.

Ammonia and its Salts, Manufacture of, from Nitrogen Oxichlorides or Nitrogen Oxides. Improvements in the. J. Raschen and J. Brock, Liverpool. Eng. Pat. 7288, April 9, 1895.

A MIXTURE of nitrosyl chloride and hydrogen, the latter in slight excess over the proportion required by the equation $\text{NOCl} + 6\text{H} = \text{NH}_4\text{Cl} + \text{H}_2\text{O}$, is passed over heated platinised asbestos, all atmospheric oxygen having been previously displaced from this platinised asbestos and from its containing tube or vessel, by an inert gas, such as nitrogen or carbonic acid. The mixture of ammonia, hydrochloric acid, and aqueous vapour produced is passed into a chamber kept at about 100° C., in which ammonium chloride is deposited. The hydrogen required is preferably obtained by passing steam over incandescent coke. Nitrosyl chloride may be replaced in the process by nitrogen oxides, free ammonia and aqueous vapour being produced. The ammonia may be condensed, or transformed into any required ammonium salt.—E. S.

Carbon Dioxide, Methods of Solidifying, and of Utilising the Solidified Substance, Improvements in. H. S. Elworthy, Bandra, Bombay, and P. D. Henderson, London. Eng. Pat. 7436, April 11, 1895.

CARBONIC acid gas is liquefied, and passed through a coil contained in a "regenerative-refrigerating" apparatus, the coil being placed within an upright closed cylinder within an external cylinder, the space between being exhausted of air, to form a vacuum, non-conductive of heat. From the coil the liquid passes to a combined motor-pump, which it drives, and thence is sent through a pipe, the open end of which enters the upper part of a solidifying chamber, shaped like a covered inverted funnel, jacketed, and with vacuum space between. Here the liquid jet sprays out and solidifies as snow, which falls into a box at the bottom in which the carbonic acid snow is compressed into a block by the ram of a hydraulic press. As gas accumulates in the solidifying chamber, it passes by a suitably arranged tube to the cylinder containing the refrigerating coil. Modified forms of apparatus are shown and described to which the same essential features pertain, especially the system of vacuum-jacketing. In one of these a jacketed close tank containing alcohol has, arranged in it, a series of boxes surrounded by a coil, into which coil liquid carbonic acid is run, and in which it volatilises, thus greatly cooling the alcohol bath, and also the boxes. Part of the expanded gas enters the boxes, forming snow, and part is passed through the cylinder of a motor, to be returned to the boxes, where it consolidates into "ice," and may be removed in that state.

The solidified carbonic acid may be compressed into blocks or slabs, for convenience of application in aerated waters, wines, and the like. It is stated that the solidified

gas may be stored or transported in felt bags or in ordinary ice-boxes. But preferably, a special ice-box is made with double or triple walls, of metal or glass, secured air-tight, and with the intervening space rendered vacuum, as by Prof. Dewar's method.—E. S.

Soda, Bicarbonate, Manufacture of, Improvements in. J. Brock and J. Hawliczek, Liverpool. Eng. Pat. 8314, April 26, 1895.

Coke or sodium bicarbonate or sesquicarbonate, such as the "roaster ash" of the ammonia-soda process, is treated with steam in a close vessel, the mass being well agitated; after sufficient hydration, carbonic acid gas is passed in, with continued agitation. The salt is thus completely converted into bicarbonate, and may be dried while yet hot with a stream of carbonic acid gas. As an alternative process, the roaster ash may be subjected to the joint action of steam and carbonic acid gas.—E. S.

Gas Liquor, or like Ammoniacal Liquor, Improvements in the Treatment of, and in Obtaining Useful Products therefrom. H. Bower, Philadelphia, U.S.A. Eng. Pat. 8330, April 26, 1895.

GAS LIQUOR is distilled, after addition of iron or an iron salt and of lime, to remove ammonia, the cyanogen present being left in the liquor as calcium ferrocyanide and sulphocyanide. So far the process is similar to that described in Eng. Pat. 2918 of 1882. An acid solution of a copper salt, preferably cuprous chloride, is added to obtain a mixed precipitate of copper ferrocyanide and sulphocyanide, which is separated. The moist precipitate is agitated with finely divided iron, to produce copper and iron ferrocyanide and soluble iron sulphocyanide. The iron ferrocyanide, on treatment with an alkali, yields a soluble ferrocyanide; while the solution of iron sulphocyanide may be concentrated and crystallised, or evaporated to dryness.—E. S.

Prussiates, Manufacture of, Improvements in [Use of Iron Sulphocyanide]. H. Bower, Philadelphia, U.S.A. Eng. Pat. 8381, April 27, 1895.

POTASSIUM (or sodium) carbonate, iron, and animal matter are mixed and heated, as in the ordinary process for obtaining a cyanide, but towards the end of the operation small portions of iron sulphocyanide (such as that obtained by the process described in the preceding abstract) are added at intervals. The yield of cyanide is thus increased.—E. S.

Cyanides and other Cyanogen Compounds, Manufacture of, Improvements in. W. P. Thompson, London. From J. Finlay and E. W. Derry, Johannesburg, South African Republic. Eng. Pat. 10,442, May 27, 1895.

A MIXTURE in about equal parts is made of "carbon, alkali, alkaline oxide or carbonate, or alkaline earths, preferably barium carbonate," which mixture is strongly heated in a current of air deprived of oxygen and sulphur dioxide. The formation of cyanates is stated to be thus prevented. On lixiviating the melt, a solution containing barium cyanide, sulphocyanide, and hydroxide is obtained. A slight excess of a chlorate or permanganate is added, and a current of deoxygenised air and carbonic acid gas is passed through the heated solution, when barium carbonate is precipitated and hydrocyanic acid and sulphur dioxide are evolved. The hydrocyanic acid is condensed and added to a strong solution of caustic soda kept at 40° F., from which crystals of sodium cyanide are obtained without the aid of alcohol. After the condensation of the hydrocyanic acid, the accompanying nitrogen and sulphur dioxide are conducted over a mixture of the precipitated barium carbonate with carbon, heated as before described.—E. S.

Metallic Cyanides, Manufacture or Production of, particularly Cyanide of Potassium and of Sodium, Improvements in. C. Kellner, Vienna, Austria. Eng. Pat. 23,580, Dec. 9, 1895.

THE nitrate or nitrite of the metal of which a cyanide is required, is subjected, either alone or mixed with carbon free from nitrogen, to the action of an electric arc between carbon electrodes. An electric melting furnace of known construction may be used.—E. S.

Chlorates, Improvements in the Manufacture or Production of Alkaline. C. Kellner, Vienna, Austria. Eng. Pat. 23,591, Dec. 9, 1895.

CHLORATES of the alkali metals are produced from the chlorides by electrolysis, without use of a diaphragm, by suspending in the electrolyte a suitable oxide or hydrate, such as calcium hydrate, not soluble in the liquid. The function of such a hydrate is to effect the transference of the chlorine from the anode to the cathode, without participating in the conduction of the current. The oxide is kept agitated during the process. A modified process consists in separating a hydrate, as of calcium or magnesium, from its chloride by electrolysis, and then converting the chlorate so formed into the required alkaline chlorate by the addition of a solution of the corresponding chloride. In this manner calcium and magnesium chlorides occurring as waste products may be utilised in the production of alkaline chlorates.—F. S.

VIII.—GLASS, POTTERY, ENAMELS.

PATENTS.

Glass, Producing Indelible Pictures upon; A Method of. F. Schachinger, Munich. Eng. Pat. 6602, March 30, 1895.

AN emulsion of gelatin and "chromate" of potassium, &c., containing a sufficient quantity of ceramic black colouring matter, is spread on the surface of the glass, exposed under a negative, and treated in the usual manner. The resulting picture is finished in pigments and burnt.—F. H. L.

Producing Markings, Engravings, or Ornaments on Glass and Glazed Ware, Improved Means or Method for Permanently. C. G. Pickering and C. F. B. Birchall. Wood Green, Middlesex. Eng. Pat. 6790, April 2, 1895.

THE material is wetted with water or other liquid, and it is then "scratched or engraved at the parts to be marked or ornamented by an aluminium point, stick, or disc to any design required." A thin coating of metal is thus obtained having a silvery appearance.—F. H. L.

Sheet Glass, A New Product for Use in Substitution of, for Windows, Engraved Glass, Painted Glass, Blinds, Curtains, and other Purposes. J. Badon, Brussels. Eng. Pat. 24,263, Dec. 18, 1895.

A FABRIC, such as tulle, muslin, or wire gauze, is coated on both sides with a bichromated film of gelatin, &c., which is rendered insoluble by the action of light. Pigments may be incorporated with the coating liquid if desired; but if the incorporated mixture is to be finally treated with oil varnish, the use of the bichromate is not necessary. The designs are printed by photographic or lithographic processes.

The advantages claimed for the new product are:—Cheapness, insolubility and impermeability to atmospheric influences, flexibility, and suppleness.—F. H. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Slag Cement in Germany. F. H. Mason. U.S.A. Consular Reports, Feb. 1896, 224—228.

THE report details certain historical facts concerning the production of slag cement, and states that frequent failures in manufacture having brought the material into disrepute and having caused the Association of German Cement-makers to agree not to use it, great difficulty has been experienced in continuing the production. In the valley of the Saar, however, where slag of the correct composition and properly granulated can be obtained, there are two factories, one at Malstatt and another at Nennkirchen. The slag cement here made sells in lots of 50 tons, at 5.35 marks per barrel of 150 kilos. (Slag cement being lighter than Portland). Carefully made slag cement has given excellent results at various official testing stations, and can be used for foundations and under water, but preferably not for work exposed to air and sun. A good

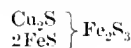
deal is utilised for making paving tiles, which consist of a mixture of gravel, sand and cement, moulded by hydraulic pressure. The cost of these tiles is 81 cents per sq. metre.

—B. B.

X.—METALLURGY.

"Cuban" [Copper Pyrites], Note on the Composition and Constitution of. R. Schneider. J. Prakt. Chem. 52, 1895, 555.

THE physical properties of the mineral analysed agree with those first described by Breithaupt, and the empirical formula obtained, CuFe_2S_3 , is the same as found by Scheidhauer, but differs from that given in Dana's System of Mineralogy, CuFe_2S_4 , which resulted from an analysis of mineral from presumably the same source (Barraconao, in Cuba). There are evidently two different minerals. The author proposes to call CuFe_2S_3 , "Cuban," and CuFe_2S_4 , "Barraconite" or "Cunpropyrites." Cuban is to be regarded as $\text{Cu}_2\text{S} \cdot \text{Fe}_2\text{S}_3$, copper pyrites, in which two-thirds of the cuprous sulphide are replaced by the isomorphous ferrous sulphide,—



—A. C. W.

Aluminium Alloys. F. G. Andrews. Dinger's Polyt. J. 1896, 299, 24.

OF the binary alloys with gold, that with 94 per cent. Al is white, but more brittle than pure aluminium. The 90 per cent. alloy is harder, and must be worked at a higher temperature; it ranges from clear violet to brown in colour. With 85 per cent., the colour is white, with a faint violet shade, and the metal is very soft and fine-grained. With 50 per cent., the alloy is violet, soft, and porous; whilst with 22 per cent. it is very brittle, and its colour lies between red and violet. With 20 per cent., the colour is a blue-violet, and with 10 per cent. it is again roseate. Alloys with but little aluminium show a clear violet colour in the blow-pipe flame. The aluminium-gold mixtures have no practical value except for decorative purposes. The alloy of 50 per cent. gold, 5 aluminium, and 45 copper has the colour and lustre of 14 carat gold, but soon loses its lustre.

Of the silver-aluminium alloys, those containing 4 to 8 parts of silver are almost silver-white, are harder than aluminium, and are not brittle, but take a good polish and are very useful, especially for medals, jewellery, and decorative work.

With nickel in equal proportions, aluminium gives a dark grey, porous, and brittle alloy of no practical use. But the alloy of 66 per cent. Cu, 24 per cent. Ni, and 10 per cent. Al takes a good polish and has the colour of 10 carat gold. That of 55 per cent. Cu, 33 per cent. Ni, and 12 per cent. Al has a fine golden-brown colour; whilst that of 72.5 per cent. Cu, 21.25 per cent. Ni, and 6.25 per cent. Al is similar, but richer and deeper in tint. These ternary alloys are tenacious, hard, and fine-grained. In making the alloys, the aluminium is added only when the other metals are fully melted.—W. G. M.

Lead, Desilverised by Pattinsonising and by Zinc; Use of. Freiberg. Jahrb. Berg- u. Hüttenm. Zeit. 1896, 55, 32.

PATTINSONISED lead is commonly preferred for the construction of vitriol chambers, and even for the manufacture of white lead. An experiment made in England gave results equally satisfactory with both kinds. Even 0.003 to 0.005 per cent. of Bi interferes in the white-lead manufacture, whilst 0.003 per cent. of Cu or 0.006 per cent. of Ag imparts a reddish tinge to the product; 0.1 per cent. Sb adds to the time required for corrosion, but even 0.5 per cent. does not affect the colour. As compared with Pattinsonising, the zinc process gives a lead with only one-third of the silver, and almost free from copper, but containing the whole of the bismuth. Lead containing even 2 per cent. of Bi may yet be rolled without difficulty to sheet 0.5 mm. in thickness. Only one Pattinson apparatus is left in Germany—at Halsbrücke. The composition of certain varieties of commercial lead is given in the following table, of which only the last was made by Pattinson's process.

	Sb.	Cu.	Fe.	Zn.	Ag.	Bi.
From England.....	0.0042	0.0090	0.0014	0.0002	0.0005	0.0052
" Italy.....	0.0020	0.0010	0.0028	0.0006	0.0005	0.0009
" the Hertz.....	0.0063	0.0070	0.0005	0.0007	0.0005	0.0024
" " Rhein.....	0.0077	0.0005	0.0017	0.0005	0.0004	0.0013
" " ".....	0.0045	0.0002	0.0003	0.0002	0.0005	0.0073
" " ".....	0.0037	0.0007	0.0002	0.0002	0.0005	0.0040
" " Muldner Huttten.....	0.0005	0.0009	0.0003	0.0003	0.0007	0.0050
" " Halsbrucker Huttten.....	0.0007	0.0095	0.0009	0.0004	0.0017	0.0318

German experiments with lead desilverised by zinc, negative the supposed superiority of Pattinson lead for vitriol works and in the chemical industries. At Freiberg, after a year's comparison of the two kinds of lead in vitriol works, no distinction could be made between them.

—W. G. M.

Phosphorus in Phosphor Bronze, New Method of Estimating. F. Oettel. Chem. Zeit. 1896, 20, 19.

See under XXIII., page 296.

Gold, Estimation of, in Brilliant Gold and Enamels.

M. Schöner. Ann. de Chim. anal. 1896, 1, 47.

See under XXIII., page 296.

Manganese, Determination of, in Crude Iron. F. Ulzer and J. Brüll. Mitt. tech. Gewerbe-Museum, 1895, 11—12, 312—315.

See under XXIII., page 296.

PATENTS.

Precious Metal [Gold and Silver], Improvements in the Extraction of, from their Ores or from Compounds containing the same. J. Maclear, London. Eng. Pat. 4004, Feb. 25, 1895.

The claim is for the use of cyanide of potassium, or other cyanide or cyanogen compound, from which free hydrocyanic acid can be liberated by the addition of an acid, containing cyanuric acid or a cyanurate. The proportions vary according to the nature of the ore. Five parts of cyanuric acid to 100 parts of cyanide give good results when the gold is fine and free, whilst a larger proportion is necessary in the case of refractory ores or when the gold is coarse, although the proportion of 25 to 100 parts never need be exceeded. The cyanuric acid may be added as such, or as a cyanurate, to the cyanide solution, or produced *in situ* by the action of a hypochlorite or hypobromite upon hydrocyanic acid or a cyanide.

The advantages obtained by the presence of cyanuric acid are: the more active and rapid solution of the gold, the avoidance of the objectionable action of the cyanide solution on the base metal compounds, and the smaller quantity of cyanide required. In the case of ores containing much silver as sulphide, the solution is rendered more alkaline than in the case of ores carrying the gold and silver in a metallic state.—A. W.

Annealing or Tempering Furnaces, Improvements in and connected with. F. T. Franke, Dessau, Germany. Eng. Pat. 244, Jan. 4, 1896.

The annealing pot is heated in a circular brick chamber in which there is a fire-gate with the usual accessories. Instead of the heated gases, &c. being allowed to pass out at the top of the chamber after having heated the annealing pot, they are now made to pass down a vertical pipe through the centre of the pot into a flue underneath. By this means more uniform heating of the castings is obtained, and the overheating of those lying near the walls of the annealing pot is avoided.—A. W.

Gold-plated Wire, An Improved Method of and Device for Manufacturing Seamless. F. Kammerer, Pforzheim, Germany. Eng. Pat. 1741, Jan. 24, 1896.

The present method of covering the copper or brass wire with gold-foil, and rotating and heating the same, causes the gold to become alloyed with the base metal, and thus lose its value in respect to colour. The author overcomes

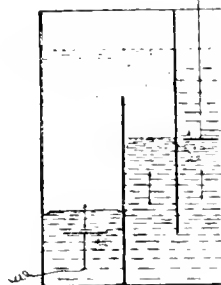
this drawback by welding the gold-foil to the wire by the application of heat and pressure. After wrapping the gold-foil round the ground wire, which should be preferably square or quadrangular, the whole is placed in a matrix consisting of conveniently shaped pieces of a suitable material, and, after binding together with a wire, strongly heated in a furnace. Whilst hot the matrix is subjected to outside pressure, whereby the gold is pressed on to the sides of the wire, to which it adheres without showing any appearance of a seam, and without losing its colour.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolysis without Diaphragms. W. Bein. Zeits. f. Elektrochem. 1895—96, 2, 346—347.

A METHOD depending upon a principle of stratification. When no diaphragms are used, the products of electrolysis remain in the neighbourhood of the electrodes, provided that the arrangements are such as to exclude currents and eddies due to differences in specific gravity or to the evolution of



gases. The products of electrolysis then remain separated from each other by a zone of undecomposed liquid, and can be run off by taps or siphons. A diagram of such an arrangement is shown in the figure.—D. E. J.

Nitrobenzene, Electrolytic Reduction of. K. Elbs. Zeits. f. Elektrochem. 1896, 2, 472—475.

In preparing paramidophenol by Gattermann's method (Ber. 26, 1847) it is difficult to obtain a good yield, and aniline is always formed simultaneously. In dilute sulphuric acid the nitrobenzene is so slightly soluble that the time required is excessive, and the yield is lessened by secondary reactions, whilst with strong acid paramidophenol sulphonic acid is formed. Aniline is always present in the product to the extent of from 40 to 100 parts per 100 of paramidophenol. The sulphuric acid acts chiefly as a solvent, and as such may be advantageously replaced by acetic acid; a greater yield is obtained, but with it a proportionate amount of aniline. Several experiments are recorded:—

(1.) With (50 per cent.) acetic acid as anode solution, and 81 sq. cm. of platinum cathode in 200 c.c. of (50 per cent.) acetic acid, 5 c.c. of strong sulphuric acid, and 30 grms. of nitrobenzene, a current of 6—7 volts (between electrodes) and 0.1—0.6 ampère, a temperature not exceeding 60° C., and a duration of 10 hours, azoxybenzene, aniline, paramidophenol, and a little paramidophenol sulphonic acid were formed.

(2.) With (90 per cent.) acetic acid as anode liquid, 100 c.c. of (90 per cent.) acetic acid, 10 c.c. strong sulphuric acid, and 40 grms. nitrobenzene as cathode solution, and a duration of 20 hours, the other conditions being unaltered, diacetyl paramidophenol and some acetamidophenol were formed.

(3.) With 3 vols. of strong sulphuric acid and 1 vol. of water around the anode, and 72 grms. of glacial acetic acid, 45 grms. of strong sulphuric acid, and 36 grms. of nitrobenzene around the cathode, using a current of 3.5 volts and 2—2.5 amperes at a temperature of 80°—85° for nine hours, with a platinum cathode as before,—the products were 4 grms. of aniline, 7.5 grms. of paramidophenol, and 1 gm. of paramidophenol sulphonic acid with some colouring matter. By working at a lower temperature (50°—55°) the yield was reduced markedly, and at 25° very greatly.

(4.) By substituting a lead cathode of 100 sq. cm. for the platinum, and using 40 grms. of nitrobenzene instead of 36 grms., the conditions being otherwise as in experiment 3 (temperature 80°),—a better yield was obtained, but the proportion of aniline was greater, viz., aniline 6.5 grms., paramidophenol 6.5 grms., the weight of other products being unchanged. A prolongation of the time to three days, led to the formation of aniline 23 grms., paramidophenol 9 grms., and paramidophenol sulphonic acid 1 gm., with a trace of colouring matter.

(5.) A three-day experiment on the lines of experiment 4, but with original platinum cathode instead of lead, and with current of 3—4 amperes, and temperature 85°, gave as the products:—Aniline 8 grms., paramidophenol 19 grms., paramidophenol sulphonic acid 0.5 gm., and colouring matter 0.2 gm.

It appears that the nitrobenzene is reduced by the lead sponge on the lead cathode without any appreciable formation of lead sulphate, which would be again reduced by the hydrogen ions liberated. This is in harmony with former observations by the author with zinc cathodes. The successive stages of reaction suggested by these experiments are as follows:—Nitrobenzene is first wholly, or in part, converted into azoxybenzene, which by the action of strong sulphuric acid slightly warmed, becomes p-oxazobenzene, and this in turn is converted by hydrogen into aniline and paramidophenol.—W. G. M.

Persulphuric Acid in Lead Accumulators. K. Elbs and O. Schönherr. Zeits. f. Elektrochem. 1896, 2, 471—472.

REPLYING to three objections raised by Schoop in regard to their previous criticisms on the Darreus theory (see this Journal, 1895, 14, 581), the authors first defend their use of platinum electrodes by showing that *ceteris paribus* more persulphuric acid would be formed on them than on lead plates, and by reiterating their statement that sulphuric containing persulphuric acid will even convert a film of lead peroxide into sulphate. Secondly, they endeavour to meet Schoop's hypothesis based on the possible action of nascent persulphuric acid by asking, how the residue of this acid differs from that of sulphuric acid (HSO_4) in moderately dilute solutions? These are well known to peroxidise lead and its salts. The third objection was that they regarded as lead sulphate the white precipitate formed on mixing lead nitrate and ordinary ammonium persulphate solutions, although it rapidly became brown by peroxidation. To this the authors reply that lead persulphate is soluble and easily decomposed, that ordinary ammonium persulphate contains sulphate, and that any lead sulphate formed would naturally become rapidly covered with brown peroxide under these circumstances.—W. G. M.

Hydroquinone, Electrolysis of. L. Liebmann. Zeits. Elektrochem. 1896, 497—499.

THE electrolysis of aniline gives a good yield of aniline black, but experiments conducted with the object of converting it by further electrolysis into quinone only gave negative results. Even hydroquinone on electrolysis only gives very small quantities of quinone, the chief product being quinhydrone. The electrolysis of the cold saturated solution of hydroquinone containing a few drops of sulphuric acid, is performed in a U-tube with platinum or

carbon electrodes, the current employed being obtained from accumulators at a pressure of 12 volts, and can vary from 0.02 to 2 amperes without affecting the result. About 10 minutes after commencing the operation, quinhydrone separates at the anode, and after one crystallisation from 75 per cent. alcohol the substance is pure. With regard to the yield of quinhydrone, it would appear that the amount produced by electrolysis is approximately the same as that obtained by the use of oxidisers such as ferric chloride or potassium ferricyanide. Similar results are obtained by the use of an alternating current (5,400 alternations per minute at 120 volts) for electrolysis, the quinhydrone, however, separating in this case, together with hydrogen, in long needles, at both electrodes, sufficiently pure for analysis.—T. A. L.

Electric Furnace for 1,000 Amperes. J. Pfleger. Zeits. f. Elektrochem. 2, 367.

See under II., page 262.

PATENTS.

Carbides or Acetylides of the Earth Metals and Alkali-Earth Metals, and Oxides or Salts of these Metals, Process for the Manufacture of. L. M. Bullier, Paris. Eng. Pat. 2820, Feb. 8, 1895.

See under II., page 265.

Electrical Storage Batteries, Improvements in and connected with. W. J. S. Barber-Starkey, Bridgnorth, England. Eng. Pat. 7315, April 10, 1895.

THE improved plates are formed of a number of discs, washers, or the like, threaded on lead tubes or rods and suspended from a transverse bar. When the tubes are employed they may be strengthened by a wooden or vulcanite core. The discs, which are punched from sheet lead, are corrugated radially, and arranged so as to afford space for the lead oxide paste. The lodgment for the active material may also be secured by stringing on the core large and small discs alternately, or by any other device.—G. H. R.

Secondary and Primary Batteries, Improvements in the Active Material for. A. Schanschiff, Norwood, England. Eng. Pat. 8081, April 23, 1895.

THIS improvement relates to the preparation of the non-metallic portions of the paste described in Eng. Pat. 12,045 (this Journal, 873, 1895). The plates are constructed of a paste composed of two parts by volume of appropriate metallic salts, say minium or litharge, and one part by volume of carbon, prepared by mixing 50 parts of sugar solution with 35 parts of strong sulphuric acid. The sugar solution is made by mixing 100 parts by weight of sugar with 30 parts of water. Instead of sugar, treacle or other hydrocarbon may be used. The carbon so prepared must be kept for a day or so to cool before being mixed with the metallic oxides or salts. For secondary batteries, this mixture of the carbon and metallic oxides is worked into a paste of the consistence of putty with an aqueous solution of the sulphuric acid of 1.1° B., and is ready to be applied to the plates. In single- and double-fluid batteries this prepared carbon is used instead of the retort carbon hitherto employed.—G. H. R.

Electrical Accumulators, Improvements in Oxidising Lead and Lead Compounds for the Construction of. H. Leitner, Niederschönhausen, Germany. Eng. Pat. 18,034, Sept. 26, 1895.

THE improvement consists in treating lead or lead compounds with an alkaline hypochlorite, and subjecting them to electrolysis, thus oxidising the mass throughout. The paste of which the plates are formed is composed of lead oxide and about 10 per cent. of retort carbon, both in powder, and intimately mixed, to which is added sufficient glycerin to form the substance technically known as glycerin-lead oxide putty. A number of tubes formed of rolled-up foil are inserted into the mass, and the whole is pressed into a carbon cylinder, which is then immersed in a saturated solution of sodium hypochlorite, causing the oxidation of the surface lead oxide to peroxide. The passage of an

electric current through the mass causes the lead and lead oxide to be thoroughly peroxidised and the binding material to be removed. It is claimed that the carbon mixed in the paste hastens the oxidation of the lead and the oxide, and is itself eventually oxidised away, leaving a porous, coherent mass of peroxide.—G. H. R.

Insulating Compositions for Electrical Purposes, Improvements in the Manufacture of. C. J. Grist, London. Eng. Pat. 22,574, Nov. 26, 1895.

Hemp, jute, cotton, or any animal or other fibre in which the fibres can be made distinct and similar, are carded, cleaned, and dried by hot air, and then dipped into cold linseed or other drying oil which has been heated up to 100° F. with the addition of litharge or other suitable drying agent. The oil must not be boiled for more than six hours at any one time, and must be kept in motion continuously. On removal from the oil, the fibres are pressed in an extractor to remove the superfluous oil, and then are spread loosely on wire gauze or netting, when the adhering globules of oil are thoroughly dried and oxidised by means of hot air. This process is repeated three times, but not more, and then the fibres are masticated between rolls of different diameters till they assume a homogeneous condition. The material is placed in crushing rolls, which must not be heated, and at least 15 to 20 per cent. of powdered sulphur is added, care being taken that the material does not heat. When it has been thoroughly incorporated, the substance is allowed to cool, and is then again placed between the crushing rolls, when from 5 to 25 per cent. of gutta-percha or wax is added to impart cohesion, and the material is rolled into sheets ready for use.—G. H. R.

Galvanic Batteries, Improvements in or connected with [Current Regulation]. A. C. Iwanowski, Kiev, Russia. Eng. Pat. 24,172, Dec. 17, 1895.

In the improved battery the cells, which are supported in a suitable frame, are connected from their under surfaces with a main pipe by means of tubes. This pipe has a tap at one end, and at the other is connected with a closed vessel of similar form to the cells. The vessel is connected by means of a pipe and cock with a reservoir, also hermetically sealed, which contains the electrolyte, and is supplied with a valve controlled by a spring and electro-magnet. When the cock is turned, the electrolyte flows through the vessel into the cells until checked by the vacuum formed in the reservoir. When the current falls below a predetermined strength, the electro-magnet can no longer restrain the spring, and the valve opens, admitting air, and the electrolyte rises in the cells until the current has regained its normal strength owing to the fresh surfaces of zinc and carbon exposed to the electrolyte, when the valve closes as before. This action repeats itself until the cells are full, when the supply tap is closed and the spent electrolyte is drawn off.—G. H. R.

Metallic Cyanides, particularly Cyanide of Potassium and of Sodium, Manufacture or Production of, Improvements in. C. Kellner, Vienna, Austria. Eng. Pat. 23,580, Dec. 9, 1895.

See under VII., page 274.

Alkaline Chlorates, Improvements in the Manufacture or Production of. C. Kellner, Vienna, Austria. Eng. Pat. 23,591, Dec. 9, 1895.

See under VII., page 275.

Electric Accumulators, Improvements in and relating to [Lead and Glass Fabric]. R. J. Gulcher, Charlottenberg, Germany. Eng. Pat. 130, Jan. 2, 1896.

The improved plates are made of a fabric formed by interweaving lead wires as the warp, and threads of glass cotton, glass, or quartz as the weft. The material is cut into pieces of suitable size, and the lead wires are bared for a short length, top and bottom, and inserted into a specially arranged mould, into which molten lead is poured to form a frame round the free ends of the lead wires, and also preferably on the two side edges. The fabric is impregnated with the active material in any suitable way, and the plates

thus formed are wrapped separately in a layer of glass cotton, and suspended between two supports connected by plates and bars.—G. H. R.

(B.)—ELECTRO-METALLURGY.

Electricity, Uses of, in Metallurgy. W. Borchers. Zeits. f. Elektrochem. 1895-96, 2, 368-372.

BEFORE smelting, many ores have to be submitted to processes of preparation, and we find that even in these preliminary operations electricity is of service. The magnetic and non-magnetic portions of a mixture can be separated by electro-magnetic contrivances, of which 170 have already been patented in the United States. Electro-magnetic preparation has been applied chiefly to ores of iron, lead, and zinc. In order to exhibit the nature of the many metallurgical processes in use and the part played by electricity in them, the author exhibits in a tabular form the various processes for reducing and separating metals extant. The table is reproduced in simplified form on next page. Empty spaces opposite the name of a metal indicate that the methods of the corresponding vertical column are not applied to it. Spaces ruled with fine vertical lines indicate methods in which electricity is not used. Spaces ruled with thick horizontal lines indicate electrical methods. We first come to those under the head of reduction of oxides by heat; in these cases, however, electricity is only employed as a means of producing a high temperature. But it is important to notice that *all* oxides (naturally with the exception of carbon monoxide) can be reduced by this method in presence of carbon. The Cowles process of manufacturing aluminium-bronze was the first important application of this principle. The author has shown that chromium, manganese, and tungsten can be prepared in the same way, although chromium and tungsten have a very high melting-point. In the chemical decomposition of sulphides and salts, electrical methods have found no application; but after this we come to processes which are entirely electrical. It will suffice to point out that the only metals not included in the columns for electrolysis of aqueous solutions and fused compounds are iron, mercury, and tungsten. Even these can be prepared electrolytically, but as yet the electrical methods have not been able to compete with the others. Among present applications of electrolysis may be mentioned the refining of metals and the manufacture of metallic objects (Elmore, Klein), the reduction of aluminium, the separation of gold and silver, the extraction of gold by the cyanide process and electrolysis, electro-deposition of zinc, &c. Hitherto electricity has played but a small part in the great iron industry, but strenuous efforts are being made to apply it both in the preparation of the raw material and in the subsequent processes of manufacture.—D. E. J.

Electric Furnace [Iron and Steel]. R. Urbanitzky. Zeits. f. Elektrochem. 1895-96, 2, 350-354.

In the blast-furnace method of reducing iron, the metal takes up impurities such as sulphur and silicon, and these are not entirely removed in subsequent treatment by the Bessemer or Martin process. The present methods of smelting must hold the field for ordinary grades of iron; but when purity is of importance, and when special qualities of steel are required, it will probably prove advantageous to prepare pure iron by electrical methods of reduction and to carbonise this subsequently. A furnace suitable for this and similar purposes is described. It is lined with a basic lining, like a Bessemer converter; this is non-conducting and almost infusible, and keeps the iron free from impurities. In the Heroult furnace used at Neuhausen the positive carbon is vertical, and the material to be fused has to be introduced into the narrow space between this and the walls of the furnace. It is preferable to have a positive electrode consisting of four carbons arranged symmetrically about a vertical axis and inclined at about 20° to it. These can be raised so as to produce an electric arc, or lowered so as to dip into the fused mass; they can also be rotated backwards and forwards so as to ensure a uniform distribution of the heat. The bottom of the furnace is insulated and forms the negative electrode;

	Electro- Magnetic Preparation.	Forma- tion of Alloys and Amal- gams.	Chem- ical Solution with sub- sequent Precipi- tation.	Chemical Decomposition of Oxides by Heat produced by Combustion.	Electricity.	Chem- ical Decom- position of Sul- phides.	Chem- ical Decom- position of Salts.	Electrolysis of Aqueous Solutions.	Electrolysis of Fused Compounds.	Electric- Thermic Processes.
Aluminium					=====				=====	
Antimony.								=====		
Lead	=====							=====	=====	
Chromium					=====			=====	=====	
Iron	=====									=====
Gold.....	=====							=====		
Potassium									=====	
Cobalt								=====		
Copper....								=====		=====
Magnesium									=====	
Manganese					=====				=====	
Sodium...									=====	
Nickel	=====							=====		
Platinum .								=====		
Mercury ..										
Silver.....								=====		
Bismuth ..									=====	
Tungsten .					=====					
Zinc	=====							=====	=====	
Tin								=====		

it may either be formed of carbon or of metal cooled by a powerful air-current. Estimates of the probable working expense are given.—D. E. J.

Zinc and Lead from Mixed Ores, Method for Extracting
R. Lorenz. Zeits. f. Elektrochem. 2, 1895-96, 318-337.

MOST zinc ores contain some lead, and most lead ores contain some zinc. The processes of reduction commonly used are suitable for the one metal or for the other; hence in dealing with mixed ores it is necessary to submit them to a tedious preliminary process of preparation, so as to obtain grades of ore containing chiefly the one or the other metal. The electro-deposition of zinc from aqueous solution requires a comparatively high E.M.F., and the metal is apt to be deposited in a spongy state. These and other difficulties encountered in endeavouring to separate the dissolved metals by electrolysis in the usual way have induced the author to try the electrolysis of mixed fused salts (chlorides) of the two metals. He finds that fused zinc chloride can be electrolysed at a temperature at which neither the salt nor the metal volatilise; the molten metal

sinks below the fused salt and forms a good conducting cathode. But the preliminary experiments were not promising: the peculiar behaviour of zinc chloride had to be studied with some patience before success was attained. For when one endeavours to electrolyse fused zinc chloride in a porcelain crucible between carbon electrodes, an abundant evolution of gas is observed. The salt offers a very high resistance and behaves much as if it were a non-conductor. The contents of the crucible froth over, and no zinc can be found either on the cathode or at the bottom of the crucible. After the operation the salt is found to be strongly basic. Addition of common salt does not help matters, nor does the use of a higher E.M.F. The trouble is due to the presence of water, which is contained in zinc chloride even when it has been fused and kept in closed vessels. But the salt can be electrolysed with difficulty as follows. It is placed in a V-shaped tube of hard glass and heated over a Bunsen flame until it no longer froths. A carbon electrode is then introduced into each limb, the negative one reaching to the bottom, and the positive higher up. On passing the current, there is at first a rapid

evolution of gas, showing that water is still present. Presently the evolution of gas at the negative electrode diminishes, and the conductivity of the electrolyte rapidly increases. The metal now begins to be deposited as small fused globules, which drop to the bottom of the tube. If chemically pure zinc chloride be required, the operation should be allowed to go on a little longer, when the regulus will contain all traces of metals more electro-positive than zinc. The fused salt can then be poured out (leaving the regulus behind) into a second bent tube previously dried and heated. If the electrolysis be continued in this second tube, there is again a large evolution of gas at first, showing how eagerly the salt absorbs water from the atmosphere. (The author considers it the most strongly hygroscopic substance in existence—more so than phosphorus pentoxide.) Zinc thus prepared is absolutely pure. The pure fused chloride is a mobile, perfectly clear, highly refractive liquid, whereas ordinary fused chloride forms a syrupy, viscous mass.

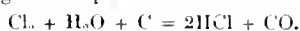
The electrolysis of fused lead chloride offers no difficulties, and can be carried out as described above. Cadmium chloride can be electrolysed in the same way; but as the boiling point of cadmium is only about 900° and the melting point of its chloride is about 540°, care must be taken not to overheat the tube.

Fused mixtures of chlorides can be fractionally electrolysed. From zinc chloride (or lead chloride) containing silver chloride, the silver is first deposited. From mixtures containing lead and zinc, the lead is first deposited. Copper is deposited before zinc. The separation of the metals is not much affected by the E.M.F. used. The following table gives the results of a separation of lead and zinc by fractional electrolysis of the fused chlorides. The current used was 0.5 ampere. The second column gives the number of ampere-minutes reckoned from the beginning of the electrolysis, and the subsequent columns the percentage composition of the regulus:—

Fraction.	Ampere-Minutes.	Pb.	Cd.	Zn.
1	20	97.34	1.35	1.30
2	115	14.71	0.62	85.54
3	175	1.30	2.55	96.15
4	215	1.23	1.37	97.30
5	335	0.00	0.00	100.00
6	455	0.00	0.00	100.00

The cadmium must have been present as an impurity in the materials used. Details are given of a similar fractional electrolysis of zinc chloride containing silver chloride as well as lead chloride. The first fractions consist mainly of silver, but mixed with some lead and zinc. The next fractions consist almost entirely of lead. The proportion of zinc then increases, and the last two fractions consist of pure zinc. But if it be desired to remove and collect all the silver, a better plan is to start with a cathode of lead, on which the silver collects.

The author suggests that mixed ores of lead and zinc should first be roasted, then converted into chlorides, and the fused chlorides fractionally electrolysed so as to separate the silver, lead, and zinc successively (the silver as an alloy). The chlorine evolved at the anode is mixed with steam and led over glowing coke so as to convert it into hydrochloric acid according to the equation—



If the ore contains mainly zinc and but little lead, it can, after roasting, be at once treated with hydrochloric acid of moderate strength. When a large amount of lead is present, this treatment would not serve, for most of the lead would come down as lead chloride. Ores rich in lead are to be extracted with dilute acetic acid, then adding HCl until the lead and silver are precipitated. The cleared extract can be used for extracting further quantities of roasted ore until all the acetic acid is saturated. Finally the acetic acid is recovered by leading in hydrochloric acid gas, evaporating to dryness, and condensing the distillate.—D. E. J.

Lead Ores containing Zinc, Reduction of. R. C. Schüpphaus. Zeits. f. Elektrochem. 1895-96, 2, 347-348.

A criticism of a process described by W. Borchers in a previous number of the same journal. The process has been tried in Colorado and New Mexico, and has not there been found successful as a method of treating these refractory ores. The author regards another method, devised by E. Lungwitz, as more hopeful. The ordinary method of reducing zinc by distillation depends upon the fact that it volatilises at its temperature of reduction. Now, the boiling point of a liquid depends upon the pressure; hence, by increasing the pressure in the furnace, it ought to be possible to prevent the volatilisation of the zinc. The necessary pressure is the vapour pressure of zinc at its temperature of reduction (or at the temperature of the furnace). C. Burus has shown that at about 76 cm. pressure the boiling point of zinc rises about 1.5° C. for each centimetre. According to this the vapour pressure of zinc may be estimated at about 5 atmospheres at 1,500° C. But this temperature is never attained in zinc furnaces; 1,200° or 1,300° would be nearer the mark. Furthermore, zinc and lead alloy at high temperatures. Hence a pressure of 3 atmospheres should suffice. Lungwitz's process is based on these principles. If it proves as successful as the writer anticipates, the pure zinc will still be prepared electrolytically; but the starting point will not be zinc sulphate, but the zinc which separates out from the lead bath.

In a note appended to the above, W. Borchers maintains the opinions he had previously expressed.—D. E. J.

Zinc Extraction, Electrolytic. B. Neumann. Chem. Zeit. 1896, 20, 36-38.

The special difficulty in the way of electrolytic zinc extraction over and above those which occur in the treatment of other metals, is that the price of common zinc is M. 30 per 100 kilos., and of pure zinc only M. 31; whilst the cost of electrolysing zinc sulphate or chloride solutions with a current of 2.5 volts is M. 18.96 when steam-power is used, or M. 13.33 with water-power. With a surplus of from M. 11 to M. 17 per 100 kilos. to pay for roasting, leaching, &c., the process cannot compete with the distillation method for ordinary ores. It may be applicable either to ores too poor to treat in the usual way, or to those containing much galena and silver, which give difficulty in mechanical preparation; or it may be applied to roasted pyrites containing too much zinc to render it useful in the iron industry; or, finally, to waste zinc products.

In practice the electrolyte is prepared with difficulty, as the anhydrous or basic zinc sulphate from the roasted ores dissolves very slowly, and is accompanied by iron, which interferes with the deposition of pure zinc, and is not easily removed. The ferrous oxide is not precipitated by the zinc oxide with which the ferric compound is ordinarily thrown down, nor is it completely peroxidised by blowing air through the hot solution, even for 24 hours (Chem. Zeit. 1895, 19, 221). This solubility of interfering substances negatives the use of Luckow's process, in which the roasted ore is made the anode. But, as the treatment of argentiferous blende is the most desirable, it must be remembered that roasting at a low temperature leads to the deficient solubility of zinc compounds, whilst very strong roasting may lead to a loss of 70 per cent. of the silver. Silver sulphate alone is very slightly volatile, but the presence of zinc compounds has been shown by Malagati and Durocher to increase the loss. The roasting of this mixed ore, followed by the leaching out of the zinc and the smelting of the residual silver-lead compounds, has been tried frequently, but with no success. A chloridising roast which is successfully applied to the treatment of zinciferous burnt pyrites at Fährfurt-a.-d.-Lahn and at Duisburg is not applicable to these ores by reason of the loss of silver, which may amount to 60 per cent. After roasting, Ashcroft extracts zinc with ferric chloride solution (Zeits. Elektrochem. 1895, 2, 376), Heinzerling with magnesium chloride (Chem. Zeit. 1892, 16, 1864), Höpfner with carnallite, and others with calcium chloride; but these substances do not appear to present any advantages. Alkaline zincate solutions have been recommended by Kiliani, Burghard, and Höpfner, but no working results have been published.

Given a suitable solution, other difficulties arise during electrolysis. Unless the solution be constantly neutralised, the sulphuric acid formed at the anode soon causes a rough cathode deposit and a co-deposition of hydrogen. But if the solution be basic (and zinc sulphate solution readily dissolves a little of the oxide), a zinc sponge comes down, which prevents the rolling of the metal, and oxidises on re-melting. The same sponge is apt to deposit if the current strength be less than 150 amperes per sq. m. Mylius and Fromm (*Zeits. anorg. Chem.* 1895, **9**, 144), and Nahsen (*Berg u. Hütt. Zeit.* 1891, **50**, 383), consider that the sponge is due to the presence of oxygen, and that it contains oxide and basic salts; whilst others refer it to the formation of a zinc hydride. Copper, antimony, and arsenic (the latter even in such small quantities as 0.01 per cent.) interfere with the precipitation. The solution must be faintly acid; the best results are obtained with 0.016 per cent. of free sulphuric acid, but it is technically impossible to maintain the liquid at this strength. The presence of organic salts assists the deposition of zinc for analytical purposes; and the use of oxalic acid has been recommended by Pertsch (*Chem. Zeit.* 1893, **17**, 285), lactic acid by Jordis (*Zeits. Elektrochem.* 1895, **2**, 148), and acetic acid by Watt; but the cost of the process would be considerably enhanced by these additions, and no results have yet been published. To prevent the formation of slime, Lindemann (*Chem. Zeit.* 1895, **19**, 1357) suspends zinc sulphide in the solution, but it is doubtful whether the evolution of hydrogen sulphide in this way would lead to the desired result. Siemens and Halske (this *Journal*, 1893, 698) recommend for the same object hypochlorous or hypobromous acid. The use of diaphragms has failed by reason of the difficulty in finding a suitable material for the purpose. Lorenz (this *Journal*, 1896, 39) has attempted the electrolysis of fused zinc chloride. But apart from the difficulty in evaporating the solution and obtaining anhydrous salts, and in finding a durable material for the furnace, the process is technically unmanageable. In Lipine (Upper Silesia) the Silesian Act. Gesellsch. f. Bergbau has tried a process of Nahsen's for the extraction of zinc from blende ($\text{ZnSO}_4 + \text{K}_2\text{SO}_4$ or MgSO_4), and Speyer has shown (*Zeits. Elektrochem.* 1895, **2**, 46) that small quantities of 99.98 per cent. Zn were obtained, but the cost of production was prohibitive. Léfrange showed electrolytic zinc at Chicago, and according to Gouch (*Berg u. Hütt. Zeit.* 1895, **54**, 402) this process may yet give good results. An English company is erecting, near Sydney (N.S.W.), works to treat the Broken Hill ores (containing 25 per cent. Pb, 26 per cent. Zn, and 20 oz. Ag. per ton) by leaching out the zinc and electrolysing the sulphate; but it remains to be seen whether they will succeed, even with the cheap ore available. The electrolytic zinc at present in the market is not produced from ores, but either from zinc residues or from the comparatively valueless zinc chloride solutions of larger factories. Of the two available solutions, sulphate and chloride, the latter is to be preferred, because of the possibility of recovering the anode chlorine as a by-product.—W. G. M.

Electric Furnace for 1,000 Ampères. J. Pfleger. *Zeits. f. Elektrochem.* **2**, 1895-96, 367-368.

See under II., page 262.

PATENTS.

Copper, Zinc, and other Metal Sheets, Strips, or Wires. Improvements in and Apparatus for the Manufacture of, Electrically. Cowper-Coles Galvanising Syndicate and S. O. Cowper-Coles, London. Eng. Pat. 2998, Feb. 11, 1895.

ACCORDING to this improvement the cathode consists of an endless band or its equivalent, which by means of rollers is caused to travel slowly through the electrolyte. The cathode may be formed of a thin flexible sheet or band of some metal, such as copper, or of a non-metallic material rendered conductive by a coating of plumbago or any suitable substance, and the band may be caused to pass, if desired, through a bath, which will prevent the undue adherence of the deposited metal thereto. Rollers are pro-

vided to strip the deposit from one or both sides of the travelling cathode, and the band or bands of metal so obtained are passed through rolls which divide the sheets longitudinally, and they are given any desired sectional form by means of dies or formers.—G. H. R.

Precious Metals, Improvements in Means or Apparatus for the Obtaining of, from Ores or Materials containing them. L. Pelatani, Paris, France, and F. Clerici, Milan, Italy. Eng. Pat. 24,803, Dec. 27, 1895.

THIS invention consists in an electrolytic cell constructed for facilitating the reactions required by a particular arrangement of anodes and cathodes, and of means whereby the liquids are kept in circulation during the electrolytic action. The bottom of the electrolytic vat, which is also the vessel in which the ore or other substance is dissolved, is lined with an insulating material, such as cement or ebonite, and is covered with a cathode formed of amalgamated copper or lead plates or of mercury. The two cylinders or drums are mounted one at each extremity of the inside of the vat, and support an endless band of nearly the same width as the vat and provided with agitators made of wood or other non-conducting material. In order to maintain a proper distance between the belt and the agitators and the cathode, any suitable stretcher or support is used. The belt may serve as an anode if made of a conducting material, or of an insulating substance rendered conductive by a suitable coating; or a fixed anode may be employed, and the belt may take the form of a wide-meshed trellis of non-conducting material passing with its agitating arms between the anode and the cathode. The solvent preferred is a dilute alkaline cyanide solution not exceeding 3 parts cyanide to 1,000 parts water, and this solution is rendered conductive by the addition of sodium chloride.—G. H. R.

Zinc from its Ores, A Process for the Electrolytic Production of. Siemens Brothers and Co., London. From Siemens and Halske, Berlin, Germany. Eng. Pat. 1575, Jan. 22, 1896.

THE zinc oxides resulting from the treatment of its ores or of calamine without such treatment, is dissolved in a solution of neutral aluminium sulphate, $\text{Al}_2(\text{SO}_4)_3 + 18\text{H}_2\text{O}$, and the solution thus obtained is electrolysed between insoluble anodes at a pressure of about 3 volts after impurities have been removed by known methods. Zinc is deposited at the cathode, and oxygen is evolved at the anode, while the basic aluminium sulphate is reconverted into neutral aluminium sulphate, which is ready to be used again. As no acid is formed, the deposited zinc is not redissolved, and therefore no diaphragm is required. The bath is best prepared by dissolving the zinc oxide in a warm solution containing from 100 to 150 grms. of neutral aluminium sulphate per litre.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Fatty Substances, Saponification of. V. Cochenhausen, Dingler's polyt. J. 1896, **10**, 233-239.

THE paper is largely polemical, disputing certain statements of Lifschütz. The conclusions which the author seeks to establish may be enumerated thus:—The belief that many saponifiable materials, e.g., oleic acid, undergo decomposition (involving further consumption of alkali) when digested for a long time, and at a high temperature, with strong alcoholic potash, is unfounded. Such a reaction as that which oleic acid undergoes when fused with caustic alkali, does not, it is stated, occur under any ordinary conditions of saponification for analytical purposes. Similar constancy of results, in spite of varying procedure, obtains with wool fat, which is not gradually and increasingly acted on by caustic potash when small increments in temperature or time of digestion are made. It is incidentally shown that many samples of commercial oleic acid are very impure, containing much neutral fat and unsaponifiable matter.

—B. B.

Oils, Vegetable Lubricating, Results of Analysis of.
A. Fraenkel. Mitt. techn. Gewerbe-Museums, 1895, [11—12], 316—318.

From the examination of numerous samples of oil, the author has arrived at the following figures for certain of their constants, and compares them with the limits specified:—

Olive Oil.

	Value found.	Specified Value.
Iodine number.....	81.38—86.12	81—85
Acid number.....	5.19—26.11	0—12
Specific gravity at 15° C.	0.9142—0.9172	0.9142—0.917

Castor Oil.

Iodine number.....	86.60—87.06	83—86
Acid number.....	2.28—5.38	0—12
Specific gravity at 15° C.	0.9626—0.9644	0.9630—0.966

Rape Oil.

Iodine number.....	97.02—102.2	98—102
Saponification number..	171.8—177.9	175—180
Acid number.....	1.42—5.86	0—6
Specific gravity at 15° C.	0.9138—0.9152	0.911—0.917

—B. B.

Glycerin, The Manufacture of. F. Jean. Rev. de Chim. Ind. 1896, 7, 33—35.

MOST of the glycerin of commerce is manufactured by the hydrolysis of stearin with water and magnesia (1½ per cent.), under a pressure of 9—9½ atmospheres (a method stated to yield glycerin in a condition of greater purity than does the method with lime), or, more usually, with lime (3 per cent.) under a lower pressure.

For the hydrolysis of fatty oils, with a view to the utilisation in the manufacture of soap of the fatty acids produced, the process of Poulain and Michaud is also employed. It consists in heating the fatty oils under pressure with zinc oxide or zinc dust, and has the advantage of yielding, along with fatty acids in the free state, soap compounds, which do not require to be decomposed with sulphuric acid, as in the case of the magnesia and lime processes, but which may be at once converted into soda soaps, as the zinc oxide present in them is soluble in the caustic soda employed, and is removed in the waste lyes. The process has especial value for the treatment of palm oil, as it gives a mixture of fatty acids almost free from colour. A yield of 6 per cent. of glycerin is obtained when 3,000 kilos. of oil are heated with water and 10 kilos. of zinc dust for six hours under a pressure of 8—9 kilos. per square centimetre.

The recovery of glycerin from the waste lyes of the soap-works is, when the caustic lyes are prepared from soda-ash manufactured by the ammonia process, relatively simple. The waste lyes are neutralised with an acid, or treated with a salt, which will precipitate the albuminous, &c. matters present, and, after the removal of these, they are evaporated, to separate the salts, the residual glycerin being purified by distillation under reduced pressure.

With the waste soap-lyes from causticised Leblanc soda, the operations are more tedious and difficult, as the glycerin is in this case accompanied by sodium sulphide and thio-sulphate, in addition to the gelatinous and other organic matters, sodium carbonate, chloride, and hydroxide, ordinarily present. The sulphuretted compounds formed when such lyes are neutralised would, if measures were not taken to obviate this, render very impure the glycerin obtained on distillation. One of the methods proposed for dealing with these lyes, namely, that of oxidation with calcium hypochlorite, after neutralisation, is unsatisfactory, as it gives a product containing objectionable oxidation derivatives. Another method—decomposition with iron and hydrochloric acid—is more satisfactory. Droux and Depouilly have suggested as a practicable method, the treatment of the magma, left on evaporation of the lyes, with oleic acid,

in an atmosphere of carbon dioxide, at 170°—175°, in an apparatus provided with an agitator. Under these conditions the glycerin combines with the oleic acid, forming an oil which contains twice as much glycerin as natural olein. This is washed with water and then hydrolysed.—E. B.

Fatty Bodies, Unsaturated, Action of Sulphur on.

J. Altschul. Zeits. f. Ang. Chem. 1895, 535.

BENEDIKT and UZER showed that on heating oleic acid with sulphur to between 200° and 300° C., sulphuretted hydrogen was evolved through the conversion of oleic acid into sulpholeic acid, but it appears that the action of sulphur upon unsaturated fatty bodies and at temperatures at which re-evolution of sulphuretted hydrogen takes place, has never been investigated. On heating oleic acid with 10 per cent. of sulphur to from 130° to 150° C., the sulphur gradually dissolves, and does not crystallise out again on cooling. The oleic acid thus treated dissolves in ether without any sulphur separating out. In the same way all unsaturated fatty oils behave. That in this treatment the sulphur has entered into combination with the fatty acids, is proved by the observation that the saponification of oils treated with sulphur in the manner above described, leads to the formation of salts of true sulphuretted fatty acids, which can be obtained from them in the free state by the action of acids. Since in the reaction between sulphur and oils, no sulphuretted hydrogen is evolved, the sulphuretted compounds obtained must be addition products. The saponification of these sulphuretted compounds of the fatty oils and acids must, however, be carried out in the cold, as their hot saponification is accompanied by a more or less complete elimination of the sulphur. Oils that are not very readily saponifiable, such as linseed oil, receive an admixture of cocoa-nut oil, when their complete saponification at a temperature of 25° C. is easily effected. It is very probable that these sulphur addition products of the unsaturated fatty oils are closely analogous to the oxidation products of those bodies which are obtained either by exposing them to the air in thin layers at ordinary temperatures, or by blowing air through them at higher temperatures. For the latter, Henriques showed that they can be converted into india-rubber substitute, with a much smaller percentage of chloride of sulphur than the oils in their original condition require, and exactly the same is true for the sulphuretted oils.—C. O. W.

Fatty Bodies, Unsaturated, Action of Sulphur on.

R. Henriques. Zeits. f. Ang. Chem. 1895, 691.

ALTSCHUL's statement (see preceding abstract) that the treatment of unsaturated oils with sulphur at low temperatures results in the formation exclusively of addition products, is not quite correct, neither can it be said that at high temperatures only substitution products are formed. Indeed substitution and addition seem always to take place concurrently, though the former is favoured by high temperatures, the latter by low ones. The high iodine numbers of the fatty acids obtained by the saponification of "brown" india-rubber substitutes are in no way opposed to the assumption of these substitutes being addition products. Altschul's method of saponifying his sulphuretted oils in the cold, in conjunction with a certain quantity of cocoa-nut oil, is not very satisfactory for analytical purposes. The same result is better obtained by saponifying the sulphuretted oil, dissolved in petroleum spirit, with standard alcoholic soda. Analysing in this manner a number of sulphuretted oils, cold saponification always yielded fatty acids containing more sulphur than when the saponification was carried out at higher temperatures, but the amount of sulphur remaining in the fatty acids was always rather less than the total sulphur contained in the substitute, so that the latter must either contain free sulphur, which is highly improbable, or it must be admitted that even in the process of cold saponification, sulphur, in the form of hydrogen sulphide, is eliminated.—C. O. W.

Transparent Soap, Alcohol used in the Manufacture of; Denaturing the latter. R. Hirsch. Die Chem. Ind. 1895, 18, 475—476.

It has recently been permitted—tentatively at least—to employ, in the manufacture of transparent soap, spirit

denatured by means of methyl alcohol ($\frac{1}{2}$ per cent.), castor oil ($\frac{1}{2}$ per cent.), caustic soda solution ($\frac{1}{4}$ per cent.). These ingredients, according to the author, have no injurious effect on the transparency and odour, &c., of the finished soap. He suggests, however, that in order to render the spirit completely undrinkable, larger proportions of castor oil (10 per cent.), and of soda solution (2 per cent.), should be added; whilst the methyl alcohol, on account of its high price, might be replaced by various essential oils ($\frac{1}{2}$ to 2 per cent. of bergamot, &c.). The latter are required in any case, as scent, and would not therefore add to the total cost.

Treu and Nüglisch (*ibid.* 1895, 499–501) severely criticise the author's suggestions,—chiefly on the score of costliness,—and state that most of the ethereal oils in contact with alcoholic caustic soda, would be gradually decomposed or more or less spoiled. To this Hirsch replies (*ibid.* 1896, 80), pointing out that in alcoholic solution castor oil and soda rapidly react to form soap, so that no injury can result to the essences added.—H. T. P.

Cold Saponification. R. Henriques. *Zeits. f. ang. Chem.* 1895, 721.

See under XXIII., page 299.

Oil Cakes and other Feeding Stuffs, Free Fatty Acids in. B. Dyer and J. F. H. Gilbard. *Analyst*, 20, 241.

See under XVIII. A., page 288.

Saturation and Critical Temperatures [Testing Butter, Fats, Oils, &c.]. Crismer and Motten, Assoc. Belge des Chim. *Chem. Zeit.* 1896, 20, 41.

See under XXIV., page 300.

PATENTS.

Oil-Mill Presses, Anglo-American, Improvements in the Construction and Working of, and in the Conversion of Taper-Bar Presses into. G. E. Selby, Hull. Eng. Pat. 8823, April 26, 1895.

STRUCTURAL alterations are proposed and claimed of such a kind, that besides the conversion foreshadowed in the title, in the working it is stated, greater cleanliness is secured, general construction is simplified, and increased economy effected.—J. J. K.

Soap, Tormentil, An Improved Process for making, by the Cold Process. W. P. Thompson, Liverpool. Eng. Pat. 8814, May 3, 1895. From J. B. Okie, Wörishofen, Germany.

CAUSTIC soda-lye is run into cocoa-nut oil with stirring, and there is added to the mass a mixture of extract of tormentil, tincture of tormentil, sassafras oil, sandal-wood oil, oil of fennel, and oil of violets. The extract of tormentil imparts to the soap a bluish-brown tint.—J. J. K.

Separating Oleaginous Matter from a Solvent, Apparatus for. J. F. Lester and A. Riccio, Atlanta, Georgia, U.S.A. Eng. Pat. 23,159, Dec. 3, 1895.

THIS is an apparatus designed for the purpose of separating oils or fats from the hydrocarbon solvent used in their extraction from seeds or animal matter, without the aid of heat. The still employed is placed inside a closed vessel filled with cold water, in which is a coil for condensing the vaporised solvent, as it is withdrawn by means of a vacuum pump. The novel feature consists in the principle that when a vacuum is formed in the still, the solvent rapidly vaporises, and, on being pumped into the condenser, the latent heat which it contains passes into the water, becoming sensible heat, which then warms the oil in the still, thus assisting the distillation, until the whole of the solvent has been vaporised and condensed.

—J. J. K.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

Bronze-Colour Manufacture, Developments in. E. Odenheimer. *Dingl. polyt. J.* 1896, 299, 43–48.

IN this manufacture, thin hammered brass leaf is reduced to metallic dust, after which it is graded as to size. For the coarser kind of powders the material is subjected in the polishing mill to the action of steel wire brushes rubbing against the steel walls of a closed cylinder, a small proportion of fatty matter being added to prevent oxidation. To reduce to still finer condition, the powder is commonly rubbed with gum-arabic solution, and washed and dried at the lowest possible temperature. Oxygen, moist carbon dioxide, and hydrogen sulphide tarnish the powdered metal. Rosenthal, in 1893, endeavoured to avoid the tarnishing by these gases in the air, by conducting the operations either in a vacuum chamber, or in one supplied with air, from which oxygen and harmful gases had been absorbed. When a vacuum is used, an electro-motor forms a convenient driving agent for the rotating mechanism, as it may be itself enclosed within the exhausted chamber, and obviates the necessity for packing a rotating joint, airtight. Siebelstiel, in 1894, patented a pattern of stamp by which the agglomeration of bronze particles in places where they are but little rubbed, is prevented (Ger. Pat. 81,420, 1894). Sattler (Ger. Pat. 61,069, 1891) combines a grinding mill, in which roughened steel balls rub against hard steel ribs, with a polishing mill, in the same apparatus.

The Colouring of Bronze-Powder.—The powder is heated in open vessels with oil and vinegar, or with wax, paraffin, or oils containing sulphur; or (by Buchner's process) by shaking in a closed vessel with hydrogen sulphide solution, letting stand for 24 hours, drying, and heating in an oil-bath until sufficiently coloured; or by the fumes of ammonium sulphide; or by heating (brass) in stannous chloride solution. Zinc-dust is frequently coated with brass by simple immersion in a copper and zinc cyanide solution, the powder being kept in agitation by means of brushes (see this Journal, 1894, 13, 893 and 958); it is then treated finally in the usual polishing mill. Copper is best obtained for use as bronze-powder by the reduction of finely-ground copper oxide in hydrocarbon vapours.

Bismuth-Aluminium Bronze-Powder.—Lehmann (Ger. Pat. 14,242, 1887) prepares bronze-powder from an alloy containing 5 to 10 per cent. of Al, and 0.05 to 0.1 per cent. of bismuth. The filings of this are heated, crushed under stamps, the powder again heated, rubbed, sifted, and polished between rolls. The shade of colour is altered by varying the percentage of aluminium, and by heating in air.

Improvements in Bronzing Apparatus.—Supf has patented a process of direct printing in bronze (Ger. Pat. 74,452 and 74,453, 1893). The bronze is washed by means of hypochlorite of soda (eau de Javelle), and in polishing, a small quantity of refined glycerin is added; the powder is then mixed with dissolved albumin and glycerin, and finally ground with gum-solution, beer, and carbolic solution to a suitable paste. For printing on felt-like materials, the colour is mixed in the necessary proportion with 1,500 grms. of dammar and 1,600 grms. of boiled linseed oil. Blancan (Ger. Pat. 73,267, 1892) has also patented a direct-printing bronze, by mixing aluminium-bronze powder with a solution of shellac in borax water, with the addition of oxgalls to render the paint supple after drying. For "liquid bronzes," the action of the fluid medium upon the metal must be avoided. Stroschein (Ger. Pat. 52,973, 1889) accomplishes this by dissolving dammar in benzene and neutralising any acidity with ammonia before mixing the bronze-powder with it. Ferl (see this Journal, 1894, 13, 164) uses a solution of pyroxilin in acetic ether or amyl acetate. Menrer (Ger. Pat. 76,220, 1891) coats metal surfaces with aluminium by sprinkling the powdered material upon a half-dry film of tar painted upon them; the object is then heated to 300°–350°C. in a muffle, when the varnish melts, and the aluminium forms a smooth, bright surface that is readily cleaned by washing.

Bronze Substitutes.—Mosaic gold was one of the chief of these, and is still used almost universally for treating lamp stems, as bronze-powders are ruined by the acidity of the varnish employed. Coloured mica bronzes are now made by Sachs, Meyer, and Gerstendorffer, of New York (this Journal, 1894, 13, 532). They are now, however, displaced by tin bronzes coloured with coal-tar dyes. The mica bronzes were obtained by crushing the material in stamps, boiling with hydrochloric acid to remove traces of iron, washing well, and sifting. The powder was used white, or tinted with aniline colours. To colour the mica powder, the New York firm treat it with dilute solution of white of egg, dry it, and after steaming, place it in the colour vat; bronze powder is mixed with it to increase the lustre. Silver and gold are cheaply obtained in powder by painting a mixture of one of their salts with gum senegal upon a glass plate and placing it in an atmosphere of hydrogen phosphide; after drying, the coating may be washed off the plate and pulverised. Lead and tin give metal-like powder, by treating their salts with hydrogen sulphide after the same manner.—W. G. M.

PATENT.

Paper, Wood, Metals, Canvases, and other Materials. Improvements relating to Ornamenting, Printing, and Writing on. H. Thacker, London. Eng. Pat. 6938, April 4, 1895.

ANY kind of plain, tinted, or coloured writing paper is covered wholly or partly by a solution of colouring matter made from aniline or other chemical material (with, in some cases, the addition of a mordant, to prevent it from being washed out), which can only be discharged by means of acids, alkalis, or other chemicals. The paper is then written upon, stamped, or printed with a chemical fluid or ink, composed of a solution of calcium hypochlorite in distilled water with the addition of a little acetic acid. The action of this ink leaves the parts, which have been impressed with it, bare, thus exposing the colour of the under surface of the paper. Combination colours can also be used. The process is said to be suitable for the manufacture of cheques and bankers' drafts to prevent forgery and alterations.—J. J. K.

(B.)—RESINS, VARNISHES.

PATENTS.

Waterproof Coating Compositions for Wearing Apparel, Covers, Engine and other Packings, Acid Tank Linings, and for other Uses, Improvements in the Manufacture of. C. J. Grist, London. Eng. Pat. 21,742, Nov. 15, 1895.

LINSEED oil is boiled with litharge for 24 hours at 400° F., the mixture being kept in motion during this time and for a further 24 hours, after which the oil is allowed to cool to its normal temperature. Any fibrous substance, such as jute, hemp, and cotton, after carding to free it from deleterious foreign matter, and drying to expel all moisture,

are immersed in a loosened and graduated condition in the oil, and immediately taken out again, when they are placed in a hydro-extractor to extract the superfluous oil. The fibre is now spread loosely on wire gauze, and a current of heated air blown through it till each particle of adhering oil has been oxidised and dried. The operation of dipping and oxidising is repeated twice. The fibre is then ground into a homogeneous condition, and placed in crushing rolls with the addition of 5 per cent. to 10 per cent. of powdered sulphur; after being thoroughly mixed it is allowed to cool, replaced in the rolls, and any desired colouring matter added. It is then ready for waterproofing goods.—J. J. K.

Oil [For Finishing Wood], and of a Varnish Prepared therefrom, Improvements in the Manufacture of. L. Knoche, Hamm, Germany. Eng. Pat. 24,224, Dec. 18, 1895.

200 lb. of oil pressed from the berries of a tree called "Abura Giri" or "Japanese wood oil," are boiled until a temperature of 205° C. is reached, and maintained at this temperature for three hours to render the oil of greater density. It is then cooled down to 180° C., and 70 lb. of naphtha or turpentine are thoroughly mixed with the oil to cause it to flow freely. Linseed oil may also be mixed with the raw oil and treated in the same manner. The oil compound produced is said to be superior and more durable than either linseed or cotton seed oils. A mixture of equal parts of this oil compound and ordinary varnish is said to produce a new varnish, which is superior in finish and brilliancy.—J. J. K.

Sheet Glass, A New Product for Use in Substitution of, for Windows, Engraved Glass, Painted Glass, Blinds, Curtains, and other Purposes. J. Badon, Brussels. Eng. Pat. 24,263, Dec. 18, 1895.

See under VIII., page 275.

(C.)—INDIA-RUBBER, &c.

Unsaturated Fatty Bodies, Sulphur, its Action on. J. Altschul. Zeits. f. angew. Chem. 1895, 535.

See under XII., page 282.

Unsaturated Fatty Bodies, Sulphur, its Action on. R. Henriques. Zeits. f. angew. Chem. 1895, 691.

See under XII., page 282.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Glue and Glue-yielding Substances, Composition of. W. Fahrion. Zeits. f. angew. Chem. 1895, 529.

THE method for the analysis of leather described by the author in a former paper (this Journal, 1895, 1072) is also applicable to the analysis of glue and glue-yielding substances. The author analysed by this method a number of materials with the following results:—

	Moisture.	Mineral Matter.	Unsaponifiable Matter.	Fatty Acids.	Liquid Oxy-Acids.	Solid Oxy-Acids.	Proteids.
Very pure white glue	13.74	1.80	0.49	0.08	0.04	0.27	83.58
Animal hide powder	19.15	0.25	0.72	0.18	0.08	0.37	79.25
Hide dressings	11.23	10.06	9.74	0.39	0.46	1.01	66.51
Horn of sheep	9.09	1.00	0.68	1.03	0.29	1.49	87.62
Bony part of sheep's horn	10.00	53.87	4.81	4.23	0.19	1.52	25.38

—C. O. W.

Water for Tanneries, Valuation of. A. Bartel. Dingler's polyt. Jour. 1896, 299, 136—141.

THE waters A, B, C, and D (see table) were found by Simand (Gerber, 1889, 15, No. 361) to be good for the purposes of a tannery, whilst E was very unfavourable, both on account of its high content of carbonates and its excess of chlorides. In this water (E) sole-leather hides plumped very badly and were difficult to tan. The water B plumped the hides quickly and tannage was comparatively rapid. A left the hides somewhat softer in the suspenders, a result

which Simand attributes to the higher temperature of this water than that of B, which it closely resembles in other respects.

Water No. 20 is very soft, but contains much organic matter besides that held in suspension (0.7 mgrm. per litre). In such a case filtration of the water through spent bark, and provision for keeping the soaks as cool as possible, should be resorted to.

Nos. 21 and 22 suffer from excessive hardness, and gave very poor results, probably due to over-plumping and con-

traction of the grain, slow tannage and hard leather being the main faults. No. 23 produced a leather showing black specks, which the tanner attributed to the iron, but which were more probably due to organic lime salts or putrefactive bacteria, for the water was comparatively rich in organic matter.

In the case of several of the waters here given the practical results are at variance with those which would be expected from our knowledge of the effect of the presence or absence of this or that salt on the hide. Thus with water No. 4 an excellent oak-tanned sole leather is made, in spite of its extreme softness and poverty in sulphates. The same may be said of No. 11, whilst the abnormal hardness of No. 15 and the excess of alkali sulphates in No. 17 do not prevent the production of a mild upper leather, so that these waters cannot be supposed to cause excessive plumping. The high content of iron in

Nos. 5 and 16 does not seem to have any prejudicial effect on the colour of the finished leather, since no complaints have been made in this respect. Particularly remarkable is the fact that a good product is sent out from the factories using waters Nos. 13 and 14, which the majority of experts would certainly condemn for tannery use.

The author concludes that whilst it must be admitted that the separate constituents of a water, together with its physical properties, have a weighty effect on the individual operations of the tannery, there is no doubt that every water, save mineral waters and sea water, may be employed by the tanner. It must not, however, be forgotten that in the majority of cases, it is essential that the tanner should have an intimate knowledge of the properties of his water, and should arrange his practice in such a way that these shall not prove injurious.

Mgms. per Litre.	A.	B.	C.	D.	E.	4.	5.	11.	13.
(Na, K)Cl	6.6	4.8	3.8	20.1	745.7	0.8	21.3	6.1	209.1
(Na, K) ₂ SO ₄ .....	..	..	..	..	..	4.3	31.4	7.5	..
(Na, K) ₂ CO ₃ .....	..	..	..	..	..	4.6	..	32.3	..
CaCl ₂ .....	..	15.5	11.9	..	..	..	..	..	51.4
CaSO ₄	22.8	22.4	25.2	27.3	234.3	..	20.7	..	113.7
CaCO ₃	61.8	40.2	98.4	141.6	405.0	5.9	27.7	16.1	145.2
MgCl ₂ .....	..	..	..	..	271.3	..	..	..	..
MgCO ₃	38.2	30.2	59.0	96.4	148.5	Trace	17.4	1.5	33.2
Fe ₂ O ₃ , Al ₂ O ₃ , P ₂ O ₅ .....	..	..	..	..	9.0	2.0	9.0	..	3.0
Insoluble and suspended matter	4.5	5.0	9.5	8.0	15.6	..	..	5.0	..
Loss on ignition	22.1	31.9	15.2	21.7	233.8	17.0	92.0	22.0	78.0
Permanent hardness*	2.91 ^o	2.99 ^o	3.01 ^o	3.12 ^o	11.65 ^o	0.33 ^o	2.85 ^o	0.99 ^o	6.68 ^o
Temporary hardness*	4.01 ^o	3.64	8.04 ^o	12.35 ^o	48.49 ^o	..	0.17	..	10.93 ^o
Total hardness*	6.95	6.56	11.08 ^o	15.47	60.14	0.33	3.56	0.99 ^o	17.61 ^o
Potassium permanganate consumption .....	..	..	Not determined.	..	..	13.3	9.1	17.9	13.5

Mgms. per Litre.	14.	15.	16.	17.	20.	21.	22.	23.
(Na, K)Cl	304.4	23.2	5.8	8.9	15.0	43.7	86.0	52.9
(Na, K) ₂ SO ₄ .....	..	33.4	11.0	123.1	5.5	180.0	249.2	10.8
(Na, K) ₂ CO ₃ .....	..	4.8	28.2	..	58.5	..	105.1	..
CaCl ₂	199.5	..	..	..	..	..	..	..
CaSO ₄	50.6	..	..	45.7	..	443.4	..	..
CaCO ₃ .....	..	396.4	120.4	230.7	30.4	9.6	394.6	109.6
MgCl ₂	21.1	..	..	..	..	..	..	..
MgCO ₃	26.0	38.6	14.9	6.1	7.1	252.6	187.5	25.2
Fe ₂ O ₃ , Al ₂ O ₃ , P ₂ O ₅	4.0	0.8	10.3	1.0	2.0	22.0	9.0	10.0
Insoluble and suspended matter .....	..	..	4.0	..	7.0	..	6.0	..
Loss on ignition	103.0	47.0	65.4	88.0	54.0	182.0	266.0	162.0
Permanent hardness*	4.33 ^o	2.00	2.00 ^o	3.88 ^o	2.00 ^o	20.26	2.00 ^o	2.00 ^o
Temporary hardness*	10.70	22.78	5.74	11.38 ^o	0.18	15.38 ^o	32.60 ^o	9.61 ^o
Total hardness*	15.12 ^o	24.78	7.74	15.21	2.18	35.64	34.68 ^o	11.61 ^o
Potassium permanganate consumption	18.4	19.3	?	7.5	69.3	?	6.4	?

* German degrees, 1° = 10 mgms. CaO per litre.

† Calcium nitrate, 28.8 mgms. per litre.

--A. G. B.

Calf Leather Dyeing. F. Kast. *Färber Zeit.* 1896, 7, 93.
See under VI., page 272.

Tannin, Determination of, by Metallic Oxides. W. H. Krug.
J. Amer. Chem. Soc. 1895, 17, 811.
See under XXIII., page 299.

PATENTS.

Tanning and Preparing Leather, Manufacture of a New Acid and Glycerin, or Acid, Glycerin, and Alcohol Mixture, and its Application for. M. Schmeltzer and C. Aschman, Ettelbruck, Luxemburg. Eng. Pat. 7365, April 10, 1895.

In order to "swill" hides in an acid bath, so as to obtain leather which is supple and not liable to crack in bending, a liquor is used which is prepared as follows:—3.5 parts of crude methylated spirit are mixed with 4 parts of crude glycerin, and 15 parts of sulphuric acid (60° Beaumé) are added while constantly stirring. When this mixture has cooled it is added to water in the proportion of 7 litres to 5,000 litres of water. For thick and fresh hides and for trans-atlantic dry hides the proportion of glycerin is increased. The mixture of methylated spirit, glycerin, and sulphuric acid is to be known as "Malattinic acid."

—A. G. B.

Tannic Extracts, An Improved Process for Decolorising and Clarifying. A. Sinan, H. Sinan, and E. Gouin, Nantes, France. Eng. Pat. 7555, April 13, 1895.

The ooze is led from the diffusion vat to a vat provided with a steam-coil, and the liquor heated to boiling. During the heating, residues from grain or oleaginous fruits which have been pressed for their oil, are added and are mashed in the ooze for about an hour. The quantity of residues used is regulated by the degree of decolorisation to be effected; 500 grms. per 100 litres per degree Beaumé are recommended. The liquor is allowed to cool, filtered, and concentrated in a vacuum.—A. G. B.

XV.—MANURES, Etc.

Thomas Slag, Ground, Improved Method for Estimating Soluble Phosphoric Acid in. F. Mach and M. Passon. *Zeits. angew. Chem.* 1896, 129.

See under XXIII., page 296.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Progress in, for the last Quarter of 1895. Dingler's Polyt. J. 1896, 299, 91—95.

Reducing Power of Levulose.—R. Lehman has constructed tables for the gravimetric estimation of levulose, and for

this purpose used a syrup containing 83.14 per cent. of the sugar prepared from inulin by the action of 0.5 per cent. sulphuric acid. O. Sule (this Journal, 1895, 498) employed pure crystalline levulose, and has shown that more copper is obtained when Lehman's method is followed than that author's tables will account for. With very dilute solutions the results are fairly concordant, but with greater concentrations differences of more than 20 mgrms. occur. These divergences induced Sule to revise Lehman's tables from 20 to 130 mgrms. of copper.

The Occurrence, Properties, and Action of the Caramel Constituents of Cane-Sugar (Raw Sugar).—C. Volmer's investigations on this subject were carried out in 1883, and have recently been published (*Zeits. des Ver. f. die Rüben-zuckerind. des deutsch. Reich.* 1895, 45, 451). They were made to afford explanation of the damage done to the boiler, the seams of which were loosened, whilst the boiler plates were caused to bulge considerably and showed deep corrosion, the interior of the boiler being covered with a layer 50 to 60 mm. (the bottom plates 300 mm.) thick, of a substance bearing a resemblance to peat. In the main steam-pipe were found large masses of a stiff blackish-brown matter which exuded from the joints in the form of glistening stalactites. These substances are shown to be the decomposition products of cane-sugar.—Caramelan, Caramelen, Caramelin—and under the combined influence of steam pressure and metals, metallic oxides in particular, assume a form characteristic of their chemical individuality. By special experiments the author has demonstrated that the presence of metals exerts an accelerating influence upon the decomposition of sugar, and that at the commencement of decomposition rapid oxidation of the metal takes place from the combined action of the nascent elements of water, and the resulting acid caramel components. Considerable quantities of the metal forming the boiler walls are removed, their superficial corrosion being thus accounted for. It, therefore, appears that the decomposition products of sugar are of a nature to cause considerable harm when chemical change is in progress within the apparatus employed for the generation of steam.

The Mucilage Separated in the Osmose Process and the Dextrans resulting therefrom.—According to Anderlik (*Zeits. f. Zuckerind. in Böhmen*, 1895, 20, 81) this mucilage is caused by certain bacteria. The fresh substance consists of closely grouped colonies of micro-organisms apparently connected to one another by secreted unorganised matter. The first coloration of the mud appears at a later stage of the decomposition, and is not due to the molasses, provided that the inflowing liquid is exclusively diluted osmose water. The inflow, at first alkaline, becomes acid in the presence of the mucilage and reduces Fehling's solution. In the event of much mud accumulating in the osmogen and reaching the osmose water stored in the reservoirs, the latter may become acid, and the sugar it contains is consequently inverted. In conjunction with infection the following are the necessary conditions for the production of the mud:—a steady introduction of osmose water drop by drop, sufficient air, a temperature of 18° to 30° R., and a uniform outflow.

The formation of the mucilage takes place for the most part at the expense of the cane-sugar, which is primarily converted into dextrose and levulose. The glucose is used up as a plastic material for the formation of the bacterial cells, whilst the levulose undergoes further decomposition. It appears that less solid matter and matter soluble in water is contained in the newly-formed mucilage than in the old. The soluble matter is the product of the decomposition of the mucilage caused by various processes of fermentation which are accompanied by the formation of fatty acids and, in particular, of lactic acid; moreover, a portion of the insoluble solid matter becomes soluble by the action of enzymes resulting from the fermentation, since, if the mucilage is filtered, the filtrate contains a dextran which undoubtedly is a hydrolytic product of the insoluble slimy substance. An old mucilage, when treated with alkalis, emits an odour of ammonia and methylamine.

The author has extended his investigations on the hydrolysis of the mucilage, and has ascertained that the portion of the slime insoluble in water is a hemicellulose, for when hydrolysed it forms substances which vary according to the

intensity of the hydrolysis. The products are dextrose, dextrans, and substances intermediate between these and the former. The dextrans may be divided into two principal groups, A. and B., according to their behaviour towards basic lead acetate. A. is composed of the precipitable, B. the non-precipitable dextrans. In A. are included two characteristic types, neither of which reduces Fehling's solution. The aqueous solution of the first type is strongly opalescent, and has a low specific rotation, whilst that of the second type is not opalescent, and has a greater rotation. Group B. is not of a pronounced dextran character; its rotatory power is less than that of the first group, and it reduces Fehling's solution.

N. Rydlewsky (*Die deutsch. Zuckerind.* 1895, 20, 1411) has studied "The Ash of Beetroot Slicings dried according to the Büttner-Meyer Method." It has been found that the chemical composition of slicings is practically unaltered by drying; the ash-content, however, increases from the adhering dust. Inasmuch as the percentage of ash in the dried slicings varies according to different authorities, the author has examined the beetroot material of the last three campaigns for the elucidation of this question. From his results he finds that the slicings undergo no chemical alteration on drying, but the ash-content increases to about 1 per cent., calculated on the dry substance, on account of ash from adhering dust. This latter contained from 10 to 15 per cent. of lime, and so explains the increase of lime (0.68 per cent.) in the ash of the dried slicings. The percentage of sulphuric acid in the dried slicings was raised to 0.93 per cent. on the dry substance, in consequence of the oxidation of the sulphurous acid in the furnace-gas. In some factories the high-pressure revolving presses as constructed by Büttner and Meyer are in use, and since in this process lime is added to the pressed slicings, some samples were examined for the purpose of comparing them with the unlined slicings. It was found that the dry lined slicings contained more ash, and that the amount of calcium oxide had increased by 2.68 per cent. on the dry substance as compared with that in the unlined slicings.—J. L. B.

Extraction, Estimation of, in Sugar Houses. M. Trubek. *J. Amer. Chem. Soc.* 1895, 17, 920—923.

In 1865, E. Lecry (*Ann. chim. et Phys.* 5, 350—410) determined the extraction of the cane (the weight of juice obtained from 100 parts of cane) by quickly digesting a known weight of bagasse with warm water, drying perfectly in an oven, and weighing, the fibre of the cane being previously known. In order to effect a more thorough exhaustion of the sucrose in the cane, water is allowed to run in fine streams over the bagasse as it comes from the first set of rollers; the resulting bagasse contains therefore a certain amount of water which does not belong to the cane. In such a case the author determines the extraction in the following manner:—

F_{100} = Fibre in diluted bagasse.

B = Original bagasse corresponding to 100 parts of diluted bagasse.

F_c = Fibre in cane.

x = Bagasse resulting from 100 parts of cane.

E = Extraction.

$$1. \quad \frac{F_{100} \cdot 100}{B} : F_c = 100 : x$$

$$2. \quad 100 - x = E$$

The unknown figures are B , x , and E , as F_{100} and F_c are found by analysis of the cane and of its bagasse. To find a third equation, the sucrose in the cane S_c in the extracted juice S_p , and in the resulting diluted bagasse S_{100} are determined. In $(100 - E)$ bagasse there is left $(S - \frac{ES_1}{100})$ sucrose,

or in 100 bagasse $(S - \frac{ES_1}{100}) \cdot 100$. The third equation is:

$$3. \quad \frac{(S - \frac{ES_1}{100}) \cdot 100}{100 - E} = \frac{100 S_{100}}{B}$$

After eliminating we have—

$$E = \frac{a}{2} \pm \sqrt{b + \left(\frac{a}{2}\right)^2}, \text{ where}$$

$$a = \frac{100 F_{n1}(S + S_1) - 100 S_{n1}F_1}{S_1 F_{n1}}$$

$$b = \frac{10000(F_{n1} - F_1S)}{S_1 F_{n1}}$$

—J. L. B.

Raw Sugar, Grey Colour of. Herzfeld. Zeits. Rübenz. Ind. 1896, 46, 1.

A SERIES of experiments show that grey or reddish-grey sugars as a class have an acid reaction towards phenolphthalein, and that this discoloration of the products is no longer observed when their manufacture is so conducted that they have an alkaline reaction. The author observed that certain sugar factories working with the so-called dry defecation, i.e., defecation with caustic lime, obtained unsatisfactory results. The alkalinity of the solid products was not estimated, whilst that of the syrups was determined with rosolic acid as indicator, the use of which led to great errors, for the apparently alkaline juice was in reality acid, and therefore readily dissolved ferric and ferrous oxides, in the presence of which (during the process of saturation with sulphurous acid) discoloured sugars result. By proper methods of controlling the manufacture, the formation of grey sugar may be avoided, and in the event of harm having already occurred, it may be minimised by subsequently covering the sugar with a strongly alkaline syrup.—J. L. B.

PATENTS.

Sugar, Improvements relating to the Separation of, from Sacchariferous Solutions, Juices of Plants, and the Like. Haseltine and Lake, London. From G. Kassner, Munster, Germany. Eng. Pat. 23,171, Dec. 3, 1895.

CANE or other varieties of sugar can be separated from their solutions by treatment with hydrated or non-hydrated oxide of lead. The oxide of lead is mixed with substances which are without chemical action on sugar, such as fibrous cellulose, carbonate of magnesium, saccharate of lead, &c. The mixture, which may be prepared beforehand, is employed in a moist pulpy condition or in the form of a solid resistant material, the latter being formed from the pulp by exposure to air, or to heat, and partial vacuum. Such mixtures are suspended in the solution of sugar and allowed to stand, or the solution may be filtered through the mixture, or these methods may be combined. The separated lead saccharate is afterwards treated with carbonic acid, or a gas containing carbonic acid.—J. L. B.

Potato Starch, Process for Treatment of, with Chlorine and Heat. Abel and Inray, London. From C. Hellfrisch, Kyritz, Prussia. Eng. Pat. 24,456, Dec. 20, 1895.

The inventor describes two processes for removing the unpleasant flavour and odour of potato starch.

In the first method the potato starch coming from the rasping machines and diluted with water is conveyed into a preliminary heating apparatus provided with stirrers. The contents are then raised to about 45° C., treated for a short time with chlorine, chlorinated water, or chloride of lime solution, and washed in the usual way.

In the second method a very thin paste of the raw potato starch is heated in suitable vessels fitted with stirrers to a temperature of 45° C., and then treated with a chlorine solution as above described. 1,000 kilos. of starch liquid, containing 1 part of starch to 1.5 of water, require 200 to 300 litres of a 0.2 to 0.25 per cent. solution of chlorine.—J. L. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Fermentation-Limit of Different Potatoes, Variations in. G. Heinzelmann. Zeits. Spiritus ind. 1896, 19, 33.

GREAT variations are observed in the fermentation-limit of potatoes, which appear to be traceable to differences in the climate, soil, and manures, as well as to the degree of ripeness of the potato. Unripe potatoes give the worst results; and in one case where they were taken whilst the plant was still in bloom, the fermentation limit was reached at 6—7 B., and the addition of 150 lb. of malt to the vat only brought it to 4 B. "Daber" potatoes with the same yeast and malt, and under like conditions always reached the limit at 1.2 B.—W. G. M.

Di-Saccharides, Can they be rendered Fermentable by the Presence of a Fermentable Sugar? H. Van Laer. Bull. Assoc. Belge d. Chim. 9, 319—322.

THE monosaccharides vary in point of susceptibility to the action of ferments, only those sugars not far removed from glucose in geometric molecular arrangement being decomposable by these organisms. In the case of the di-saccharides the conditions are different, the preliminary hydrolysis of each sugar into the corresponding monose by the action of a special enzyme being an essential prelude to fermentation.

In view of the results obtained by Bourquelot revealing the possibility of an ordinarily non-fermentable monosaccharide, such as galactose, being fermented when associated with a readily fermentable sugar like glucose, the author experimented on the same lines with disaccharides to see if they too were capable of being rendered fermentable by a similar process of induction. Such an effect, if occurring, would dissipate the current theory on the necessity of special enzymes to produce hydrolysis, but the results of the investigations made under varying circumstances with two torule, one incapable of fermenting maltose, and the other capable of fermenting saccharose but not maltose when unmixed with other sugars, show that the fermentation of those disaccharides cannot be brought about by the presence of readily fermentable sugars.—C. S.

Acetone, Determination of, in Wood Spirit and Crude Acetone. M. Klar. Die Chem. Ind. 1896, 19, 73.

See under XXIII., page 299.

Transparent Soap, Alcohol used in the Manufacture of; Denaturing the latter. R. Hirsch. Die Chem. Ind. 1895, 18, 475—476.

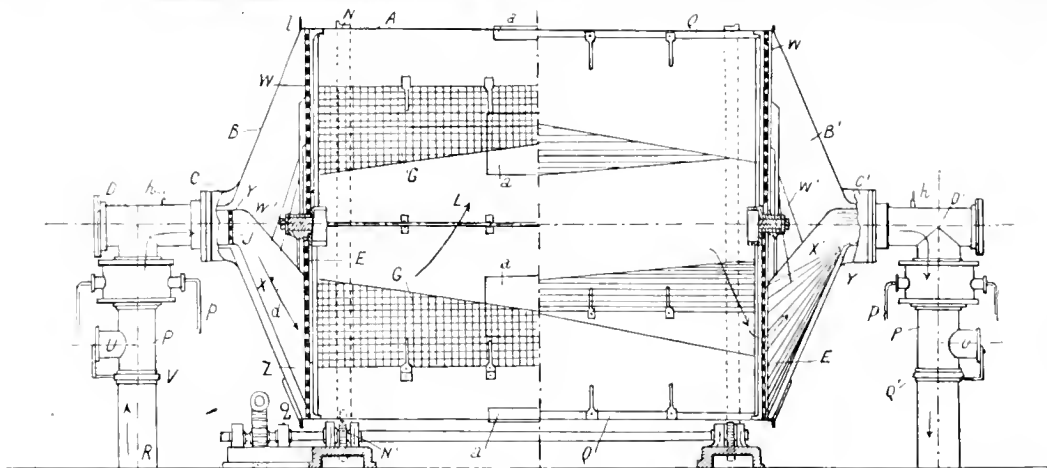
See under XII., page 282.

PATENTS.

Malt, Improvements in Apparatus or Machinery for the Manufacture or Production of. A. Ravinet, Dunkirk, France. Eng. Pat. 3480, Feb. 18, 1895.

THE operation of malting is effected in the following manner:—The damp grains are introduced at a at the upper part of the enamelled or galvanized iron cylinder A, which is not completely filled, so as to allow of germination and swelling. The cylinder is then revolved. The suction pipe D¹ and the aperture U are opened; the register V is closed. The sprayer p is started and so regulated that the entering air is saturated with aqueous vapour. At the ends of the cylinder are screens W, upon movable axes W¹, and the former have a tubular piece X, the cylindrical parts of which coincide with the arrival and exit pipes D D¹. The terminal head Z of the screen W is situated at the lower part of the conical end B; the tubular piece X serves as a counterweight to the screen W, which consequently always remains uppermost, and the gases can only penetrate the grain at the lower part of the cylinder.

During the rotation of the cylinder A the grains roll on to the metallic gauze webs G, which prevent the packing and agglomeration of the grains by a constant change of their position. The metallic gauze only extends to within a certain distance from the side of the cylinder and the



space Q thus formed, allows the grain to pass from one section to another.

When the grain is sufficiently germinated, the sprayer *p* is stopped and the door *U* of the pipe *P* closed. The hot current of air from *R* is put into communication with the cylinder *A* by opening the register *V* as well as *Q* communicating with the fan.—J. L. B.

Malt, Improvements in or connected with Manufacture of, and in Malt Houses for Treating Same. F. Colley, Tadcaster. Eng. Pat. 5329, March 13, 1895.

AFTER the grain has been soaked, it is removed from the tank and vegetated on the growing floor until it reaches a perforated floor, over which it is distributed by means of fans. These fans draw in hot or cool air, and force it into a space beneath the floor, of a sufficiently large size to allow the temperature of the air to become equalised, and to make it rise at a regular rate through the perforated floor. The grain is treated with the forced draught until it is dry enough for removal to the kiln. It is claimed that the malt is withered more effectually, and time economised in which the malt remains on the kiln. A larger output follows; for when the kiln is not required for its especial purpose, it may be employed for drying barley previous to storing.—J. L. B.

Malt and Grain, Improved Method of Treating, in Brewing and other Operations. Harris and Mills, London. From P. Puvrez, Lille, France. Eng. Pat. 5780, March 19, 1895.

DURING the process of mashing the malt and grain, either whole or crushed, is submitted to a wet grinding. For this purpose, the entire mash is passed between plane or roughened rollers of metal or porcelain, placed very close to each other. The rollers can be fixed on the edge of the brewing vat, or in any other desired position, and may be heated internally by steam or water to avoid lowering the temperature of the mash, or to raise it if necessary. By this treatment the kernel of the grain is reduced to a paste, and the husk left intact for the effective filtration of the wort.—J. L. B.

Sterilising Liquids, Improvements in and Apparatus for. E. W. Kuhn, Paris. Eng. Pat. 7286, April 9, 1895.

THE sterilisation by heat of liquids, especially fermented liquids, has not hitherto been generally successful, owing to the undesirable chemical and other changes frequently resulting from the treatment. The inventor's object is to provide an apparatus in which these changes may be prevented or reduced to a minimum (1) by conducting the operation in a closed vessel, kept in oscillatory movement, and provided with such a large heating surface that the necessary temperature may be attained very rapidly and without local overheating; (2) by rapid artificial cooling of the liquid as soon as complete sterilisation has been effected; and (3) by coating the interior of the vessel with silver, so

that the liquid may be kept from contact with metals likely to produce chemical effects. Such an apparatus is described in the specification.—L. A.

Alcoholic Liquors, An Improved Method of and Apparatus for Purifying and Refining. D. Young, London. From C. Ballock, Cambridge, U.S.A.; and C. M. Reed, Boston, U.S.A. Eng. Pat. 24,387, Dec. 19, 1895.

SMALL quantities of the alcoholic liquor, in the form of a shower or spray, are delivered from a distributor into a tank. They are here subjected to the action of air which has previously been passed through hot water, whereby fusel oil and other impurities are oxidised. The air, freed from alcoholic vapours, accumulates in a condensing-chamber until the pressure is sufficient to open a safety-valve.

—J. L. B.

Casks, Barrels, or the like, Improvements in or relating to Apparatus for removing Pitch from. A. J. Boulton, London. From C. F. L. Froberg, Rosswein, Germany. Eng. Pat. 1412, Jan. 20, 1896.

THIS is a process for cleansing barrels from pitch by passing superheated steam through a nozzle of special construction, which fits tightly into the tap-hole of the barrel. The melted pitch and exhaust steam find their exit through the bung-hole.—J. L. B.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Oil-Cakes and other Feeding-Staffs, Free Fatty Acids in. B. Dyer and J. F. H. Gilbard. Analyst, 20, 241.

THE authors give the results of the examination of nearly 1,000 oil-cakes and feeding-stuffs of different kinds (this Journal, 1893, 8). In newly-made cakes, the amount of free acid was generally very small. In 116 samples of freshly-made cakes the free acid only amounted to about 3 per cent. of the oil, and in over 100 samples the amount did not exceed 5 per cent. of the oil. In 11 samples the free acid was between 5 and 10 per cent. of the oil, whilst in two samples it was between 10 and 12 per cent.

Out of 268 linseed cakes made from well-screened linseed, 170 samples contained free acid not exceeding 5 per cent. of the total oil, while 69 samples contained free acid amounting to between 5 and 10 per cent. In 14 samples the free acid amounted to between 10 and 15 per cent., in 15 others, from 15 to 20 per cent., and in 10 samples above 20 per cent. of the oil.

71 cakes made from impure linseed gave an average acidity of over 15 per cent. of the oil, 21 of the cakes having over 20 per cent. of free acid.

"Dirty," impure cakes generally show higher acidity than pure cakes, and high acidity in pure cakes generally shows that they are in bad condition. The free fatty acid is given in terms of oleic acid, obtained by multiplying the quantity of potash used to neutralise the oil by 5.

A table is given showing the results obtained with rape seed, ground-nut, maize, rice meal, &c.—A. S.

PATENTS.

Food, A New or Improved, and Method of Manufacturing the Same. W. P. Thompson, Liverpool and London. From L. H. Green, Durban, Natal. Eng. Pat. 2909, Feb. 9, 1895.

THE new red-coloured grain, of Kaffir corn or mealies, is first thoroughly washed, the skimmed off floating particles being useful as a food for fowls. After soaking for 24 hours in soft water, the grain is placed in sacks in a warm place and kept until it begins to germinate, which it will generally do in 12 hours. It is now dried and then roasted like coffee in a revolving cylinder. The grain is then cleaned in a stamping mill, or otherwise. The outer skin is now removed from the kernel, and the latter is then ground in a roller mill to the required fineness. The meal may be advantageously mixed with half its weight of ordinary baked flour. To 50 lb. of this mixture may further be added 3 oz. of a preparation of 2 parts of table salt and 1 part of bicarbonate of potash, and the whole is then baked in an oven and well stirred. The product will keep for a long time in tins or other air-tight packages, and is devoid of the ill-flavour of the untreated Kaffir corn.—L. de K.

Eggs, An Improved Process of Preserving. E. Markham, London. Eng. Pat. 3513, Feb. 18, 1895.

THE preserving liquid is made by dissolving $7\frac{1}{2}$ oz. of boric acid, 1 oz. of borax, and 2 oz. of cornflour in a gallon of water and boiling for 3 minutes. If the water is very hard it is advisable to add $\frac{1}{4}$ oz. of soda. To improve the taste $\frac{1}{2}$ oz. of best sugar may also be added. As soon as the solution has cooled down to 204° – 210° F., the new-laid eggs supported on an openwork galvanised iron tray are dipped in the liquid for 11 seconds, the tray being kept in motion during that time. The eggs are then allowed to dry in a suitable receptacle, so as not to touch one another. When dry, they are made to stand on their longer ends in suitable cases and sprinkled over with boric acid. They may then be kept for a long period in a cool dry chamber.—L. de K.

Bean Flour, Improvements in the Manufacture of. H. H. Lake, London. Communicated by A. D. Bergtold and I. H. Falk, both of New York, U.S.A. Eng. Pat. 19,832, Oct. 22, 1895.

THE object of the inventors is to deprive beans of their disagreeable taste without removing any valuable constituents.

A batch of ordinary dry beans is reduced in a suitable grinding machine to the size of split peas, and the mass is then introduced into a tank containing a solution of 5 parts of soda and 95 parts of water and left to soak for 24 hours with frequent stirring. The alkali loosens the hulls from the beans and also dissolves the undesirable albuminoids. A little of the gluten-fibrin is also dissolved, but not in sufficient quantity to reduce the nutritive value. The detached hulls rise to the surface of the liquid and are skimmed off, whilst the heavier bean substance settles to the bottom. The alkaline liquid is drawn off and the beans are then removed to another tank containing a mixture of 1 part of hydrochloric acid and 99 parts of water, to neutralise the alkali. The excess of acid is then removed by washing by means of spray pipes arranged in the upper portion of the tank, the water escaping through an outlet pipe provided with a strainer. The mass is then dried in a suitable apparatus at a temperature not exceeding 215° F., and is then reduced to flour in a suitable grinding mill.

The dissolved albuminoids may be recovered by neutralising the fluid and may be used as cattle food or manure.—L. de K.

Nitrogenised Water, An Improved Process of Manufacture of. H. J. Haddan, London. From E. Freixa, Barcelona, Spain. Eng. Pat. 24,293, Dec. 18, 1895.

Air, deprived of oxygen by the combustion of phosphorus in the inverted bell of a hydro-pneumatic apparatus, is taken through washers containing solution of caustic soda, and is then pumped into a tank containing water, from which suction pipes simultaneously draw the water and gas to an air-compressor, in which they are subjected to a pressure of 18 atmospheres, while being agitated, to produce nitrogenised water.—E. S.

(B.)—SANITATION: WATER PURIFICATION.

PATENTS.

Precipitation Tanks for the Clarification of Sewage and Impure Waters, Improvements in or relating to. J. S. Pickering, Nuneaton, Warwick. Eng. Pat. 4186, Feb. 27, 1895.

UPWARD-flow precipitation tanks, provided with means for the removal of sludge, are furnished with filter-beds supported on fixed floors carried by girders which are built into the upper sides of the tanks. The filter beds, which are formed of gravel in the ordinary manner, are flushed periodically by removing the sludge from the tank below.—L. A.

Purifying Water, An Improved Method of. T. Royle, London. Eng. Pat. 8256, April 26, 1895.

THE purification of water for drinking purposes is effected by first mixing it with a solution of an alkaline manganate or permanganate and then with a solution of manganous chloride or other manganous salt. The precipitate is removed by filtration. Quantities mentioned are 1 grain of potassium permanganate and 2 grains of manganous chloride per gallon of water. If it is desired also to soften the water, the necessary quantity of lime is added during or at the end of the purifying treatment.—L. A.

Furnaces suitable for Consuming House, Trade, and other Refuse, Improvements in. J. B. Allott and J. McC. C. Paton, Nottingham. Eng. Pat. 8748, May 2, 1895.

THE furnace consists of a main combustion chamber, having a hearth and fire-grate at the bottom, a feeding opening at the hearth end, and a clinkering door at the grate end; this chamber has an arched reverberatory roof, through which pass ducts to flues or supplementary combustion chambers located above the roof of the main chamber. By this arrangement all gases and products of combustion have to pass over the hottest part of the fire before entering the flues or supplementary combustion chambers, and in these flues complete oxidation may be ensured by the admission of a secondary air supply.—A. G. B.

Purifying Water in Reservoirs and the like, and in Steam Boilers, An Improved Composition for. L. Lachery, La Bassée, Department du Nord, France. Eng. Pat. 11,289, June 8, 1895.

THIS composition contains "distilled water, eachon (an extract obtained from the *mimosa catechu*), neutral oxalate of potash, oxalic acid mixed with organic substance, neutral phosphate of soda, sugar, tannin, molasses, glycerin, potato flour, caramel, and pure crystallised nitrate of silver."—L. A.

(C.)—DISINFECTANTS.

Protecting Sugar Canes, Grape Vines, Currant Bushes, and like Plants from the Attacks of Parasites or Injurious Insects or Vegetable Growths, A New or Improved Preparation for. J. Y. Johnson, London. Communicated by A. Figge, Hameln, Germany. Eng. Pat. 6313, March 27, 1895.

NATURAL bitumen, reduced to a sufficiently low temperature to make it hard and brittle, is finely ground, and then intimately mixed with powdered dry clay, chalk, or earthy material in order to prevent the particles of bitumen from

adhering together or to the roots of the plants in such a manner as to injure them. This mixture, called "Strabonite," is to be introduced into the soil in which the plants are grown.—L. A.

Sulphurous Acid for Curative Purposes. An Improved Process for Manufacturing a Solution containing. F. Hartmann, Hallein, Austria. Eng. Pat. 19,702, Oct. 19, 1895.

THE aromatic parts of plants rich in essential oils, such as the pine, spruce fir, eucalyptus, peppermint, juniper, &c., are distilled in a digester with a solution of alkaline or alkaline-earthly bisulphites, under a pressure higher than the atmospheric. The distillate, which is an amber-yellow liquid of fragrant odour, is said to contain sulphurous acid in a form which does not irritate the respiratory organs and yet is fully as effective antiseptically as pure sulphurous acid. For curative purposes, the distilled liquid is caused to drip on to pine branches or shavings arranged in suitable frames, and the air thus impregnated with the vapours is inhaled.—L. A.

Disinfection, Formaldehyde Lamp for. B. Tollens. Zeits. f. angew. Chem. 1896, 51.

THIS is a spirit lamp with a hood of platinum wire gauze. The lamp is filled with wood spirit of about sp. gr. 0.792, and the hood placed over the wick, resting on the flat part of the wick-holder. A light is applied and as soon as the flame completely envelopes the hood, it is



extinguished by a momentary use of the glass cap. The platinum continues to glow, and formaldehyde is abundantly evolved. The chimney is now placed in position and the air-supply regulated so that the platinum glows brightly but no flame appears.—A. C. W.

Oxalic Acid, Behaviour of, during Putrefaction. D. Vitali. Boll. chim. farm. 1895, 34, 641.

100 grms. of flesh cut into small pieces, and some albumin were placed in a flask containing 2 grms. of oxalic acid dissolved in 1000 c.c. of water and allowed to stand for nine months. During this period the temperature was most favourable for putrefaction: in the summer it fluctuated from 25°–30°. At the expiration of the nine months, the mixture had a nauseating odour and an alkaline reaction. The flesh had a reddish colour and the filtered liquid gave characteristic reactions for albumins. It was possible to isolate the oxalic acid which, for the most part, remained unaltered. The acid appears to hinder the putrefaction to a certain extent, as evidenced by the relatively good preservation of flesh and albumin. The author considers this fact of importance in the detection of oxalic acid in toxicological cases.—J. L. B.

XIX.—PAPER, PASTEBOARD, Etc.

Papers, Tub-sized, Cost of Drying. C. Beadle. The Paper-maker and Brit. Paper Trade J. 1896, 11, 9–13 and 77–79.

IN drying paper after tub-sizing, the wet paper is generally caused to pass over skeleton drums, in which fans are made to revolve. The air is heated by means of steam pipes which are placed in stages, and so gradually raise the temperature of the air from the floor to the roof and thus maintain its capacity for moisture. This method the author calls the indirect method.

In the direct method, the air is drawn into the building by a fan through a series of cast-iron pipes placed over a coke-furnace. The defect in this method is that the pipes get unevenly heated, those at the bottom becoming red-hot, but this could be easily prevented by using different thicknesses of a non-conducting material, such as asbestos.

Another method of drying coming into use is the method of festooning, in which the paper is carried over laths by a travelling band, in loops about 5 ft. long. This method is specially adapted for surface-coated paper, as the coated surface is dried without being touched.

In the comparison of cost the skeleton drums were used. Data are given, and therefrom the author maintains that the cost of circulating the air bears no fixed relation to that of heating it, and that no conclusions can be come to in regard to cost per hour. When, however, the cost per ton of paper is taken, it is found that there is a direct relationship between this and the humidity of the outside atmosphere.

The direct system is found to be the most economical, as the air is heated directly, and no waste of heat occurs by radiation, &c., as in the indirect method. The mean cost per ton in the indirect method, was found to be 11s. 8d., and in the direct method 10s. 5d., thus being a saving of 1s. 3d. per ton. Coke was used in the furnace for heating the tubes, and an experiment proved that this was 1.8 times as expensive as coal, so that supposing coal to have been used in the direct method instead of coke, with the same efficiency of furnace, the saving in cost would have been 3s. 4d. per ton of paper, or 28 per cent. over the cost of drying by the indirect method of heating.

—S. P. E.

Modern Paper, Durability of. W. Herzberg. Die Chem. Ind. 1895, 18, 476–479.

BECAUSE paper made in former ages from rags only, has proved highly durable and been found in good condition even centuries after manufacture, it is frequently assumed that production from pure rag-pulp is still at the present day an essential and sufficient condition to ensure an equal degree of permanence. This conclusion the author considers to be too far reaching, since the manufacturing process now used differs widely from that formerly in vogue. The preliminary treatment of the rags by boiling with lime, soda, &c. is probably an improvement—resulting in less injury to the fibre—on the old putrefaction process. The modern bleaching process with chloride of lime is, however, a more serious factor. Undoubtedly, at this stage the fibre is more or less attacked, although there is no reason to suppose that its resisting power is seriously impaired. The danger lies rather in the incomplete removal, from the pulp, of decomposition products—especially calcium chloride. The latter in contact with alum (added during sizing) would give rise to aluminium chloride—a substance which readily gives off free hydrochloric acid, and, therefore, must exert a destructive action on cellulose. Again, when "antichlor" (sodium thiosulphate, &c.) is used to destroy excess of bleach, free sulphur is always deposited on the fibre, and this will in the course of time exert an injurious effect. Another possible source of weakness is the substitution of rosin for animal sizing. Mineral loading and staining materials may in general be regarded as inert bodies, having no action on cellulose. Some varieties of ultramarine, however, are apt to liberate free sulphur after a time.

As regards the durability of papers produced, wholly or partially, from wood-cellulose, esparto, &c., opinions are

still divided, some holding that these rag substitutes should never be used for paper that is intended to remain sound for long periods, and *vice versa*. In the case of unbleached cellulose and ground wood no doubt exists; these materials are known to deteriorate rapidly.

The author concludes, therefore, that this question of durability can only be definitely decided by series of systematic experiments extending over a long period of time.—H. T. P.

Blotting Paper, Absorptive Power of. G. Lanbeck. Mitt. Techn. Gewerbe-Museums, 1895, 11—12, 301—303.

THE author has made experiments with a specially prepared blotting paper containing 0.8 per cent. of ash, and with the same blotting paper loaded with various proportions of mineral matter, his object being to determine whether the presence of ash influenced adversely the absorptive power of the paper. The loading material used was "asbestos" and it was found that as much as 11 per cent. might be present without diminishing the capillarity of the paper which, however, fell off when the percentage of ash was further increased. The author points out that the presence of loading material may not be disadvantageous in cases where the spaces between adjacent fibres of the paper are larger than is necessary, but that when the quantity of loading is excessive the spaces on which absorption depends may become unduly congested.—B. B.

Plant Tissues, The origin of the Unsaturated Constituents of. C. F. Cross, E. J. Bevan and C. Smith. Ber. 1895, 1940.

See under XXIV., page 300.

PATENTS.

Vegetable Parchment Paper, Improvements connected with the Manufacture of. H. Sweetapple, Liverpool. Eng. Pat. 24,826, Dec. 21, 1891.

THE object of this invention is to produce vegetable parchment paper from raw paper web, by machinery consisting of a series of tanks containing the various liquids, with propelling winches or rollers at different points along its length and washing devices between the different stages of the process, the paper being introduced at one end as raw paper, passed in a continuous web and delivered as complete parchmentised paper at the other end. The machine includes an acid-treating apparatus, a bath containing water through which the acid-treated paper is passed, and by which the recovery of the acid is effected, a separate washing apparatus, and suitable nipping and propelling rollers, and vertical jet washing devices.—C. F. C.

Paper Making, Improvements in or connected with Machines for Grinding Pulp, Dyes, and the like for. G. Hibbert, Gateshead-on-Tyne. Eng. Pat. 25,040, Dec. 21, 1894.

THIS invention relates to improvements in a combined pulp refining engine and water mixer, and lifter used in pulp and paper making, and also for mixing and grinding colours, dyes, and other materials for paper and pulp making. Inventor claims in such engine the employment of a casing containing two revolving discs mounted on shafts and working in opposite directions, by which means the material being operated upon, is kept longer in the faces; the use of a centrifugal pump on the back of one of the discs for the purpose of lifting the backwater and better mixing the stuffs being operated upon; and the use of a hollow shaft by which the material is conveyed direct to the faces and so insures the stuff being operated upon before being discharged.—C. F. C.

Dandy Rolls for Paper Making, An Improvement in. John Lister, Leslie, North Britain. Eng. Pat. 797, Jan. 12, 1895.

THE spindle of the dandy roll is made hollow and perforated and is connected with a supply of steam. When the dandy roll is working, a number of fine jets of steam, issuing from the perforations, impinge upon the inner surface of the dandy roll cover, this process preventing the accumulation of froth upon the exterior.—S. P. E.

Paper, Improvements in Strainer Plates used in the Manufacture of. H. B. Watson and J. S. Watson, Newcastle-on-Tyne. Eng. Pat. 22,551, Nov. 27, 1895.

STRAINER plates, especially in oscillating paper pulp strainers, are at present arranged so that the paper stuff is preferably caused to travel in a direction at right angles to the slits, and as it is imperative in suction strainers to have strengthening ribs on the underside of such strainer plates, a certain amount of clean stuff is wasted by its rapid flow across these non-slitted strengthening bars.

According to the present invention, strainer plates are so constructed that the strengthening bars do not run across the plates, but end at a mid tie-bar, from which, to the opposite side, similar strengthening bars secure the necessary rigidity of the complete plate. By this contrivance the stuff is no longer able to avoid passing over the straining slits, as it does at present when the strengthening bars extend uninterruptedly across the plate, and a maximum amount of slit area is secured.—C. F. C.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Hydrobromic and Hydriodic Acids, Preparation of. J. H. Kastle and J. H. Bullock. Amer. Chem. J. 18, 105—111.

FOR the preparation of the first-named acid the method here proposed is considered simpler and better than either Erdmann's or Champion and Pellet's process. It is based on the reaction between bromine and naphthalene, which results in the evolution of hydrobromic acid gas. The naphthalene is dissolved in orthoxylenes, or petroleum distilling above 150° C., and the bromine is run slowly in under the surface. The effluent gas is allowed to pass through a concentrated solution of the same acid, containing in suspension amorphous phosphorus, and also through a tube containing a further supply of this latter substance. The acid and phosphorus remove any traces of free bromine and leave the gas, after drying, perfectly pure and colourless.

The operation is as easy and rapid as the preparation of hydrochloric acid from sodium chloride and sulphuric acid, and can be rendered automatic by controlling the flow of bromine into the naphthalene. When pure naphthalene is not available, "moth balls," consisting chiefly of this body, will do equally well.

From five series of quantitative experiments, the amount of hydrobromic acid produced came to an average of within about 9 per cent. of the theoretical yield of the bromine consumed. The method is recommended for lecture work and for preparing the acid in quantity.

The method adopted for preparing hydriodic acid is based on the reaction between iodine and colophony when heated together. It was first proposed by Etard and Moissan (Bull. Soc. Chim. 34, 69), but in the original form the acid is impure, and the following improvement has been devised:—

Equal weights of iodine and fine resin, both in an intimate state of division, are mixed with a slight excess of white sand, and gently heated in a retort. The iodine and brown liquor distilling over along with the acid are condensed in a Woulff's bottle, or in the attached U-tube containing red phosphorus, and, after passing through drying tubes, the pure hydriodic acid can be collected by displacement of air. The yield amounts to 5.4 parts of acid per 10 parts of iodine employed.

There is an entire freedom from danger of explosion by these methods, and no risk of the apparatus becoming choked by bromide or iodide of phosphorus as in other processes where this latter body is employed.—C. S.

Airol, A new Substitute for Iodoform. Therapeut. Monatsh. 1896, 10, 86.

THIS preparation, which was first described by Lüdy, is a basic bismuth-oxyiodide gallate. It is closely related to "Dermatol," a basic bismuth-gallate.

Airol is a greyish-green powder, stable towards light, possessing neither smell nor taste, and readily soluble in

sodium hydroxide and dilute mineral acids. It becomes gradually red in moist air, with the formation of a more basic compound containing less iodine.

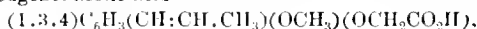
Haegler has obtained satisfactory clinical results with airoil, it is less poisonous than iodoform, and not more poisonous than dermatol.—J. L. B.

Eugenol, Some Derivatives of [Vanillin]. Ch. Gassmann and E. Krafft. Bull. Soc. Ind. Mulhouse, 1895, 263—267.

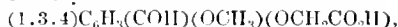
WHEN eugenol (*p*-hydroxy-*m*-methoxy-allyl-benzene) is cohobated with chloroacetic acid in presence of caustic soda for 20 hours, and the melt is subsequently acidulated with hydrochloric acid, eugenol-acetic acid—



separates out and, after crystallisation from water or 50 per cent. alcohol, forms white needles melting at 75° C., easily soluble in hot water, alcohol, and acetone, and volatile with superheated steam. By heating this acid for 24 hours at 150° C. with potash and amyl alcohol it is converted into iso-eugenol acetic acid—



which crystallises from alcohol, melting at 92—94° C. The same product can also be obtained by the action of chloroacetic acid and caustic potash on iso-eugenol, or by heating eugenol acetic acid with caustic soda for a short time at 200° C. When the sodium salt of this acid is oxidised with potassium permanganate and acetic acid, it yields acetaldehyde and vanillin-acetic acid—



which melts at 187° C. (Elkon, Ber., 19, 3055.) This latter product, when heated with twice its weight of phosphorus pentachloride at 130° C. until dissolved, and then poured into hot water, gives vanillin on evaporation or extraction, which was identified by its smell and melting point, 80° C.—T. A. L.

Rhodinol or Geraniol. H. Erdmann and P. Huth.

J. Prakt. Chem. 53, 1896, 42—46.

ACCORDING to the authors, the new terpene alcohol, $C_{10}H_{18}O$, which Hesse obtained by purifying geranium oil from the island Réunion, and termed "Réuniol," is identical with rhodinol, the principal fluid constituent of otto of roses. Rhodinol is further characterised by its diphenylmethane derivative $(C_6H_5)_2C:N(CO.OCC_{10}H_{17})$, which melts at 84° C., and crystallises from 80 per cent. spirit in long silky unacted needles. It is proposed that the term rhodinol shall be reserved as a scientific name for the chief fluid constituent of otto of roses. In commerce, however, it is necessary to employ both the terms geraniol and rhodinol since they designate oils of different origin, which, although undistinguishable by analysis, exhibit slight differences in taste and smell in the same way that alcohol differs when obtained from wine, corn, potatoes, or roots.—T. A. L.

Geraniol and Rhodinol. J. Bertram and E. Gildemeister.

J. Prakt. Chem. 53, 1896, 225.

THE authors review the literature concerning these substances and summarise it as follows:—

(1.) The alcoholic constituents, boiling about 230°, of the essential oils of the geranium, citronella, and rose, consist entirely or nearly entirely of geraniol, as also does the liearhodol, described by Barbier.

(2.) The fractions of the different pelargonium and geranium oils boiling at 225°—230°, contain another alcohol in addition to geraniol.

They find that the preparations from different sources, designated rhodinol, are not pure substances. These agree in containing geraniol, but in very varying quantity.

—A. C. W.

Réuniol, Rhodinol, and Geraniol, the alleged Identity of. A. Hesse. J. Prakt. Chem. 53, 1896, 238.

THE réuniol discovered by the author in pelargonium oils has been found in Wallach's laboratory to be a terpene alcohol of the formula $C_{10}H_{18}O$. It differs from geraniol, $C_{10}H_{18}O$,

in constitution and properties. Rhodinol is an impure réuniol. Prepared according to Ger. Pat. 80,007 of the firm of Gilliard, P. Monnet, and Cartier, from French pelargonium oil, rhodinol, in consequence of the large proportion of geraniol it contains, differs completely from réuniol.

—A. C. W.

Acetanilide, Phenacetin, Quinine Sulphate, &c., Scheme for Identification of. F. S. Hyde. J. Amer. Chem. Soc. 1895, 17, 933.

See under XXIII., page 297.

Alkaloids, Acidimetric Estimation of Vegetable. L. F. Kebler. J. Franklin Inst. 1896, 141, 141.

See under XXIII., page 300.

PATENTS.

Vanillin, Improvements in the Manufacture of. M. O. and A. Verley, Paris. Eng. Pat. 24,446, Dec. 15, 1894.

THE process consists in electrolytically oxidising a solution of iso-eugenate of soda (or other convenient base) treating the resulting product with an acid and separating the vanillin so produced.—C. F. C.

Ethers of Para-lactylamidophenol, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Höchst a/M., Germany. Eng. Pat. 2427, Feb. 4, 1895.

To prepare lactyl-*p*-phenetidine, equal molecular proportions of *p*-amidophenol and lactic acid are heated to 170°—180° until the formation of water ceases. The melt is then dissolved in water, and after the addition of animal charcoal is crystallised from the aqueous solution. The *p*-lactylamidophenol thus obtained is dissolved in dilute alcohol, and heated with the calculated quantity of alkali and ethyl bromide, chloride, or iodide, or salts of ethyl sulphuric acid, in a closed vessel on a water-bath for 4—5 hours. The alcohol is then distilled off, and the residue is crystallised from hot water.

By substituting methyl halogen derivatives or salts of methyl sulphuric acid for the ethyl compounds, *p*-lactyl anisidine is obtained.—C. F. C.

Benzamide-o-Sulphonic Acid and of Saccharin and other Derivatives thereof, The Manufacture of. H. E. Newton, London. From "The Farbenfabriken vorm. F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 3930, 1895.

THE basis of this patent is the preparation of benzamide-*o*-sulphonic acid by heating benzene-*o*-sulpho-carboxylic acid, or salts of the acid with ammonium sulpho-cyanate.

From the product they proceed to "Saccharin" by the following stages: (1.) Treatment of the salts of the acid with $POCl_3$, PCl_5 , &c. (2.) Treatment of the resulting chloride with ammonia to produce the corresponding amide. (3.) Hydrolysing the benzamide group by heating with sodium hydroxide solution containing 4 per cent. of NaOH. (4.) Finally precipitating the saccharin by acidulating the solution from (3).

The specification contains a full statement of the advantages of the process over that in which benzene-ortho-sulphonic carboxylic acid is used initially.—C. F. C.

Assimilable Iron Compounds, Manufacture of. O. Imray, London. From "The Farbwerke vorm. Meister, Lucius, and Brüning," Höchst a/M., Germany. Eng. Pat. 7169, April 8, 1895.

WHEN, previously freed from albumin and milk-sugar, is treated with barium or calcium salts to throw down the phosphates, and after the excess of the reagent is removed, an iron compound is precipitated by the addition of ferric chloride in the hot. It forms a heavy brown powder, containing about 30 per cent. of iron, soluble in alkalis and alkaline carbonates; and it is only decomposed by sulphides and ferrocyanides after standing some time. It is adapted for use in medicine.—F. H. L.

Chemical Compounds containing Sulphur from Derivatives of Cinnamic Acid, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vorm. F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 8425, April 29, 1895.

Two parts of the ethylic salt of cinnamic acid and 1 part of sulphur are heated for 8 to 10 hours at 250° — 260° C. After the alcohol has distilled off, the mass is cooled, dissolved in hot spirit, decolorised with animal charcoal, and crystallised several times. The product has the formula $C_{11}H_8S_2O$. It forms yellowish, odourless plates, soluble in benzene, ether, acetone, fats, &c.; but it is almost insoluble in water. On boiling with caustic soda, it is decomposed, acetophenone being produced. Other alkyl salts of cinnamic acid may be employed in an analogous manner. The new thio-compound is claimed as suitable for therapeutical purposes.—F. H. L.

Vanillin, Improvements in the Manufacture or Production of. W. Majert, Falkenberg, Prussia. Eng. Pat. 21, Jan. 1, 1896.

16.4 KILOS. of iso-eugenol, 4.0 of caustic soda, and 25.6 of the sodium salt of chloronitrobenzene sulphonic acid, or 30.0 of the corresponding bromo-compound, are dissolved in water and boiled under an inverted condenser for 12 hours. The resulting sodium salt is salted out, and forms a brownish gum-like product. 37.6 kilos. are then oxidised with 32 kilos. of sodium bichromate and 445 of 10 per cent. sulphuric acid. After boiling for 6 hours, the liquid is made alkaline, the chromium hydrate filtered off, 10 kilos. of caustic soda added, the whole again boiled till the yellow colour no longer increases in intensity, then acidified with dilute sulphuric acid, and the vanillin extracted with ether. The extract is shaken with an aqueous solution of sodium bisulphite, and the resulting compound decomposed with the necessary amount of acid; the vanillin being finally re-crystallised from benzene.

—F. H. L.

XXI.—PHOTOGRAPHY.

Ferrous Oxalate Development, Use of Clearing-Bath after. C. H. Bothamley. Photography, 1896, 8, 98.

DURING ferrous oxalate development, a part of that salt becomes peroxidised, and in the absence of free acid, is converted into a basic ferric oxalate; it is probable that the deposition of this salt in the film on subsequent washing produces the red-brown deposit, which would be most noticeable when the wash-water is very hard. The presence of free acid in sufficient quantity prevents the precipitation of this substance by the formation of a soluble ferric salt; and the good effect of adding a little sulphuric acid to the developer is thus explained. To prevent the formation of the coloured deposit, the plate is dipped before washing into a 3 to 4 per cent. alum solution containing a little oxalic acid. This acid has the desired effect without seriously injuring the gelatin film.—W. G. M.

PATENT.

Colour Photographs, Improvements in, and Apparatus for Producing and Viewing the same. B. J. Edwards, Hackney. Eng. Pat. 3613, Feb. 19, 1895.

THIS patent contains a description of (1) a device for the production of three coloured negatives on different plates by simultaneous exposure in one camera, and (2) arrangements for viewing the dia-positives prepared from these negatives. An ordinary camera is fitted with two semi-transparent mirrors, consisting of lightly silvered glass plates, set at an angle of 45° to the path of the rays. The front mirror is so arranged that half of the light admitted by the lens is reflected, made to pass through a red screen, and allowed to act on a red-sensitive plate. The second one reflects part of the light transmitted by the former, whence it passes through a yellow or green screen, and acts on the plate for the green sensation. The residual light is used to produce the negative for the blues, the plate being placed in

the usual position, and either sensitised specially for blue, or exposed behind a blue or violet screen. By adjusting the relative amounts of light reflected and transmitted by the mirrors, and also the depth of tint of the screens, the three plates may be arranged to require the same length of exposure. The camera may be made to give stereoscopic pictures if desired; and it will be noticed that two of the negatives are "reversed," the third being in the natural position.

To view the positives, each may be mounted in contact with a transparent medium of the required colour; the three being superimposed by optical means. They may be "projected" by a triple lantern, or by a lantern having only one lens and arranged exactly as the original camera. A composite slide is, however, preferable, and is prepared by making "lantern-slides" on glass from two of the negatives, and on celluloid from the third, in the respective complementary colours, mounting the former film to film with the celluloid in the middle, and throwing a beam of white light through the whole.—F. H. L.

Glass, Producing Indelible Pictures upon, A Method of. F. Schachinger, Munich. Eng. Pat. 6502, March 30, 1895.

See under VIII., page 275.

XXII.—EXPLOSIVES, MATCHES, Etc.

Saturation- and Critical Temperatures [Valuation of Dynamite, &c.] Crismer and Motteu. Assoc. Belge des Chim. Chem. Zeit. 1896, 20, 41.

See under XXIV., page 300.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

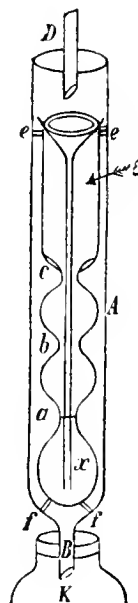
Extraction Apparatus, A New. J. J. L. Van Rijn. Ber. 28, 2387.

THE apparatus consists of a wide glass tube A, drawn out at the end B.

A second tube c, narrowed at three places a, b, c, and having four equally large holes at e.

At the narrow part a is a mark indicating 20 c.c. from the bottom of the tube.

The tube c rests in A by means of pieces of glass rod fused to it at e and f. A funnel tube is suspended, reaching almost to the bottom of C.



The liquid to be extracted (solution of extract, milk, &c.) is introduced through the funnel, by means of a pipette into *x* up to the mark *a*. The ether vapours rising from *K* enter the tube *A* through *B*, warm the inner tube *x*, and rise by *c* into the condenser *D*. The ether then drops through the funnel into the liquid in *x*, becomes saturated with alkaloid or fat and then rises, passing through the holes at *c*. The extraction takes place at a temperature very near the boiling point of the extracting liquid (ether, benzene, &c.) The apparatus is easily cleaned, and is so arranged that for extracting liquids no weighing is required, but the liquid is simply measured.

The special advantage of the apparatus is seen when several estimations of the same liquid or extract are required. A solution of known concentration is made and 20 c.c. introduced into *x*, viz., up to the mark *a*, and the extraction proceeded with in the usual way.—H. M.

Gas Burettes, Modifications of the Hempel and Bunte.
O. Bleier. Ber. 28, 2423.

Fig. 1 is a modification of Hempel's gas burette, and consists of a measuring tube *A*, with which a levelling vessel *B* is connected. At the top of the measuring tube is a capillary *a* fitted with tubing and a clip. At the bottom is a

Fig. 1.

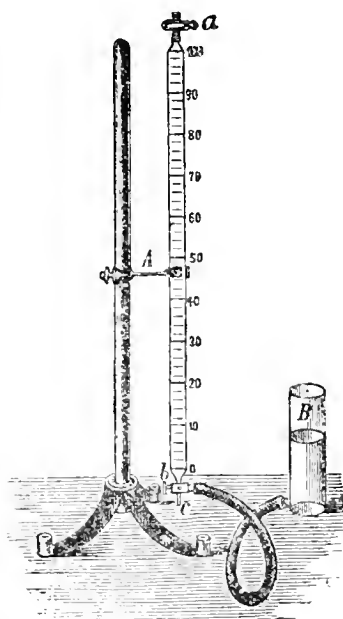
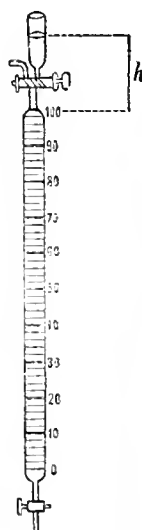


Fig. 2.



three-way tap *h*, which makes the connection either with the outlet *c* or with the levelling vessel.

The gas is drawn through the tube *a*; easily soluble gases are allowed to pass through for a few seconds after the tube is emptied, so that the water adhering to the sides becomes saturated.

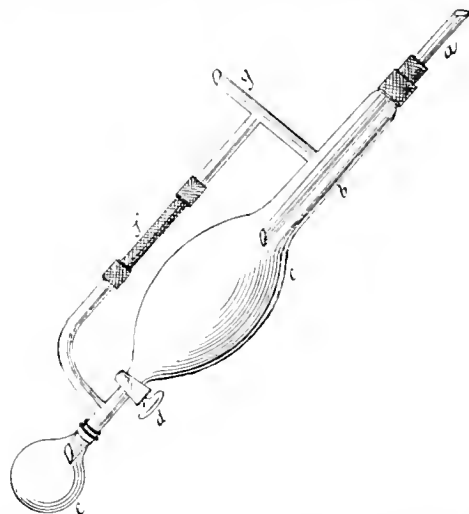
Fig. 2 is a modification of Bunte's burette, and may be made from the same by simply shortening the lower end. At the top is a two-way tap, and at the bottom an ordinary glass tap with water outlet drawn to a fine capillary, so that the tube requires 2–3 minutes to empty. From one tap to the other is a space of 100.7–101 c.c. So much water is contained in the cup that when the burette is filled with gas at ordinary atmospheric pressure, water admitted through the two-way tap reaches up to the 0 c.c. mark, thus causing the burette to hold exactly 100 c.c. of gas. All measurements are then taken with the water in the cup at the same level *h*.

The measuring tube is filled with water, and gas allowed to pass through for a few seconds. The absorbing liquid is introduced from the cup, and after shaking and washing with water, the reading is taken. The second absorption

liquid is introduced either by running in at the same time as the first liquid runs out, or by drawing out the first liquid by means of suction, and causing a partial vacuum.—H. M.

Laboratory Apparatus, New. O. Eberhard. Chem. Zeit. 1896, 20, 39.

Receiver for the Fractional Distillation of Fuming Solutions.—The end of the condenser tube *a* is connected by india-rubber tubing with the neck of the receiver *c*; the



receiver has a side tube *g*, which may be joined to a calcium chloride tube. The other end of the receiver is closed by a stop-cock *d*, and the side tube *g* is connected with the receiver-tube beyond *d*, by glass tubing joined with a rubber tube *f*, that may be closed by a pinch-cock or with a glass stop-cock sealed on to the glass tubes themselves. The cocks are only closed when the flask *c* is changed. In this way fume or poisonous gases are prevented from escaping, and the collecting flask may be changed without stopping the distillation. For distillation *in vacuo* either a flask with a side-tube is substituted for *c*, or an ordinary flask is attached by means of a two-holed cork.

Condenser for Use in Distilling Small Quantities of Substances.—A weighed test-tube is inserted in the mouth of the condenser with the aid of an india-rubber joint, and

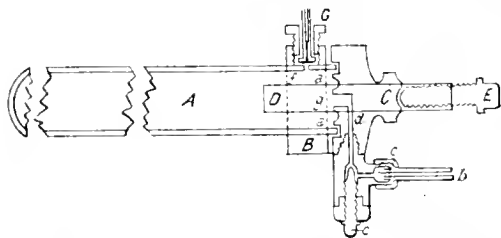


the tube of the fractionating flask is brought directly into it. The condensation even of volatile substances is satisfactory.—W. G. M.

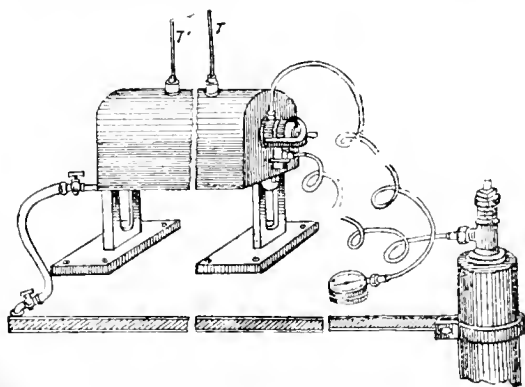
Pressure Tube for Laboratory Purposes. J. Walter.
J. Prakt. Chem. 1896, 53, [2, 3], 132–139.

The author's pressure tube is designed to prevent the bursting of ordinary sealed glass tubes during heating by subjecting them to increased pressure from without. For this purpose the sealed glass tube is introduced through the bronze cover of the apparatus at *E* into the Mannesmann metal tube *A* which is about 560 mm. long and 32 mm. wide. *B* is hard-soldered to a copper tube of 2 mm. bore connected with a cylinder containing compressed carbon dioxide which is admitted to the tube *A* by opening the

valve *c*. *G* communicates with a gauge for indicating the pressure. The apparatus, mounted for an experiment, is shown in the second figure. When the cover is made of



bronze a washer of lead, &c. is, as a rule, unnecessary, and as soon as the apparatus has been proved to be gas-tight the heating may be begun.



With the above apparatus much thinner sealed tubes may be heated with safety, and in many cases, *e.g.*, in splitting off the SO_3H group by means of dilute sulphuric acid, it is not even necessary to seal up the tubes at all if the apparatus is placed in a vertical position in a suitable heating bath. The action of corrosive vapours on the apparatus may often be prevented by pouring a little paraffin or mineral oil on the surface of the liquid and by employing sufficient pressure, or when heating up to about 140° by corking up the tube. When alkaline liquids are being heated the glass tube may be omitted. The apparatus may also be used for drying or heating *in vacuo*, for distillation under pressure, for the determination of the solubility of gases and of solid substances in liquids at high temperature and pressure, and for the determination of the vapour pressure of liquids at high temperatures.—J. S.

PATENT.

Thermometers, Improvements in. E. M. V. Gibb, London, and G. W. Simpson, London. Eng. Pat. 5653, April 1, 1895.

INSTEAD of the wide enamel backing as usually arranged for chemical, clinical, and other thermometers, a narrow vertical strip only of enamel or other suitable material is used, which is placed immediately behind the liquid column, leaving a clear strip on each side, whereby the graduations, which are marked on the back, are easily seen through these clear portions.—R. S.

INORGANIC CHEMISTRY.— QUANTITATIVE.

Methane and Hydrogen, Determination of, by Explosion. A. H. Gill and S. P. Hunt. J. Amer. Chem. Soc. 1895, 17, 986—994.

The results of the authors' investigations may be summarised as follows:—

1. That the usual method of preparing methane by heating sodium acetate with sodium hydroxide and quick-

lime yields a gas largely contaminated with hydrogen. 2. That the determination of methane and hydrogen by one explosion with oxygen yields results within 0.5 per cent. of the methane and 0.3 per cent. of the hydrogen, whilst with two explosions the limits were 0.2 and 0.3 per cent. respectively for the two gases. 3. When a mixture of hydrogen and methane is exploded with a quantity of oxygen insufficient for both, but more than sufficient for either taken separately, about 60 per cent. of hydrogen, 25 per cent. of methane, and 50 per cent. of oxygen are consumed. 4. The method of determining methane and hydrogen by one explosion with air does not afford accurate results.—J. L. B.

Vitriol, Determination of Arsenic in Concentrated.

G. Hattenauer. Zeits. angew. Chem. 1896, 130—131.

THE smallness of the amount of arsenic necessitates the employment of large quantities of vitriol. The literature of the subject is almost exclusively confined to the reactions of hydrogen sulphide and arsenious and arsenic acids or their salts. Authors note the conditions favourable to a rapid and complete precipitation of arsenic by hydrogen sulphide, but solutions of suitable acidity are supposed to be under examination. Even the instructions given in technical hand-books have been found faulty, since the dilution with water precipitates the lead incompletely as PbSO_4 , and what is precipitated is most difficult to filter off. A further disadvantage is that the after treatment with hydrogen sulphide may precipitate other bases than arsenic, and the arsenic precipitate is usually a mixture of arsenic tri- and pentasulphides with free sulphur.

All these difficulties may be avoided if use be made of the property of arsenic, of being quickly and completely precipitated from solutions containing large excess of hydrochloric acid and if at the same time attention be given to the strength of the acid solution used for precipitation.

The author used for his experiments an acid of sp. gr. 1.815 at 22.5°C . 500 c.c. of this acid were cooled and diluted with 500 c.c. of water. An acid of sp. gr. 1.46 at 15° was produced. 500 c.c. of dilute hydrochloric acid (1:2) were then added to 500 c.c. of the diluted vitriol, the cooling being continued. The author finds that a greater excess of hydrochloric acid than the above has no detrimental effect upon the after precipitation of the arsenic; still the above amount is sufficient to prevent either lead sulphate or lead sulphide from being precipitated, this prevention being the object of its addition. The liquid, which must be cooled as far as possible and kept at a low temperature, is now subjected to a rapid stream of hydrogen sulphide, continuing it at least for 45 minutes. It is better to allow an extra 15 minutes, and then the arsenic pentasulphide, which should be of brilliant yellow colour and curdy, may be immediately filtered off. The degree of dilution obtained by following the directions given above is one which leaves the filter paper unattacked by the acids. No lead was found in the washed precipitate, although the vitriol contained 10 times as much lead as arsenic. The precipitate consists, according to Branner and Tomieck (Monatsh. f. Chem. 8, 607) and Neher (Zeits. anal. Chem. 32, 45, this Journal, 1894, 376) of pure arsenic pentasulphide. The further treatment of this precipitate is carried out in the usual way, according as one desires to weigh it as the sulphide, the oxide, or as magnesium arsenate.

The author concludes by stating that, using his method, the determination of arsenic in concentrated vitriol can be completed in 3—4 hours, and that it is therefore one of the most rapid gravimetric determinations known.—J. B. C. K.

Persulphates, Analysis of. F. Ulzer. Mitt. techn. Gewerbe-Museums in Wien, 1895, [11—12], 310—311.

THE author takes exception to such existing methods for the determination of the available oxygen in persulphates as depend upon the liberation of iodine from potassium iodide in presence of hydrochloric acid, and on the liberation of chlorine by distillation with hydrochloric acid, and determination of the iodine ultimately liberated according to the method of Bunsen. He also considers the process of heating the persulphate with excess of standard oxalic acid in the

presence of dilute sulphuric acid, and titrating the residual oxalic acid by means of potassium permanganate as invalid.

The method adopted by him is as follows:—0.3 gram. of the persulphate is heated with a solution of ammonium ferrous sulphate, containing 1 to 1.5 gram. of the salt and dilute sulphuric acid, either in a stream of carbon dioxide or in an apparatus provided with a Hansen valve. At the end of half an hour oxidation is complete, and the excess of the ferrous salt can be titrated back with potassium permanganate. The results quoted for this method worked on commercial ammonium persulphate, are good. A complete analysis of the salt, which commonly contains ammonium sulphate and bisulphate, may be made by determining the total sulphuric acid (including that resulting from the decomposition of ammonium persulphate, by boiling with hydrochloric acid for some time), estimating the ammonia in the usual way and ascertaining the content of free sulphuric acid by titration, using methyl orange as an indicator. Water must be taken by difference. A sample thus analysed had the following composition:—Ammonium persulphate, 45.61 per cent.; ammonium hydrogen sulphate, 48.77 per cent.; fixed salts, 0.61 per cent.; water, 5.01 per cent. It may be remarked that an aqueous solution of ammonium persulphate of a strength of about 15 grms. of the crude salt per litre, keeps its strength very well.—B. B.

Manganese, Determination of, in Crude Iron. F. Ulzer and J. Buill. Mitt. techn. Gewerbe Museums in Wien, 1895, [11—12], 312, 315.

THE author criticises existing methods for the determination of manganese in crude iron and proposes the following process:—A solution from which the iron has been removed by the use of zinc oxide and containing about 0.1 gram. of manganese, is treated with 20 c.c. of a 0.5 per cent. solution of hydrogen peroxide; caustic soda is added so long as a precipitate appears and the solution is boiled, allowed to cool, treated with a known amount of standard oxalic acid, and 10 to 20 c.c. of pure dilute nitric acid (1:10). The whole is gently warmed until the precipitate is dissolved, finally brought nearly to boiling, and the excess of oxalic acid is titrated back with permanganate. In calculating the content of manganese the composition of the precipitated peroxide is taken as 5 MnO , MnO . The authors state that under the conditions named the excess of hydrogen peroxide used in precipitating the manganese is wholly dissipated. The results of this process as compared with a gravimetric analysis are satisfactory. A rapid method somewhat less exact, but suitable for works tests on ferro-manganese, can be adopted by omitting to remove the iron by means of zinc oxide, and thus carrying out the final titration in a solution coloured by a ferric salt. Dilute sulphuric acid if substituted for dilute nitric acid at the stage of the process in which the manganese peroxide is caused to act upon oxalic acid, leads to low results. The iron under analysis may be conveniently dissolved in a mixture of 10 parts of strong nitric acid to 2 of strong sulphuric acid and 2 of water (all by volume). During evaporation about 10 c.c. of strong hydrochloric acid should be added.—B. B.

Gold, Estimation of, in Brilliant Gold and Enamels. M. Schöner. Ann. de Chim. anal. 1896, 1, 47.

BRIGHT-GOLD is a varnish consisting of a sulpho-organic gold compound, contained in a liquid sufficiently viscous to admit of being painted on the polished surface of glass and ceramics. After "kilning" at a temperature not exceeding a low red heat, a glistening coating of metallic gold results. The colour and lustre are dependent upon the amount and quality of the gold contained in the original liquid. The estimation of the gold cannot be effected by removing the organic matter by ignition, owing to the presence of other metals, such as silver, and of readily fusible bismuth salts, the latter serving as an adhesive between the gold and glass. The author weighs out about 10 grms. of the varnish into a fairly large porcelain crucible, and evaporates the volatile constituents at a gentle heat on a sand-bath, avoiding violent ebullition. The residue is then burnt at the lowest possible temperature, so that the porcelain glaze does not fix gold, the mass is then repeatedly extracted with cold or slightly warm aqua regia, consisting of 2 parts of hydrochloric acid

and 1 part of nitric acid (36° B.). The gold is separated from the combined extracts by reduction in the usual manner with ferrous sulphate. If after treatment with aqua regia the interior of the crucible be spotted of a violet or rose colour, such portions of the crucible must be finely powdered and extracted as before, so that all gold adhering to the glaze may be removed.—J. L. B.

Phosphorus in Phosphor-Bronze, New Method of Estimating. F. Oettel. Chem. Zeit. 1896, 20, 19—20.

FROM 3 to 10 grms. of the bronze are digested with nitric acid; the tin oxide is filtered off, well washed, dried, ignited, and fused in a porcelain crucible for a few minutes with three times its weight of potassium cyanide. The melt is boiled with water, and the reduced tin is filtered off. The solution contains the whole of the phosphorus as potassium phosphate, in addition to potassium cyanate and cyanide; it is boiled with an excess of hydrochloric acid until there is no more smell of hydrocyanic acid; traces of lead and tin are precipitated by hydrogen sulphide and filtered off. The filtrate is boiled, the last traces of hydrogen sulphide are oxidised with a few drops of bromine, and the phosphoric acid is precipitated with magnesia mixture. The volume of solution at this time need not exceed 50 c.c. The presence of arsenic does not interfere with the determination in the least, a part of it being lost on the calcination of the filter, a part on fusion with the cyanide, whilst the remainder is reduced with the metallic tin, which is always found to collect more readily into globules in the presence of arsenic than it is otherwise.

—W. G. M.

Oxygen in Commercial Copper, Determination of.

B. Blount. Analyst, 21, 57.

THE author points out that the unreliability of existing methods for the estimation of oxygen in copper is probably due to the fact that all the oxygen does not exist as cuprous oxide (except in refined ingot copper), but as lead oxide, lead arseniate, &c.

The following process, which was found to be very satisfactory, will act equally well for copper-tin alloys, but not for brass, on account of the difficulty of reducing zinc oxide.

The copper is cut into stout strips and weighed out into a porcelain boat, which is placed in a porcelain tube, and the tube heated in a small blast furnace. Pure dry hydrogen is passed through the tube and the water formed, is collected in a weighed sulphuric acid tube.—A. S.

Thomas Slag, Ground, Improved Method for Estimating Soluble Phosphoric Acid in. F. Mach and M. Passon. Zeits. angew. Chem. 1896, 129.

PRECIPITATION with ammonium molybdate is avoided in this method, and considerable time saved.

100 c.c. of the solution of the phosphoric acid prepared according to Wagner's directions, are placed in a $\frac{1}{2}$ -litre flask, having a long narrow neck; 10 c.c. of concentrated sulphuric acid, 15 c.c. of concentrated nitric acid (to promote quiet ebullition), and a drop of mercury of the size used in the method of Kjeldahl for nitrogen determinations are added, and the mixture is then gradually heated to boiling, until colourless. After cooling, 20 c.c. of a 10 per cent. NaCl solution are added to precipitate the mercury, the liquid is rinsed into a 200 c.c. flask, which is filled up, and 100 c.c. of this filtered solution are then treated with 100 c.c. of the usual ammonium citrate solution and 25 c.c. of magnesium mixture. The remainder of the process is carried out in the usual way.

The authors give results of 28 separate determinations by the usual Wagner method and their own, showing that the greatest difference between the actual amounts of magnesium pyrophosphate obtained by the two methods was 0.0022 gm.

They also remark that there is no danger of the presence of silicic acid in the magnesium pyrophosphate obtained when using their method, whilst by the older method with silicious slags this is a possible impurity.—J. B. C. K.

Metals in Liquids, Estimation of Minute Quantities of, [Drinks] Note on. E. R. Budden and H. Hardy, Analyst, **21**, 12.

THE authors found that in the colorimetric estimation of metals, the presence of sugar, essence of lemon, saccharin alone, and a mixture of saccharin and sugar, made no appreciable alteration of tint. In the colorimetric estimation of iron, the tint was found to darken rapidly if the solution were allowed to stand for any length of time. The authors point out the necessity of making colorimetric tests under exactly similar conditions for any purposes of comparison.

From a number of experiments on the electrolytic determination of metals, it was found that in the case of copper, the results obtained were somewhat low, but on the whole fairly satisfactory. With lead, the results were very unsatisfactory, this being also the case when both copper and lead were present.

The authors state that in their opinion, colorimetric methods are best for estimating small quantities of metals.

—A. S.

ORGANIC CHEMISTRY.—QUALITATIVE.

Alcohol, Molybdic Acid as a Reagent for. E. Merck. Chem. Zeit. 1896, **20**, 228.

As little as 0.02 per cent. of ethyl alcohol or 0.2 per cent. of methyl alcohol may be detected in water by means of molybdic acid. The method which gives the best results is to dissolve the molybdic acid in warm strong sulphuric acid, and to pour the alcoholic liquid gently upon the solution in a test tube at a temperature of 60° C. At the point where the liquids meet, a blue ring appears when alcohol is present, which is always more marked as the percentage increases. On mixing, the ring disappears but it recurs on the addition of fresh molybdenum solution. A number of other substances besides alcohol give the same reaction.—W. G. M.

Acetanilide, Phenacetin, Quinine Sulphate, &c., Scheme for Identification of. E. S. Hyde. J. Amer. Chem. Soc. 1895, **17**, 933—935.

By boiling the substance with caustic potash and chloroform (isonitrile reaction), phenacetin gives this reaction, but

SCHEME FOR THE IDENTIFICATION OF ACETANILIDE, PHENACETIN, QUININE SULPHATE, &c.

Pure Substance.	Melting Point.	Solubility in Water.	Solution of Substance in Water.			
			Boiled with Excess of Caustic Potash and Few Drops of Chloroform.	Ferric Chloride.	Dilute Nitric Acid.	Bromine Water.
Acetanilide (phenylacetamide)— $C_6H_5NH.COCH_3$	113°	Soluble in cold; more so in hot.	Odour of isonitrile.	Yellow solution; red on boiling.	Colourless.	White crystals; para-bromo-acetanilide.
Exalgin (methylphenylacetamide)— $C_6H_5N.CH_3(COCH_3)$	101°	Cold: not very soluble. Hot: easily soluble.	No odour of isonitrile. Class of secondary amines.	Yellow solution; cloudy red on boiling.	Colourless.	No precipitate.
Phenacetin (acetyl-para-amido-phenetol)— $C_6H_4.OC_2H_5.NH.COCH_3$	135°	Soluble with difficulty.	Odour of isonitrile.	Yellow solution; blood-red on boiling.	Cloudy yellow solution. Crystals of nitro-compound.	No precipitate.
Phenecoll hydrochloride (glycocoll para-amido-phenetol)— $C_6H_4 \begin{cases} OC_2H_5 \\ NH.COCH_2.NH_2.HCl \end{cases}$	No m.p. HCl comp.	Very soluble.	Odour of isonitrile.	Yellow solution; darkens and orange precipitate on boiling.	Colourless.	No precipitate.
Salol (phenol salicylate)— $C_6H_4.OH(COO.C_6H_5)$	83°	Soluble with difficulty.	No odour of isonitrile. Yellow solution.	Yellow solution; blood red on boiling.	Colourless.	No precipitate cold; white cloudy compound on boiling.
Resorcinol (meta-hydroxybenzene)— $C_6H_4(OH)_2$	118°	Easily soluble.	No odour of isonitrile. Carmine-red solution.	Dark violet; yellowish on adding drop of sulphuric acid.	Yellow solution.	Yellowish precipitate, dissolving immediately.
Quinine sulphate— $C_{20}H_{24}N_2O_5.H_2SO_4$	..	Slightly soluble with few drops of sulphuric acid; dissolves with blue fluorescence.	Base precipitates and dissolves on heating.	Yellow solution.	Colourless, with bluish fluorescence.	Dry substance on porcelain with weak bromine water gives green coloration on addition of two or three drops of ammonia water. Thallicum test.
Antipyrin (phenyldimethyl-pyrazolone)— $HOC_5N_2(CH_3)_2C_6H_5$	113°	Soluble.	Nothing.	Blood-red; disappears on adding a drop of sulphuric acid.	Colourless.	Yellowish-white precipitate.

exalgin being a secondary amine, does not. In carrying out the test it is advisable to make the solution strongly alkaline, so as to ensure complete decomposition, and a quick reaction. (See tabulated scheme above.)

—J. L. B.

Nitrotetramethyldiamidotriphenylmethanes, Reduction of [Qualitative Test for Position of Nitro-Groups]. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1895, 239.

See under IV., page 268.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Petroleum Industry, Uniform Methods of Testing, Review of Methods Based on the Degree of Refinement by

Means of Caustic Lye. K. Charitschkoff. Chem. Rev. u. d. Fett u. Harz Ind. 1896, [36], 57—58.

APART from the unreliable test with decinormal sodium hydroxide and phenolphthalein, there are two methods current in Baku for determining the degree to which the alkali process of refining has been performed. In the one a strong soda-lye of 30° to 35° B. is shaken up with twice its volume of petroleum, and the formation of flocculent soaps at the plane of contact of the liquids forms a measure of the degree of impurity still remaining. This test, however, does not suffice for purposes of comparison between different oils, and another method has been adopted wherein 6 per cent. by volume (as compared with the amount of petroleum) of a 2° B. soda solution is used, the agitation being effected at 70°. The aqueous solution

is filtered off and made slightly acid with hydrogen chloride, whereupon any petroleum acids present are liberated and give rise to turbidity in proportion to their amount. The test is rapid and affords a good indication of the comparative purity of different oils; it can be worked on the basis of the production of a certain degree of opacity either with a standard amount of alkali, or with a fixed amount of petroleum. In the case of lubricating oils, to which the test is also applicable, and for which a somewhat higher temperature must be maintained, the degree of impurity is indicated by the amount of insoluble soapy layer formed at the zone of contact, the soaps from the acids of the heavier oils being less soluble than those from oils of lower density.—C. S.

Asphaltum, Use of Acetone in the Technical Analysis of. F. F. Peckham. J. Franklin Inst., **141**, [843], 219—223.

In examining the method advocated by Sadtler (this Journal, 1896, 222), wherein acetone is employed as a solvent for bitumen instead of petroleum spirit, the author tested samples of Trinidad pitch, both crude and purified, by the process described by Miss L. A. Linton (this Journal, 1895, 960), and also by the acetone method. He found that whilst petroleum spirit dissolves more of the bitumen than does acetone, the latter extracts a quantity of non-bituminous and mineral matter more than sufficient to compensate for the deficiency. In other instances, such as the case of a very dry Egyptian asphaltum and an Athabasca River maltha, the solvent power of petroleum spirit greatly surpassed that of acetone, and the author therefore considers that the lack of parallelism observed, puts acetone out of the question as a substitute for the spirit. Besides, its property of dissolving non-bituminous matter is calculated to defeat the object in view, and its action more closely resembles that of the alcohols than that of true solvents of bitumen.—C. S.

Crude Cresol, Approximate Valuation of. A. Schneider. Pharm. Centralhalle, **36**, 552.

This process is founded on a comparison of the intensity of the yellow tint assumed respectively by a pure cresol mixture, and by cresols obtained from the substance examined, when treated with nitric acid and ammonia. Crude cresol is dissolved in soda-lye and the solution is diluted with 5 vols. of water, and the hydrocarbons (naphthalene, &c.) are removed by shaking with benzene, the cresols being separated by means of acid, the pyridines being combined at the same time. The cresols thus separated, are collected, dried with calcium chloride, and distilled. Thus, the pure cresol mixture is prepared. But, instead of this, commercial cresol dehydrated with calcium chloride, may be used. 1 gram. of this pure cresol is dissolved in water, and the solution is diluted to 100 c.c.; it serves as the standard of comparison. 1 gram. of the cresol to be examined, is also dissolved to 100 c.c., a small quantity of powdered quicklime being added in order to seize upon any resinous matters which may be separated, and to increase the solubility of the cresols enclosed by the insoluble matters. 1 c.c. of the solution of the crude cresol is then taken (= 0.01 gram. of the substance), 5 c.c. of dilute nitric acid are added, and the mixture is heated on the water-bath for five minutes. The yellow liquid is then poured into a glass cylinder suitable for colorimetric comparisons, the ringings are added, as also 10 c.c. of liquid ammonia, and the cylinder is filled up with water.

10.85 c.c. of the solution of the pure cresol (= 0.0085 gram. of pure cresol) is treated in the same manner, and the colours of the two solutions are compared. Of an official sample, the colour of 0.01 gram. of crude cresol should not be weaker than that of 0.0085 gram. of pure cresol.

The author assumes as the lowest percentage of an official sample 85 per cent. of pure cresol, since cresols can take up as much as 12 per cent. of water, and 3 per cent. of other impurities may be calculated. A high percentage of water is shown by the circumstance that such samples give with benzene a turbid mixture, whilst anhydrous samples form a clear mixture therewith.—A. S.

Aniline in Presence of Small Quantities of Toluidine, and Toluidine in Presence of Small Quantities of Aniline, Estimation of. P. Dobriner and W. Schranz. Zeits. Anal. Chem., **34**, 734—740.

A METHOD proposed by Reinhardt (Chem. Zeit., **17**, 413; this Journal, 1893, 954) for the determination of aniline in toluidine, has been adapted by the authors for the estimation of aniline, *o*- and *p*-toluidine in commercial aniline oil. The method depends upon the fact that nascent bromine converts aniline into a tribromo derivative and the toluidines into dibromo derivatives. The brominating solution being standardised against pure aniline, the toluidine value is obtained by multiplying the aniline value by $\frac{100.5}{93}$. When an oil contains only aniline and the two toluidines, and is free from water, one titration gives the amounts of the two constituents according to the following equation:—

$$x = 2.3777 vt - 1.3777 a,$$

in which *a* = weight of oil, *x* = amount of aniline, *t* = value of the brominating solution calculated on pure aniline, and *v* = No. of c.c. of brominating solution taken. Then *a* - *x* = amount of toluidine contained in the oil. The method gives very accurate results when detecting and estimating small quantities of toluidine in aniline. In the case of toluidine containing small quantities of aniline, the results obtained are somewhat too high, and even a pure toluidine appears to contain aniline. Correct numbers are, however, obtained by titrating the brominating solution against pure toluidine, and calculating the aniline value *t* by multiplying it by $\frac{93}{100.5}$. It is indeed preferable to titrate the brominating solution against pure aniline and pure toluidine, and, designating these values by *t* and *T*, the amount of aniline is given by the equation—

$$\frac{x}{t} + \frac{x-a}{T} = v.$$

The method can also be employed for the valuation of aniline salt (aniline hydrochloride), which, for the purpose of the analysis, must be dried over sulphuric acid. The formula becomes $X = 2.5102 VT - 1.5102 A$,—*A*, *X*, and *V* having corresponding values to those given above. *T* is the value of the brominating solution in pure aniline hydrochloride, and is obtained from the aniline value *t* by multiplying by $\frac{120.5}{93}$.

All the determinations are carried out according to Reinhardt's directions, except that the hydrobromic acid is replaced by potassium bromide and hydrochloric acid. The end of the reaction is detected by spotting on starch-iodide paper, and in the case of aniline is exceedingly sharp. With *p*-toluidine it is advisable to run in the brominating solution slowly at the beginning and towards the end of the reaction. About 150 c.c. of brominating solution (1 litre corresponding to 8 grms. of aniline) are taken for a determination, the readings being observed very carefully at 15° C. The paper contains a number of analyses, both of mixtures of pure aniline and toluidine, and also of commercial samples.—T. A. L.

Moisture in Aniline, Ortho- and Paratoluidine, Estimation of. P. Dobriner and W. Schranz. Zeits. Anal. Chem., **34**, 740—742.

THE determination depends upon an application of Reinhardt's method (see preceding abstract), by observing the number of c.c. of brominating solution absorbed by equal weights of the moist and dried substances. If *a* c.c. be absorbed by the wet, and *b* c.c. by the dry substance, then *F*, the percentage amount of moisture, can be calculated from the proportion:—*a* : *b* = (100 - *F*) : 100. Aniline and *o*-toluidine can be obtained anhydrous by treatment with fused potassium carbonate, whilst for technical purposes it is sufficient to distil *p*-toluidine, and after 10 per cent. have distilled over, to consider the residue as dry. Of several samples of commercial *p*-toluidine examined, none contained more than 1 per cent. of water.—T. A. L.

Cold Saponification. R. Henriques. *Zeits. f. angew. Chem.* 1895, 721.

All glycerides capable of saponification according to the method of the Koettstorfer test, may also be saponified in the cold by means of petroleum spirit and semi-normal or normal alcoholic soda. The process is carried out by dissolving from 4 to 5 grms. of the oil or fat in 25 c.c. of petroleum spirit, and adding to this solution 25 c.c. of normal alcoholic soda. Saponification sets in almost immediately, but it is advisable to allow the mixture to stand overnight, and in the case of the waxes and wool fars with difficulty saponifiable, 24 hours should be allowed. The samples may then be proceeded with in the usual manner by titration. This cold saponification test appears also preferable to the usual form of the Reichert-Meißl test. For this purpose 5 grms. of the oil are dissolved in 25 c.c. of petroleum spirit and saponified in the manner above mentioned. On the following morning the saponified mixture is evaporated to dryness, the dry residue transferred to the distillation flask, the dish washed with the usual quantity of hot water, which is then added to the contents of the distillation flask. Distillation is then carried out in the usual manner.—C. O. W.

Tannin, Determination of, by Metallic Oxides. W. H. Krug. *J. Amer. Chem. Soc.* 1895, 17, 811—814.

The oxides were applied in the manner adopted for hide powder by the "shaker method" (this Journal, 1894, 494). In the case of lead oxide it was found that after 4 grms. of it had been shaken with 75 c.c. of a dilute liquor (containing 2 grms. per 100 c.c. of an extract which yielded 42.35 per cent. of soluble matter) for 4 hours, the tannin had not been completely absorbed, and two days' rest were needed before the tannin had disappeared from the solution. Two grms. of zinc oxide, used under exactly the same conditions, required one week before absorption was complete; a very small quantity of zinc oxide was found in the ash of the non-tannins, and in the case of lead oxide none was dissolved. The use of both oxides is, however, prohibited on account of the slowness of their action.

Magnesia is of no use, because it dissolves to a considerable and variable amount in the liquor, thus increasing the percentage of non-tannin and decreasing that of the tannin.

Yellow mercuric oxide gave good results in a comparatively short time, as is indicated by the following table. The diluted extract was that mentioned above, and contained in 25 c.c. 0.0113 gm. of ash:—

Method.	H ₂ O used.	Diluted Extract used.	Filtrate evaporated.	Weight of Residue.	Tannin in Extract.	Weight of Ash in Residue.
	Grms.	C.c.	C.c.	Grm.	Per Cent.	Grm.
Stood 48 hours, with occasional shaking	4.0	75	25	0.0833	25.60	0.0070
" 48 " " " " " " " " " "	4.0	75	25	0.0820	25.77	0.0077
Shaken 1½ hours; stood overnight	4.0	75	25	0.0842	25.51	..
" 3½ " " " " " " " " " "	4.0	75	25	0.0863	25.60	0.0081
" 4 " " " " " " " " " "	4.0	75	25	0.0839	25.57	0.0084
" 4 " " " " " " " " " "	4.0	75	20	0.0638	26.41	0.0065
" 4 " " " " " " " " " "	4.0	75	20	0.0632	25.65	0.0103
" 4 " " " " " " " " " "	4.0	75	25	0.0863	25.60	0.0083

The author claims that these figures (and some more of the same character not here quoted) show that, even though the conditions may be varied, fairly concordant results may be obtained with mercuric oxide, provided that care be taken to ensure complete absorption of tannin before filtration. The end of the reaction is indicated by the fact that the yellow oxide no longer sinks to the bottom, but the whole mass partly gelatinises and becomes dirty brown. A clear filtrate, free from tannin and mercury, can then be readily obtained. The figures show that a certain amount of the ash present in the extract is held back by the oxide, but the error introduced is quite constant and very small. The time required is somewhat longer than that necessary for the analysis by the hide-powder method.—A. G. B.

Glue and Glue-yielding Substances. Composition of. W. Fahrion. *Zeits. f. angew. Chem.* 1895, 529.

See under XIV., page 284.

Extraction, Estimation of, in Sugar Houses. M. Trubek. *J. Amer. Chem. Soc.* 1895, 17, 920—923.

See under XVI., page 286.

Acetone, Determination of, in Wood-Spirit and Crude Acetone. M. Klar. *Die Chem. Ind.* 1896, 19, 73—79.

An investigation as to the relative merits of Krämer's and Messinger's methods.

Krämer's Method.—This has been officially adopted in Germany for the examination of wood-spirit intended for denaturing purposes. The following *modus operandi* is (officially) laid down:—10 c.c. of the sample are diluted to 100 c.c. with water, 1 c.c. of this solution is transferred to a narrow cylinder and thoroughly shaken with 10 c.c. of twice-normal NaHO, then with 5 c.c. of twice-normal iodine. The iodoform produced is dissolved by agitation in 10 c.c. of ether (sp. gr. 0.722), 5 c.c. of the ethereal layer are then withdrawn, allowed to evaporate spontaneously on a watch-glass, dried for two hours over sulphuric acid, and the residue weighed. Its weight should not be less than 0.07 gm. The above amount of iodoform is con-

siderably less than that theoretically obtainable from spirit containing 30 per cent. of acetone (the minimum standard). The method is therefore merely empirical, but, even as such, yields, according to the author, results so irregular as to be quite useless for purposes of comparison. Correct results—corresponding to the amount of acetone really present—may be obtained, however, Krämer's method being in other respects adhered to, by reducing the quantity of acetone operated on. The spirit under examination should be diluted 40 times, and 1 c.c. of this solution used. Secondly, the iodine must be added slowly (in 3—4 minutes), drop by drop, with constant agitation; and the ether used for extraction must be free from alcohol, aldehyde, and peroxides.

Messinger's Method.—In this process the iodoform reaction is applied volumetrically.

One c.c. of the diluted wood-spirit (1:10) contained in a stoppered flask is mixed with 20 c.c. of normal NaHO (accurately measured). About 20 c.c. of $\frac{N}{5}$ iodine is then run in slowly (3—4 minutes), drop by drop, the contents of the flask being vigorously rotated the whole of the time. 20 c.c. of normal H₂SO₄ (accurately measured) is next added, and allowed to act for 1—2 minutes (this is essential to ensure complete decomposition of iodates and iodides), after which the residual iodine is titrated by $\frac{N}{10}$ Na₂S₂O₃ in the usual way. (1 c.c. $\frac{N}{5}$ iodine = 0.001333 acetone.) A determination of acetone by this method can be made in 10 minutes. The results obtained are very concordant on repetition, and correspond accurately with theory. The official adoption of this process in place of Krämer's is therefore strongly recommended.—H. T. P.

Acetone, Determination of. G. Krämer. *Die Chem. Ind.* 1896, 19, 79.

REFERRING to Klar's communication (see preceding abstract) on this subject, the author states that in the official version of his (Krämer's) method, certain precautions (Ber. 1880, 1000) that must be observed in order to obtain exact results are omitted—for the sake of simplicity and because

a moderate degree of accuracy suffices in practice. Apart from this, the author ascribes the grossly inaccurate results obtained by Klar to faulty manipulation, and supports his contention by some comparative determinations made by his and Messinger's methods.—H. T. P.

Alkaloids, Acidimetric Estimation of Vegetable. L. F. Kebler. *J. Franklin Inst.* 1896, **141**, 141—147.

The author finds that methyl orange is unsuitable for titrating alkaloids, especially in dilute solutions. The following indicators, arranged in their order of merit, *viz.*, hæmatoxylin, Brazil wood, and cochineal, gave very promising results. The author also appends a list of the literature of the subject.—J. S.

Nicotine and Ammonia in Tobacco, Estimation of. R. Kissling. *Zeits. Anal. Chem.* **34**, 731—734.

The author criticises a recent publication by Vedrodi (*Zeits. Anal. Chem.* **34**, 413), who, in a paper on the estimation of ammonia together with nicotine in tobacco, described several modifications of the author's original method (*Zeits. Anal. Chem.* **21**, 76; this Journal, 1882, 200) to which he now takes exception. He points out that the numbers obtained by Vedrodi are too low, since the $\frac{N}{3}$ sulphuric acid employed by the latter, containing 32.61 grms. of sulphuric acid in a litre, combines with equimolecular proportions of ammonia and nicotine, *i.e.* 1 c.c. saturates 0.01132 gm. of ammonia (NH_3), or 0.1078 gm. of nicotine ($\text{C}_{10}\text{H}_{14}\text{N}_2$). The following method, according to the author, must be applied in order to determine the various nitrogen compounds in tobacco, more especially nicotine, ammonia, amide compounds, and albumin. After determining in one portion, the nicotine, an extract is made by boiling 10 grms. of another portion of the tobacco in powder with 100 c.c. of 40 per cent. alcohol under an inverted condenser. When cold, the extract is filtered and the alcohol is distilled from an aliquot part. The residue is diluted with water, acidulated with sulphuric acid, and treated with phosphomolybdic acid to remove albuminoids, peptones, nicotine, and ammonia. The aqueous solution, made up to 100 c.c., is filtered, and the nitrogen is determined in 75 c.c. of it, evaporated with barium chloride. A third portion of the tobacco (20 grms.) is warmed with about 350 grms. of very dilute sulphuric acid. The total weight is then made up to 400 grms., of which 200 grms. are filtered off, the solution being treated with mercuric chloride to remove albuminoids and organic matter. An aliquot part having been filtered off, the mercury is removed with sulphuretted hydrogen, and the amides are converted into ammonia and amido acids by boiling for an hour. After making alkaline, the nicotine and ammonia are distilled off with steam into normal sulphuric acid. From the numbers obtained, it is possible to calculate the amount of nicotine, ammonia, and amides contained in the original tobacco, that obtained for the amido nitrogen being halved. Subtracting these numbers from the total nitrogen found, the remainder is calculated as albumin.—T. A. L.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Saturation and Critical Temperatures. Crismer and Motten. *Ass. Bodge des Chim. Chem. Zeit.* 1896, **20**, 41.

By plotting a curve of solubility of any substance in a suitable solvent, using as abscissa the temperatures at which homogeneous solutions become turbid, and as ordinates the weights or volumes of the substances examined per 100 parts of solution, the curve will be separable into three parts:—(1.) The zone of non-saturation, which corresponds to the solutions of 0—30—40 per cent., and which gradually increases as x (the temperature) is raised; (2.) the zone in which x is constant, whilst y (the percentage) varies (40—60 per cent.); this is the zone of the constant magnitude of critical temperatures; and (3.) the zone of over-saturation, in which x is smaller, whilst y becomes greater (60—100 per cent.). In the first of these

three zones the position of x is strongly affected by a very small variation in y ; thus a solution of 8.4 per cent. sulphur in a mixture of 1 vol. of absolute alcohol with 2 vols. of benzene becomes turbid at 90° , and a solution of 9.2 per cent. at 100.5° . Hence it is possible to obtain accurate estimations by observing the saturation temperatures. A known weight of dynamite may be placed in a closed glass tube or flask with a measured volume of absolute alcohol and heated to 45°C . The saturation temperature, determined to one-tenth of a degree, gives y (the percentage of nitroglycerin in solution), and as the volume of alcohol is known, the quantity of the nitroglycerin in the dynamite can be estimated. Ordinary gunpowder may be similarly treated with a mixture of 1 vol. of absolute alcohol and 2 vols. of benzene. A curve expressing the critical points of a substance in more or less diluted samples of alcohol is almost a straight line, y being the temperature and x the percentage of water in the alcohol. A weighed quantity of butter may be treated with a measured volume of absolute alcohol and the critical point taken without filtering, as the presence of casein does not interfere. This critical temperature then shows the extent to which the alcohol has been diluted, and hence the water in the butter taken. In the absence of salt the results are very accurate, but when any appreciable quantity of salt is present there may be an error of from 0.5 to 1 per cent. The authors give the critical temperatures of 23 fats and oils in the original paper.—W. G. M.

Graphite, Occurrence of, in Russia. R. Helmhaecker. *Berg u. Hütt. Zeit.* 1896, **55**, 29.

ALIBER found graphite in 1842 in the Tenkinski Mountains (Irkutsk) in a hill 2,240 m. high, composed on the north of granite and on the south of crystalline limestone and crystalline schists. In 1856 he formed the Maryinski Graphite Mining Co. The graphite contains 83.8 to 85.6 of carbon, with 11.1 to 15.7 of ash, and 3.8 per cent. of water, and picked samples gave better results still. It is won so easily that its price is practically determined by the cost of transport. It is used for pencils and for crucibles. In 1859—1863 Siderow discovered and worked graphite in the most northern division of Turuchansk (Jenisejsk), on the rivers Niznaja-Tunguzka and Kurejka. In the neighbourhood there is an outcrop of coal, probably of the Jurassic period, and some hundred versts away graphite occurs in clay slate. It is probable that the graphite owes its origin to the action of volcanic rocks upon the Jurassic coal. This graphite is comparable with that from Cumberland, and contains 89.2—94.3 per cent. of carbon, 9.7—1.4 of ash, and 1.9—0 water. In spite of its abundance the production of the graphite is very variable. A third source of graphite is the Tarbagatai Mountains, in the eastern portion of the Kirghiz steppes, but it contains 10 per cent. of ash and at present finds no market.—W. G. M.

Acetic Acid and Benzene, Mixtures of, Formation of Layers in. C. E. Lindeberger. *J. Amer. Chem. Soc.* 1895, **17**, 932—933.

ACCORDING to Duclaux (*Ann. Chim. Phys.* 1876, [5], **7**, 267) mixtures of benzene and acetic acid exhibit at certain temperatures the property of layer formation. In the course of an investigation carried out by the author on the vapour tensions of mixtures of benzene and acetic acid, the results were such as to preclude the possibility of this phenomenon. Accordingly, mixtures of pure benzene and pure acetic acid of varying concentrations were exposed to a temperature of -20° , but in no case was a separation into layers observed. It therefore appears that Duclaux's statement with regard to benzene and acetic acid is erroneous, and that the formation of layers is due to the presence of water.—J. L. B.

Plant Tissues, The Origin of the Unsaturated Constituents of. C. F. Cross, E. J. Bevan, and C. Smith. *Ber.* 1895, 1940.

THE formation of fufurals by the action of condensing acids upon the "furfurals" of plant tissues, is accompanied by that of volatile acids. The authors have investigated the

quantitative relationships of these products when formed by the action of boiling aqueous sulphuric acid of varying degrees of condensation. In the case of barley-straw the volatile acid is chiefly acetic acid, and the following yields were obtained:—

Concentration of Acid, Per Cent. H_2SO_4 .	10.	15.	20.	30.	40.	50.
	Per Cent. of Straw.					
Furfural.....	2.0	2.0	4.4	10.1	11.5	11.0
Acetic acid.....	1.7	1.9	3.1	4.3	6.3	14.8

Up to a certain point of concentration of the acid (40 per cent.), the numbers for total yields show progressive increase. Observations upon the relative rate of formation show a more rapid rate of increase of the furfural with increasing concentration of acid. It is concluded that in the earlier stages the furfural and acetic acid originate in a common reaction. This corresponds with what is known of the constitution of the lignocelluloses, which yield furfural on the one hand and acetic acid on the other—products of various processes of condensation and hydrolysis—in quantities proportional to lignification.

The celluloses isolated from the lignocelluloses yield, on boiling with condensing acids, in addition to furfural, chiefly formic acid.

In conclusion the authors discuss the bearing of these observations on the formation in the plant of substances of the R. hexene and benzenoid types of carbon condensation.

—C. F. C.

Autumn Leaves, The Yellow Colouring Matter in.

G. Staats. Ber. 28, 2807.

The yellow autumn leaves of limes digested with boiling alcohol give a deep yellow solution. This yellow colour, however, is not identical with phyloxanthin. By treating the alcoholic solution from autumn leaves of limes and beeches with caustic potash, a reddish-brown precipitate and a yellow solution are formed.

The reddish potassium compound precipitated in this way from limes, dissolves in water with a deep red colour and crystallises from a mixture of alcohol and water in long reddish-yellow needles.

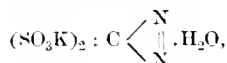
It dissolves in hydrochloric acid, forming again the yellow colour.—H. M.

Diazomethanesulphonic Acid, Preparation from Potassium Cyanide and Sulphurous Acid. H. v. Pechmann and Ph. Manek. Ber. 28, 2374.

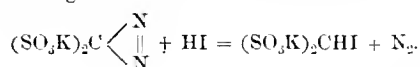
By the action of sulphurous acid on potassium cyanide (2 mols. potassium bisulphite to 1 mol. potassium cyanide), the primary and secondary salts of a dibasic acid are formed. The primary salt, $\text{CH}_3\text{NH}_2(\text{SO}_3\text{H})(\text{SO}_3\text{K})$, is with difficulty soluble in water, and the solution is decomposed on boiling.

The secondary salt, $\text{CH}_3\text{NH}_2(\text{SO}_3\text{K})_2$, is very soluble in water and crystallises easily from the same.

The acid is not known in the free state. By action of nitrous acid upon the secondary salt, diazomethane disulphonate of potassium is formed—



which separates out in yellow crystals. This salt dissolves in water, forming a neutral solution, which turns acid on standing, with evolution of nitrogen. In presence of free alkali the solution is fairly stable, and the salt can be crystallised out in this way. It reduces salts of the heavy metals that are reducible, and its solution is slightly decolorised by reducing agents. It is decomposed by acids, losing its nitrogen—



—H. M.

New Books.

WATER-ANALYSIS: A Practical Treatise on the Examination of Potable Water. By J. ALFRED WANKLYN and ERNEST THEOPHROUS CHAPMAN. Tenth Edition. Revised and partly re-written by J. ALFRED WANKLYN, M.R.C.S., formerly Professor of Chemistry in the London Institution, &c. Kegan Paul, Trench, Trübner, and Co., Lim., London. 1896. Price 5s.

A TENTH edition of this work now appears. The author (J. A. Wanklyn) states that he has "For some time paid particular attention to the detail of the estimation of the water-residue, and also to the specific gravity of different waters; and Chapter II. (in the present edition) is re-written." Part of Chapter IV. is re-written, and many additions and emendations are scattered through the work. A new chapter also appears on "Table Waters."

POUVOIR CALORIFIQUE DES COMBUSTIBLES SOLIDES, LIQUIDES, ET GAZEUX. Par M. SCHEURER-KESTNER. G. Masson, 120, Boulevard Saint-Germain, Paris. 1896. Price 5 fr.

SMALL 8vo. volume in paper cover, containing Preface, bibliography of works or articles on Fuels, Thermo-Chemical Problems in connection with Fuels and Calorimetry, and subject-matter covering 270 pages. Finally, a kind of Appendix follows with 13 tables, two of which refer more especially to calculations (a) Of the weight of carbon in the gaseous form, and (b) Of the heat of combustion of gaseous carbon. The work ends with a Table of Contents. The text is illustrated with 44 excellent woodcuts. There are two principal parts into which the work is divided: I., Containing an *exposé* of the methods made use of in calculations of the heat disengaged during combustion; II., Containing the rules to be followed in technical experiments which have for their object the determination of the calorific power of a combustible. These two principal parts are subdivided as follows:—I. Definitions. Methods. Calorimeters. Mineral, Ligneous, and Liquid Combustibles. Pyrogenic Combustibles. Gaseous Combustibles. Special Calorimeters for the Combustion of Gases. Coal-Gas, &c. II. Calorific Power of Coal burnt in Steam-Boiler Furnaces. Calculation of Gaseous Volume in accordance with Analysis. Determination of Gaseous Volume by the Anemometer, by a formula based on the Outflow of Gas, by means of a Calorimetric Calculation. Determination of the Temperatures of Gases at their Point of Issue. Transformation of Observed Data into Calories, &c.

TRAITÉ DES MATIÈRES COLORANTES ORGANIQUES ARTIFICIELLES, DE LEUR PRÉPARATION INDUSTRIELLE, ET LEURS APPLICATIONS. Par LÉON LEFÈVRE, Ingénieur (E.I.R.), Préparateur de Chimie à l'École Polytechnique. Préface de Ed. GRIMAUX, Membre de l'Institut (Académie des Sciences). G. Masson, 120, Boulevard Saint-Germain, Paris. 1896. Price 3l. 12s. H. Gravel and Co., 33, King Street, Covent Garden, London.

THIS complete treatise is contained in two large 8vo. volumes, bound in cloth, and containing 1573 pages of subject-matter, terminating in Index lists of Patents—French and German, with the pages in the work given, in which references to them may be found. An Alphabetical Index of the general subject-matter finally ends the work. The text is illustrated with 31 beautifully executed engravings, representing apparatus and plant used in the manufacture of dyestuffs, and 261 dyed and printed patterns on silk, wool, cotton, paper, and leather, these patterns being specially prepared under the direction of M. Lefèvre. The work is divided into 20 chapters, each of which is subdivided so as to contain: (1.) The Historical Introduction. (2.) Modes of Formation and Constitution. (3.) General Properties and Reactions. (4.) Description of the Individual Colouring Matters in the Groups, with Graphic Formulæ. (5.) Tabular Survey of all the Dyestuffs referred to under (4), (with many others not commercially valuable), giving modes of formation, properties, and commercial names, with also the numbers of the corresponding patent specifications. (6.) Manufacture of the Colours on the Large

Scale, and their Application, illustrated by cuts, diagrams, and dyed and printed patterns. (7.) A List of all the more important Publications; and (8.) The titles and numbers of the Patent Specifications, dealing with the Colouring Matters of the Group. The author pays a special tribute of indebtedness to M. Horace Koechlin, for his aid in the preparation of the printed patterns. The Chapters themselves may be classified as treating of the following subjects: I. Nitro Dyestuffs. II. Azoxy Colours. III. Azo Colours. IV. Hydrazine Colours. V. Indamines. VI. Indones. VII. Oxindamines or Oxazines. VIII. Oxindones. IX. Thiazines. X. Eurbodines. XI. Safranines. XII. Indulines. XIII. Naphthalene Colours. XIV. Colours derived from Quinoline Bases. XV. Diphenylmethane Colours. XVI. Colours derived from Triphenylmethane and its Homologues. Phthalains. XVII. Anthracene Colours. XVIII. Quinone-oxime Colours. XIX. Artificial Indigos. XX. Various Artificial Colours.

HANDBUCH DER CHEMISCHEN TECHNOLOGIE. In Verbindung mit mehreren Gelehrten und Technikern bearbeitet, und herausgegeben von Dr. P. A. BOLLEY und Dr. K. BUNBAUM. Nach dem Tode der Herausgeber fortgesetzt von Dr. C. ENGLER.

DIE CHEMISCHE TECHNOLOGIE DER BRENNSTOFFE. Von Prof. Dr. FERDINAND FISCHER. Dritte Lieferung. Friedrich Vieweg und Sohn, Druck und Verlag von, Brunswick. 1896. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 5s.

THIS Part III. of the above work on the Chemical Technology of Fuel, presents the various problems of Thermo-Chemistry belonging to the subject, and then treats of Wood and Peat as articles of Fuel. The subject also of Coal is dealt with, and its Occurrence, Statistics, and Chemistry are treated very fully. A subsequent Part—Part IV.—is promised, which will deal with Compressed Fuel and the Coking Industry.

This number contains 185 pages of subject-matter, and is illustrated with 39 wood engravings.

RÉPERTOIRE DES REACTIFS SPECIAUX. Généralement désignés sous leurs noms d'Auteurs. En vente chez les Auteurs, FERDINAND JEAN et G. MERCIER. Published and sold by the Authors, the former at 17, Faubourg St. Denis, the latter at 158, rue Saint Jacques, Paris. 1896. Price 2 fr., or post free 2.25 fr.

In this little work, in which each alternate page is blank, those reactions and tests are given which are generally known by the names of their authors or discoverers. In the first part of the book the substances are given, alphabetically arranged, which form the subjects of the reactions, whilst in the second part, appear the descriptions of the reactions themselves arranged under the names of their discoverers, alphabetically given. The methods of preparing the tests are added, and frequently their degrees of sensitiveness. The alternate blank pages are for the entry of additional tests, errata, &c., and the authors cordially invite readers to forward to them any such addenda and errata, which they promise, as far as may be, to enter in their next edition. This present and first edition contains 121 pages, and is of a size suitable for the pocket.

LES NOUVEAUX CHIMIQUES. Nouveaux Appareils de Laboratoires, Méthodes Nouvelles de Recherches Appliquées à la Science et à l'Industrie. Par CAMILLE POULENC, D. ès Sc. Avec 62 figures intercalées dans le texte. J. B. Baillière et Fils, 19, rue Haute-Feuille, Paris. 1896. Price 2 fr. H. Grevel and Co., 33, King Street, Covent Garden, London.

THIS little work of small 8vo. size, and in paper cover, is devoted to summary descriptions of new laboratory apparatus and methods. It contains Preface, 131 pages of subject-matter, Table of Contents, and an Alphabetical Index, and its pages are illustrated with 62 engravings representing the more recently introduced apparatus and instruments, described therein.

The book contains five chapters. In Chapter I. general methods and apparatus are described, such as those concerned in Measuring Temperatures, Heating, Illumination, Distillation under ordinary Pressures and *in vacuo*. II. Treats of the various forms of Laboratory Apparatus and methods designed for or connected with certain kinds of Purification. III. Analysis under its more recent forms is here represented, and chiefly Lunge's Volumeter and its applications. IV. New Electro-Chemical Apparatus is the subject here considered and illustrated; and V. The more recent methods in Chemical Biology or Bacteriology.

CHEMISCH-TECHNISCHES REPERTORIUM. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. EMIL JACOBSEN, 34. Jahrgang. 1895. Zweites Halbjahr. Erste Hälfte. Mit in den Text gedruckten Illustrationen. Hermann Heyfelder, R. Gaertner's Verlagsbuchhandlung, Schönebergerstr. 26, Berlin, S.W. H. Grevel and Co., 33, King Street, Covent Garden, London.

THE first issue for the second half-year of 1895, of Dr. Jacobsen's Repertory of Chemical Technology, containing reports of the progress of the following branches of chemical industry:—I. Building Materials, Cements, &c. II. Dyestuffs, Dyeing, and Calico Printing. III. Fats, Oils, Illuminating and Heating Materials. IV. Fermented Liquors. V. Tanning, Leather and Glue Manufacture. VI. Textiles. VII. Glass and Earthenware. VIII. Wood and Horn. IX. India-rubber and Gutta-percha. X. Cements and Adhesives. XI. Lakes, Varnishes, and Paints. XII. Metals.

EXPERIMENTAL-UNTERSUCHUNGEN ÜBER ZERSETZUNG UND VERBRENNUNG VON KOHLENWASSERSTOFFEN. Habilitationsschrift zur Erlangung der venia legendi für Technische Chemie an der Grossh. Bad. Technischen Hochschule zu Karlsruhe. Von Dr. FRITZ HABER. R. Oldenbourg, Verlag, München. 1896. Price M. 1.50.

LARGE 8vo. volume in paper cover, containing 116 pages of subject-matter dealing with the subject of the Decomposition and Combustion of Hydrocarbons. The method of treatment of the subject may be derived from the following brief synopsis of the contents:—A. Decomposition of Hexane and Trimethylethylene by Heat. Measuring of Temperatures in Electric Tubular Furnaces. B. Combustion of Illuminating Gas on Cooled Surfaces and in Gas Motors. Experiments on the Fractional Combustion of Mixtures of Carbonic Oxide, Hydrogen, and Methane. Qualitative Determinations of the Combustible Portions of Heating Gas. Useful Effect of Gas Cooking-Apparatus. Experiments on Combustion in Gas Motors, &c. The work is illustrated with 19 wood engravings.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

FRANCE.

Tariff Decisions.

Board of Trade Journal, April 1896, 438.

A despatch, dated March 6 last, has been received from the Foreign Office, enclosing copy of a French Customs circular to the following effect:—

"Thorium salts, especially nitrate or azotate, solutions of which are employed in the preparation of incandescent gas-burners, belong to the class 'Chemical Products not denominated, other than of an alcoholic basis,' and pay a duty of 5 per cent. *ad val.* The estimation of the value of these products having given rise to many disputes, the Departments of Trade and Finance have decided to convert the duty of 5 per cent. into an equivalent specific rate, and considering that the value of thorium salts, once 2,000 frs. per kilo., is now only about 400 frs., on account of recent

discoveries of extensive deposits of thorium ore, it has been decided to substitute for the duty of 5 per cent. *ad val.*, a specific rate of 20 frs. per kilo."

NETHERLANDS.

Free Entry of Sulphuric Ether.

Board of Trade Journal, April 1896, 435.

A despatch, dated March 25 last, has been received at the Foreign Office from Sir Horace Rumbold, Her Majesty's Minister at The Hague, enclosing translation of a law published in the *Official Gazette* of March 25 last, by which sulphuric ether, used in the manufacture of gilding for the decoration of porcelain or earthenware, is exempted from import duties under certain conditions, which apply exclusively to the importer.

The translation of the above law is given in *extenso*.

BRITISH INDIA.

Board of Trade Journal, April 1896, 418.

Exemptions from Duty.

By Customs circular, dated February 14 last, and in exercise of the power conferred by section 23 of the Sea Customs Act, VIII. of 1878, the Governor-General in Council is pleased to exempt from import duty the articles in the subjoined list, when such articles are imported by the owner of a cotton-weaving mill, and are shown to the satisfaction of the collector to be intended for use in the weaving of cotton or the baling of woven cotton goods.

List of Articles to be Exempted.

Aniline blue, bisulphate of soda, china clay, chloride of magnesium, chloride of zinc, Epsom salts, farina, flannel, taping, Glauber salts, glutina, glycerin substitute, head varnish, hoop iron, rivets for bales, sewing needles, sizing paste, sizing wax, soda ash, starch.

CUSTOMS TARIFF OF GUATEMALA.

Section 15.

Drugs, Medicines, &c.

See Board of Trade Journal for April 1896, 430—434.

UNITED STATES.

Engineering and Mining Journal, March 21st, 1896, 282.

Duty on Metal Foils.

Zinc foils and a foil of which copper is the component material of chief value. Both were assessed at 35 per cent. under para. 177. The one was claimed to be dutiable under para. 175 as zinc in sheets not further advanced, and the other as copper in sheets under para. 161. The protest was overruled.—Lehmaier, Schwartz, and Co. v. Collector of the Port of New York: Board of United States General Appraisers.

Duty on Metallic Paints.

Metal red, alizarin colours and alizarin lakes, and ultramarine blue. All of them were assessed at 25 per cent. under para. 48. The metal red was claimed to be dutiable as vermilion red at 6 cents per lb., under para. 45; the alizarin colours to be free, under para. 368, and the ultramarine blue to be dutiable at 3 cents per lb. under para. 45. The assessment on metal red was affirmed; as to the alizarin colours and alizarin lakes and ultramarine blue, the protest was sustained.—R. F. Downing and Co. v. Collector of the Port of New York: Board of United States General Appraisers.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

PHARMACEUTICAL PRODUCTS IN THE PHILIPPINES.

Chamber of Commerce Journal, March 1896, 47.

The French Consul at Manila recommends prudence in commercial relations with native pharmacists, this now being more necessary than ever in consequence of the competition between French pharmaceutical products which

are more or less gross imitations, but of which the prices are very much lower. During the last decade the value of such imports into the Philippines has greatly diminished, although the Manila pharmacies are fuller than ever of medicaments of all kinds and of all origins. Germans have particularly made headway with quinine at "half-price," but in a condition of efficacy on which the Consul does not consider it necessary to comment.

GENERAL TRADE NOTES.

GERMAN TRADE IN SOUTH AFRICA.

Board of Trade Journal, April 1896, 402.

The figures of the South African trade are of particular interest. In the seven years from 1889 to 1895, the exportation of German manufactures to the Cape is valued at 3,000,000*l.*; to the Transvaal at 1,032,000*l.* In the year 1892 the exportation to both these countries amounted to no more than 395,000*l.* In 1895 it had risen to 1,056,000*l.* This exportation embraces various branches of industry, especially iron, machinery, textiles, and chemicals. Further important articles are sugar, beer, explosives, and leather goods.

In the last two years, for instance, the following goods have been exported:—

	Cwts.
Dyed cotton goods	8,250
Cyanide of potassium	2,200
Explosives	74,400
Beer, in bottles	32,510
Refined sugar	21,200

The increase in the exportation of cyanide of potassium is very noticeable, and this is due to its demand for use in the production of gold. The exportation of this article dates only from the year 1892. In that year 1,658 cwt. of the value of 11,372*l.* was exported to the Transvaal; in 1895 the exportation of this article had increased to 18,184 cwt. and 147,000*l.*

The development of the gold production of the Transvaal has given a great impetus to the export of this article, as is evidenced by the fact that whereas the whole German exportation of cyanide of potassium to the Transvaal in 1891 only amounted to 820 cwt., in 1895 it had reached the above figures.

THE MINERAL PRODUCTION OF ITALY.

The *Revista del Servizio Minerario*, recently issued, gives statements of the mineral production of Italy in the year 1894. The output of minerals from the Italian mines for the year was as follows, the quantities being in metric tons:—

Iron ore	187,728 tons
Manganiferous iron ore	5,810 "
Manganese ore	760 "
Copper ore	92,886 "
Zinc ore	131,777 "
Lead ore	29,822 "
Gold ore	7,748 "
Silver ore	1,103 "
Antimony ore	1,504 "
Quicksilver ore	15,022 "
Iron pyrites	22,638 "
Coal and lignite	271,294 "
Sulphur, raw	13,850 "
Sulphur, melted	391,931 "
Rock salt	19,467 "
Spring salt	11,326 "
Asphalt and bitumen	60,493 "
Petroleum, crude	2,854 "
Gaseous hydrocarbon	12,000 cb. m.
Alunite	6,006 tons
Boric acid	2,745 "
Graphite	1,570 "

The total value of the minerals at the mines is given as 52,042,605 lire (810,408,521*l.*). Nearly half this amount—25,267,955 lire, or 85,053,591*l.*—was furnished by the sulphur mined. The average value of the coal mined was 7 lire (81*l.* 40) per ton. The gold ore was of low grade, being rated only at 85 lire, or 817 *l.* per ton.

Included in the total values; but not given in the table, are mineral waters valued at 499,829 lire, or \$81,965, their amount being estimated at 21,730 tons.

The total number of men employed in and about the mines was 51,994. The average value per man employed was 1,001 lire, or \$200; but no statistics are given as to the time worked. The largest number, 30,339 in all, were at work in the sulphur mines. The lead and zinc mines employed 10,173 persons; the coal mines, 2,347; the iron mines, 2,178; and the copper mines, 2,003. No other industry employed over 1,000 men. In the production of gaseous hydrocarbon only one man was engaged.

The metallurgical products for the year 1894 were as follows in metric tons, except where otherwise noted:—

Pig iron	10,329 tons
Iron castings	10,060 "
Wrought iron	141,729 "
Steel	51,014 "
Roller plates	5,750 "
Copper and copper alloys	7,918 "
Zinc	280 "
Lead	19,605 "
Silver	58,926 kilos.
Gold	349 "
Antimony	351 tons
Quicksilver	258 "
Briquettes, mineral	599,754 "
" wood, peat, &c.	21,370 "
Sulphur, refined	35,659 "
Sulphur, powdered	90,561 "
Sea salt	192,515 "
Asphalt and bitumen	7,824 "
Petroleum, refined	1,640 "
Gas, lighting	148,982,553 cu. m.
Gas products, coke, tar, ammonia, &c.	433,399 tons

The total value of the metallurgical products was 165,211,633 lire (\$33,042,327), and the number of men employed was 22,558. Of these, nearly one-half, 11,084 in all, were engaged in the iron and steel manufactures. There were 2,913 men employed in the manufacture of salt and 1,455 in the preparation of sulphur. The gas industry required 3,590 men.

The average value of the zinc produced is given at 1,100 lire (about \$220) per ton. Silver is rated at 110 lire (\$220) per kilo., and gold at 3,608 lire (\$724) per kilo. Refined sulphur had an average value of \$1 lire (\$16.20) per ton. The average value of the products was 7,324 lire (\$1,465) per man employed. The data given, however, do not state the average working time.

PRODUCTION OF CAOUTCHOUC IN BRAZIL.

Board of Trade Journal, April 1896, 471.

The *Bulletin Commercial* states that, according to American statistics, the production of caoutchouc in the province of Para (Brazil), which is constantly on the increase, has doubled in the last 12 years, and quintupled in the last 30 years. The production of 1895 was 13.4 per cent. greater than that of 1894 and 10.2 per cent. greater than that of 1893.

The following statement shows the value of the exports in certain years:—

Years.	Value.
1865	8,243,000
1870	10,528,000
1875	15,114,000
1880	18,889,000
1885	29,310,000
1890	56,300,000
1895	103,303,000

The imports of caoutchouc into the United States have increased in about the same proportion as the exports from Brazil, but in 1895, for the first time, the amount of caoutchouc sent from Para to Europe was greater than that sent to the United States. The increase is specially noticeable in England, France, and Germany, where Para caoutchouc is in great demand.

THE MINERAL PRODUCTION OF CANADA, 1895.

Engineering and Mining Journal, March 14th, 1896, 254.

Through the courtesy of Mr. E. D. Ingall, of the Geological Survey of Canada, we are enabled to publish the preliminary statistical table of the mineral production of Canada. Some of these returns are estimated, but the usual care under the direction of Dr. G. M. Dawson, head of the Department, ensures a very close approximation to the ultimate figures:—

Product.	Quantity (a).	Value (a).
METALLIC.		
Copper (b)	Lb. 8,789,162	Dols. 994,220
Gold	Fine oz. 92,448	1,916,921
Iron ore	Tons 102,797	238,070
Lead (fine, in ore, &c.) (c)	Lb. 23,075,892	749,966
Mercury	" 230	2,343
Nickel (fine, in ore, &c.) (d)	Lb. 3,888,526	1,360,984
Silver (fine, in ore, &c.) (e)	Oz. 1,775,683	1,158,633
Total metallic	"	6,370,146
NON-METALLIC.		
Asbestos	Tons 8,756	368,175
Baryta	" 8	168
Chromite	" 3,177	41,391
Coal	" 3,512,504	7,774,178
Coke (f)	" 53,356	143,047
Fire-clay	" 1,329	3,192
Graphite	" 220	6,150
Grindstones	" 3,919	31,532
Gypsum	" 236,178	202,998
Limestone for flux	" 31,579	32,916
Manganese ore	" 125	8,464
Mica	"	65,000
Ochres	Tons 1,339	1,690
Mineral water	Galls. 797,382	111,018
Moulding sand	Tons 6,765	13,530
Natural gas (g)	"	423,632
Petroleum (h)	Bbls. 892,573	1,291,184
Phosphate (apatite)	Tons 1,822	9,565
Precious stones	"	1,650
Pyrites	Tons 34,498	102,594
Salt	" 60,018	180,447
Soapstone	" 475	2,138
STRUCTURAL MATERIALS AND CLAY PRODUCTS.		
Bricks*	"	1,800,000
Building stone*	"	1,200,000
Cement, natural	Bbls. 73,169	69,482
" Portland	" 61,475	111,680
Flagstones	Sq. ft. 80,005	6,887
Granite	Tons 19,188	90,199
Lime*	"	900,000
Marble	Tons 200	2,000
Pottery	"	125,000
Roofing cement	"	3,153
Sands and gravels (exports)	Tons 277,162	118,359
Sewer pipe	"	257,045
Slate	"	58,900
Terri-cotta, &c.	"	195,123
Tiles*	"	200,000
Total non-metallic	"	15,875,197
Total metallic	"	6,370,146
Estimated value of mineral products not returned.	"	254,657
1895. Total	"	22,500,000
1894. "	"	20,900,000
1893. "	"	19,250,000
1892. "	"	19,500,000
1891. "	"	20,500,000
1890. "	"	18,000,000
1889. "	"	14,500,000
1888. "	"	13,500,000
1887. "	"	12,500,000
1886. "	"	12,000,000

(a.) Quantity or value of product marketed.

(b.) Copper contents of ore, matte, &c., at 10½ c. per lb.

(c.) Lead contents of ores, &c., at 31 c. per lb.

(d.) Nickel contents of ore, matte, &c., at 35 c. per lb.

(e.) Silver contents of ore at 65½ c. per oz.

(f.) Oven coke, nearly all the production of Nova Scotia.

(g.) Gross return from sale of gas.

(h.) Calculated from inspection returns at 100 galls. crude to 38 refined oil, and computed at 1 dol. 49½ c. per bbl. of 35 imp. galls. The barrel of refined oil is assumed to contain 42 imp. galls.

* The ton used is that of 2,000 lb.

* Estimated.

MINERAL PRODUCTION OF THE UNITED STATES IN 1894-95.

Engineering and Mining Journal, April 11th, 1896, 347.

		1894.		1895.				
No.	Products.	Customary Measures.	Quantity.		Value at Place of Production.	Quantity.		Value at Place of Production.
			Customary Measures.	Metric Tons.		Customary Measures.	Metric Tons.	
Non-METALLIC.								
	Abrasives—				Dols.			Dols.
1	Corundum and emery.....	Short Tons	1,220	1,106	169,500	385	349	56,400
2	Garnet.....	"	1,000	907	35,400	2,065	1,873	33,350
3	Grindstones.....	"	29,089	27,200	237,596	36,389	33,004	290,378
4	Millstones.....	"	297	269	4,447	105	95	8,525
5	Tripoli and infusorial earth.....	"	1,663	1,508	22,825	1,788	1,622	26,049
6	Whetstones.....	"	1,755	1,574	84,450	1,066	1,439	78,303
7	Alum.....	"	72,000	65,304	2,160,000	75,000	68,025	2,225,000
8	Antimony ore.....	"	165	150	9,675	1,683	1,082	37,005
Asbestos and Talc—								
9	Asbestos.....	"	265	240	4,350	1,010	916	11,400
10	Fibrous talc.....	"	50,500	45,804	505,000	66,500	60,316	665,000
11	Talc and soapstone.....	"	21,044	19,087	401,892	18,885	17,129	361,353
12	Asphalt.....	"	4,138	4,080	75,654	14,300	12,670	300,000
13	Bituminous rock.....	"	34,189	31,018	148,120	33,778	30,707	143,456
14	Barytes.....	"	23,758	21,518	95,632	20,255	18,371	93,020
15	Baryte.....	Long Tons	10,732	10,208	42,928	14,115	13,371	56,580
16	Borax.....	Pounds	13,140,584	5,962	949,841	13,396,356	6,126	742,850
17	Bromine.....	"	339,444	172	984,555	394,854	179	102,662
18	Cement, natural hydraulic.....	Bbls., 300 lbs.	7,813,766	1,064,297	4,455,328	7,694,053	1,047,006	4,597,255
19	Cement, Portland.....	Bbls., 400 lbs.	611,229	110,877	1,209,446	749,059	135,879	1,430,000
20	Clay, refractory.....	Short Tons	3,375,758	3,061,794	4,050,885	63,750,000	3,401,250	4,500,000
21	Clay, kaolin.....	"	24,552	22,246	185,169	30,910	28,035	258,441
22	Coal, anthracite.....	"	452,016,433	47,183,345	80,879,101	458,392,985	52,065,538	89,948,699
23	Coal, bituminous.....	"	4,117,865,318	106,913,871	103,758,567	4,138,079,466	125,247,053	125,449,488
24	Coke.....	"	8,195,295	7,706,446	12,654,548	9,927,348	9,006,090	15,258,935
25	Cobalt oxide.....	Pounds	6,550	3	8,843	6,490	3	8,640
26	Copperas.....	Short Tons	14,897	13,511	104,100	14,118	12,805	68,846
27	Copper sulphate.....	Pounds	660,000,000	27,215	2,046,000	45,000,000	20,412	1,359,000
28	Chrome ore.....	Long Tons	2,653	2,087	35,125	"	"	"
29	Feldspar.....	"	18,704	19,003	83,165	22,195	22,550	104,082
30	Fluorspar.....	Short Tons	6,400	5,805	58,391	4,000	3,628	36,440
31	Graphite.....	Pounds	770,846	349	34,689	392,008	178	17,610
32	Graphite, amorphous.....	Short Tons	165	150	1,252	1,100	998	4,700
33	Gypsum.....	"	301,536	273,493	910,831	298,572	270,804	974,219
34	Iron ore.....	Long Tons	11,880,000	12,070,080	20,710,000	16,950,000	17,221,200	29,662,500
35	Lime.....	Bbls., 200 lbs.	656,770,000	5,148,326	28,375,000	660,000,000	5,443,164	50,000,000
36	Magnesite.....	Short Tons	1,370	1,243	7,864	2,200	1,995	14,700
37	Manganese ore.....	Long Tons	11,735	11,324	74,890	14,883	15,121	92,040
38	Mica, ground.....	Pounds	829,500	377	35,957	750,000	340	31,266
39	Mica, sheet.....	"	9,900	4	11,103	6,200	3	6,400
40	Mineral wool.....	"	5,776	5,239	58,936	6,742	6,115	69,481
41	Monazite.....	"	750,000	340	45,000	1,900,000	862	114,000
42	Natural gas.....	"	"	"	13,000,000	"	"	12,000,000
43	Paints, mineral.....	Short Tons	47,343	43,167	1,011,182	47,681	42,765	1,066,767
44	Paints, vermilion.....	"	91	83	111,269	118	107	118,190
45	Paints, white lead.....	"	87,242	78,155	8,445,174	92,000	83,462	8,710,000
46	Paints, zinc oxide.....	"	22,814	20,697	1,711,275	22,690	20,498	1,588,300
47	Petroleum (crude).....	Bbls., 42 galls.	18,527,336	6,158,119	40,762,962	50,652,025	6,420,742	42,547,701
48	Phosphate rock.....	Long Tons	952,155	907,485	2,856,465	831,498	844,802	2,577,643
49	Marls.....	"	225,000	228,622	607,500	217,700	221,183	587,790
50	Precious stones.....	"	"	"	150,000	"	"	150,000
51	Pyrites.....	Long Tons	107,462	109,192	466,466	81,000	82,296	353,160
52	Salt, evaporated.....	Bbls., 280 lbs.	11,798,659	1,438,193	5,586,326	12,521,478	1,530,178	5,844,348
53	Salt, rock.....	"	2,341,922	207,376	784,063	1,367,638	173,662	518,740
54	Silica, sand and quartz.....	Long Tons	477,670	485,313	418,612	523,640	552,018	553,128
55	Slate, roofing.....	Squares	611,776	180,474	2,007,321	645,361	190,277	2,062,230
56	Slate, other manufactures.....	Square feet	4,395,125	12,966	399,758	3,786,599	11,170	369,062
57	Stone, limestone (flux).....	Long tons	3,544,393	3,601,459	2,126,636	3,390,000	3,444,240	2,542,500
58	Stone, marble.....	Cubic feet	6,331,279	518,532	3,576,853	6,942,533	568,593	4,086,261
59	Stone, onyx.....	"	1,450	110	20,000	800	66	10,750
60	Other building stones.....	"	"	"	630,000,000	"	"	33,000,000
Total non-metals.....			..	..	378,870,883	..	..	428,074,385
METALS.								
61	Aluminium.....	Pounds	817,600	371	490,560	900,000	386	495,000
62	Antimony.....	Short Tons	220	205	39,200	433	393	68,847
63	Copper.....	Pounds	353,504,311	160,392	33,540,489	386,153,850	175,294	36,944,988
64	Gold.....	Troy Ounces	1,923,612	659,824	39,761,295	2,265,612	770,470	46,830,200
65	Iron, pig.....	Long Tons	6,657,388	6,764,572	71,266,364	9,460,398	9,597,449	108,632,542
66	Lead, value at New York.....	Short Tons	106,867	145,906	10,585,018	156,854	142,298	10,132,768
67	Quicksilver.....	Flasks, 76½ lbs.	30,140	1,056	1,095,840	33,378	1,179	1,313,589
68	Silver, commercial value.....	Troy Ounces	49,849,875	1,556,387	31,463,531	46,331,235	1,441,087	30,254,296
69	Zinc, spelter.....	Short Tons	74,004	67,135	5,299,882	81,858	74,215	5,942,890
Total metals.....			..	..	194,092,119	..	..	240,615,120
Estimated products unspecified.....			..	..	5,000,000	..	..	5,000,000
Grand total.....			..	..	578,463,002	..	..	673,689,505

(a) Bituminous coal includes brown coal and lignite. The anthracite production is the total for Pennsylvania, Arkansas, and Colorado.

(b) Estimated.

(c) Kilograms.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st March.	
	1895.	1896.
	£	£
Metals.....	1,379,370	1,580,956
Chemicals and dyestuffs.....	885,527	953,968
Oils.....	680,297	581,593
Raw materials for non-textile industries.....	5,131,237	5,330,295
Total value of all imports.....	35,069,890	38,544,750

SUMMARY OF EXPORTS.

Articles.	Month ending 31st March.	
	1895.	1896.
	£	£
Metals (other than machinery)....	2,229,136	2,684,456
Chemicals and medicines.....	739,269	867,574
Miscellaneous articles.....	2,767,391	2,931,066
Total value of all exports.....	18,523,690	20,422,419

IMPORTS OF METALS FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore..... Tons	9,042	4,317	49,494	40,198
Regulus..... "	4,438	6,053	121,226	137,541
Unwrought..... "	3,116	4,548	126,521	206,197
Iron:—				
Ore..... "	353,277	469,538	203,514	334,422
Bolt, bar, &c. "	1,705	3,955	12,838	34,109
Steel, unwrought..... "	835	751	9,069	6,149
Lead, pig and sheet..... "	15,583	17,014	148,856	190,414
Pyrites..... "	51,924	56,959	87,921	94,261
Quicksilver..... Lb.	750,865	24,580	65,083	2,389
Silver ore..... Value £	..	..	182,223	76,982
Tin..... "	61,651	73,175	185,125	221,678
Zinc..... Tons	4,228	4,225	58,840	78,418
Other articles... Value £	..	..	128,665	158,198
Total value of metals.....	..	..	1,379,370	1,580,956

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Alkali..... Cwt.	8,737	17,100	6,175	8,269
Bark (tanners', &c.) ..	16,959	21,269	6,461	7,751
Brimstone..... "	46,360	15,036	7,541	3,506
Chemicals..... Value £	..	..	91,541	112,694
Cochineal..... Cwt.	623	94	4,077	608
Cutch and gambier Tons	3,124	2,508	67,285	62,818
Dyes:—				
Alizarin..... Value £	..	..	30,808	22,628
Anilin and other..... "	..	..	32,393	39,495
Indigo..... Cwt.	23,223	25,801	436,548	453,038
Nitrate of potash..... "	13,706	30,490	13,322	26,705
Valonia..... Tons	3,668	3,302	35,796	36,337
Other articles... Value £	..	..	153,580	180,419
Total value of chemicals.....	..	..	885,527	953,968

IMPORTS OF OILS FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Cocoa-nut..... Cwt.	13,065	22,230	14,074	24,740
Olive..... Tons	1,214	2,809	40,465	87,651
Palm..... Cwt.	45,283	94,456	98,102	97,878
Petroleum..... Gall.	18,801,423	10,554,270	203,049	228,227
Seed..... Tons	3,795	2,539	73,469	54,544
Train, &c. Tons	1,766	774	20,114	12,997
Turpentine..... Cwt.	47,183	858	53,659	609
Other articles... Value £	..	..	78,074	74,937
Total value of oils.....	..	..	680,297	581,593

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Bark, Peruvian .. Cwt.	4,365	4,514	10,726	6,999
Bristles..... Lb.	237,009	295,452	33,302	37,063
Caoutchouc..... Cwt.	41,166	55,344	501,374	686,558
Gum:—				
Arabic..... "	5,970	9,268	13,440	23,483
Lac, &c. "	13,190	23,561	71,662	116,394
Gutta-percha..... "	4,203	4,132	57,741	37,655
Hides, raw:—				
Dry..... "	48,380	34,841	107,262	89,676
Wet..... "	61,599	27,904	107,228	59,143
Ivory..... "	837	553	39,450	24,614
Manure:—				
Guano..... Tons	4,545	1,903	25,998	11,977
Bones..... "	9,171	7,876	39,492	30,456
Nitrate of soda..... "	12,788	26,057	109,983	206,766
Phosphate of lime..... "	32,028	28,124	57,718	50,553
Paraffin..... Cwt.	77,008	51,393	75,314	51,388
Linum rags..... Tons	2,257	2,630	19,165	22,543
Esparto..... "	16,500	20,419	70,283	85,667
Pulp of wood..... "	19,066	19,575	92,792	96,092
Rosin..... Cwt.	216,397	116,723	56,012	30,369
Tallow and stearin..... "	322,697	239,934	385,680	269,638
Tar..... Barrels	1,922	739	649	274
Wood:—				
Hewn..... Loads	112,739	137,874	214,353	250,696
Sawn..... "	88,991	101,958	215,012	237,062
Staves..... "	3,397	5,886	21,027	29,346
Mahogany..... Tons	4,169	3,768	33,760	35,937
Other articles... Value £	..	..	791,314	839,316
Total value.....	..	..	3,131,237	3,330,295

Besides the above, drugs to the value of \$4,890⁰⁰ were imported, as against \$8,725⁰⁰ in March 1895.

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Gunpowder..... Lb.	480,600	680,400	11,913	18,673
Military stores... Value £	..	..	183,607	126,553
Candles..... Lb.	2,139,600	1,756,000	35,372	28,627
Caoutchouc..... Value £	..	..	99,251	107,961
Cement..... Tons	28,616	30,552	50,184	50,553
Products of coal Value £	..	..	134,704	194,135
Earthenware .. "	..	..	151,117	150,115
Stoneware..... "	..	..	13,806	11,417
Glass:—				
Plate..... Sq. Ft.	94,083	188,940	5,376	8,282
Flint..... Cwt.	7,591	8,926	17,410	19,121
Bottles..... "	53,670	61,518	24,952	28,905
Other kinds..... "	16,434	14,239	12,887	11,534
Leather:—				
Unwrought..... "	13,165	12,030	112,743	113,716
Wrought..... Value £	..	..	28,230	34,224
Seed oil..... Tons	4,603	4,809	90,117	98,803
Floorcloth..... Sq. Yds.	2,325,800	2,166,300	84,779	82,189
Painters' materials Val. £	..	..	128,116	139,996
Paper..... Cwt.	81,235	95,266	123,766	146,478
Rags..... Tons	4,978	5,147	30,980	27,192
Soap..... Cwt.	57,472	65,634	62,249	68,081
Total value.....	..	..	2,767,391	2,931,006

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,349	10,594	£ 35,619	£ 42,337
Copper.....				
Unwrought....	50,806	52,669	109,893	129,296
Wrought.....	30,977	32,562	78,404	88,145
Mixed metal....	24,227	24,197	54,101	51,018
Hardware..... Value £	..	..	139,713	180,256
Implement.....	..	..	99,981	117,615
Iron and steel... Tons	295,507	293,341	1,521,315	1,862,060
Lead.....	3,637	2,632	41,985	35,061
Plated wares... Value £	..	..	21,951	30,901
Telegraph wires ..	..	..	19,598	21,238
Tin..... Cwt.	8,913	9,992	28,531	33,357
Zinc.....	12,746	19,268	8,415	13,258
Other articles... Value £	..	..	56,939	80,014
Total value .....	..	..	2,220,136	2,681,153

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 31ST MARCH.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	563,948	449,639	£ 136,112	£ 109,772
Bleaching materials ..	122,639	97,878	44,213	34,872
Chemical manures, Tons	26,723	40,803	202,151	235,875
Medicines..... Value £	..	..	88,834	98,865
Other articles....	..	..	272,657	388,190
Total value .....	..	..	739,269	867,574

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

5833. J. D. Morel. Improvements in mechanism for cleaning wool, cotton, and other fibrous substances. Complete Specification. March 16.

5849. F. H. Tyacke and C. E. Gittins. Improvements in water softening and purifying apparatus. March 16.

6210. S. T. Wellman and C. H. Wellman. Improvements in apparatus for charging metallurgical and other furnaces. March 20.

6318. J. F. Lester. Improvements in apparatus for treating vegetable and animal fibre with solvents. Complete Specification. March 21.

6377. D. Adorjan. Improved method and apparatus for producing highly overheated steam and vapour. March 23.

6749. H. Krack. Improvements in cooling apparatus for liquids. Complete Specification. March 27.

6785. H. L. Doulton. Improvements in condensing worms constructed of pottery. March 28.

6934. F. Jurschina, Z. Schnitzer, and F. Hersch. An improved filtering material and process of making the same. March 30.

7251. L. M. G. Delaunay-Belleville. Improvements in distilling apparatus for the production of fresh or drinking water. Complete Specification. April 2.

7335. P. S. U. Pickering. An improved evaporimeter. April 4.

7802. A. T. Pfeiff. Improvements in apparatus for sterilising milk, cream, and other liquids by means of steam. Complete Specification. April 13.

7868. T. C. Sanderson. Improvements in apparatus for drying white lead, colours, and other powdery, granular, and nodular substances. April 14.

7878. W. R. Jones. Improvements in furnaces. Complete Specification. April 14.

7913. E. Johnson and J. Thompson. Improvements relating to gas-regenerative furnaces. April 15.

7997. W. Shedlock. Improvements in and relating to evaporating apparatus, chiefly designed for obtaining salt from brine. April 15.

8198. A. S. Bryce, jun. Improvements in packing for hydraulic apparatus. Complete Specification. April 15.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

6231. H. Nehmer and F. Nehmer. Improvements in statical machines for lighting gas, ether, benzoline, and such like. March 25.

6491. J. Lee. Evaporating apparatus. April 1.

9395. C. H. Wild. Improvements in certain hydraulic presses for pressing fabrics. March 25.

10,571. E. Theisen. Improved method of and apparatus for evaporating, condensing, and cooling fluids. April 15.

11,039. J. Humes. Gas compressors. April 8.

11,405. C. Pottier. An improved basket or packing-case for carboys of acid and the like. April 15.

1896.

3345. J. Laidlaw and J. W. Macfarlane. Improvements in centrifugal machines for separating fluids of different densities. April 8.

3569. E. Petzholtz. Improvements in or connected with furnaces. March 25.

3668. T. Jenkins. Hydro-extractors. March 25.

4253. E. C. Nichols. Apparatus for compressing and storing air. April 8.

4418. H. H. Lake.—From W. F. Jobbins and J. van Ruymbeke. Evaporating apparatus. April 22.

4604. E. Theisen. Apparatus for evaporating, condensing, and cooling fluids. April 22.

5109. S. Pitt.—From La Compagnie Internationale des Procédés A. Seigle. An automatic re-ignition apparatus for hydrocarbon furnaces. April 15.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

5786. H. A. Kent. An apparatus for the utilisation or efficient burning of small or dust coal and other fuel in ordinary fire grates. March 16.

5790. P. R. de Fauchaux d'Ilumy. Improvements in the manufacture of fuel. March 16.

5796. P. R. de Fauchaux d'Ilumy. Improvements in the manufacture of briquettes for use as fuel or the like. March 16.

5813. T. Holliday. Improvements in means or apparatus for use in the production and application of acetylene gas. March 16.

5905. G. Webb and J. W. Kelly. Automatic gas-generator. March 17.

5916. F. A. MacKinnon. A new or improved method or process for the treatment of coke so as to render it suitable for transport. March 17.

5976. E. Appleby and H. F. Harris. An apparatus for automatically and safely generating and storing acetylene. March 17.

5984. W. W. Holmes. Improvements in the manufacture of artificial fuel. March 17.

5989. T. M. Ash and H. N. Weldon. Improvements in the manufacture of mantles for use in incandescent gas-lighting. March 17.

6008. F. S. Cripps. Improvements in apparatus for evaporating oil or other liquids, and mixing the vapours produced with coal-gas. March 18.

6254. W. Parlbj. Improvements in apparatus for quenching or cooling coke produced in the manufacture of coal-gas. March 20.

6349. H. Hart. Improvements in or relating to illuminating apparatus. March 23.

6380. Sir E. Green, Bart. Improvements connected with fuel economisers. March 23.

6408. A. Sweetser. Improvements in and connected with apparatus for the manufacture of oxygen gas. March 23.

6719. R. Reitmeyer. — From A. Cerekel. Improved apparatus for lighting and heating by means of acetylene. March 27.

6739. J. C. Bayley. Improvements in apparatus for generating and storing acetylene gas, especially suitable for use in portable installations. March 27.

6852. H. C. B. Forester. Improvements in and in apparatus for pressing artificial or patent fuel or the like into solid form. March 28.

6853. H. C. B. Forester. Improvements in apparatus for manufacturing artificial or patent fuel. March 28.

6857. G. Hilgenstock. Improvements in coke ovens. March 28.

6919. J. E. Dowson. Improvements in apparatus for making combustible gas. March 30.

6922. V. B. Lewes. Improvements in the manufacture or production of illuminating gas. March 30.

6930. J. C. Mcburn. — From A. C. Fraser. Improvements in the treatment of acetylene for illuminating and other purposes. March 30.

6999. A. Hussener. Improvements in horizontal coke ovens. Complete Specification. March 31.

7082. A. G. Wild. Improvements in apparatus for the production of acetylene gas for use upon railway carriages and other vehicles and places. April 1.

7085. W. Wardle. An improved method of manufacturing fuel from refuse and various waste substances. April 1.

7226. G. G. Schroeder. Improvements in gas-enriching apparatus. Complete Specification. April 2.

7242. W. C. Clarke. Method of and apparatus for generating acetylene. Complete Specification. April 2.

7243. W. C. Clarke. Method of generating illuminating gas. Complete Specification. April 2.

7286. C. Billington, jun. An improved method of and means for removing "scum" or "retort carbon" from gas retorts. April 4.

7367. H. Hill. Improvements in mantles or hoods for incandescent gas lights. April 7.

7429. J. B. de Lery. Improvements in and relating to mantles for incandescent gas and oil lamps. Complete Specification. April 8.

7438. E. H. C. Ochlmann. Improvements in incandescent gas burners. April 8.

7463. L. Denayrouze. Improvements in incandescent gas lighting. April 8.

7477. P. Schroeder. Improvements in incandescence gas burners. Complete Specification. April 8.

7559. W. Hampson. Apparatus for separating mixed gases by refrigeration, especially applicable to the separation of oxygen from air. April 9.

7624. A. Guaseo. Improvements in means and process for purifying and utilising the gases and other volatile products resulting from combustion. April 10.

7693. P. Woog. Improvements in or relating to lamps and apparatus for the generation and combustion of acetylene gas. April 11.

7869. H. A. Kent. Improvements in combined apparatus for generating, accumulating, and regulating a constant supply of acetylene gas. April 14.

7901. J. M. Mitchell. Apparatus for mixing air and gas. Complete Specification. April 14.

8005. W. Irwin. An improved method for the extraction of cyanides from coal-gas. April 16.

8098. W. H. Hill-Hartland. Improvements in treating furnace gases for re-use and consumption of smoke, and in means or apparatus therefor. April 17.

8161. W. Tyree. Improvements in or relating to the combustion of fuel. April 17.

8239. C. Gautzsch. Improvements in apparatus for producing illuminating gas. Complete Specification. April 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6615. H. H. Lake. — From M. M. Rotten and Co. Treatment of peat and apparatus therefor. April 8.

9739. D. W. Stone and B. Chaplin. An improved method of and apparatus for the treatment of smoke. April 1.

10,129. H. Reeser, jun. Improvements in the manufacture of mantles or luminous bodies for incandescent gas lamps and in compounds for use in such manufacture. April 1.

10,477. J. H. Ladd. Improvements relating to the manufacture of gas and to apparatus therefor. April 1.

10,697. W. Fiddes. Apparatus for discharging gas retorts. April 22.

11,039. J. Humes. See Class 1.

11,820. H. Gardner. — From La Société Française de l'Héliogène. Improved method of combining air and gas for incandescent lighting purposes. April 22.

12,020. S. Hersey and Kirkham, Hulett, and Chandler, Lim. Apparatus for washing or scrubbing gas. April 1.

16,691. R. Campe. An improved generator for acetylene gas lamps. April 15.

19,202. S. H. Crocker. Mantles for incandescent light. April 8.

1896.

2000. C. Kortwich. Glow bodies for incandescent gas lighting. April 8.

4192. A. Morgan. Improvements in gas heating and lighting. April 15.

4421. J. Anderson. — From W. Anderson. A shield for an incandescent gas mantle. April 1.

5375. E. T. Turney. Improvements relating to the generation of gas and to apparatus therefor. April 22.

5624. E. Farnsworth. Apparatus for the manufacture of gas. April 22.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,617. C. H. McEwen. — From J. C. Alexander and R. C. Beveridge. Improvements in the treatment of kerosene shale for the production of hydrocarbons and other products therefrom. April 8.

1896.

4598. A. Schmidt. Apparatus for the dry distillation of wood, coal waste, and the like. April 8.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

5857. H. H. Lake. — From Farbwerk Mühlheim. Improvements in the manufacture of colouring matters. March 16.

5858. H. H. Lake.—From Farbwerk Mülheim. Improvements in the manufacture of colouring matters and raw materials for use in such manufacture. March 16.

7043. G. H. Weiss. The manufacture of a new colour-producing aromatic diamine. Complete Specification. March 31.

7313. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of new raw materials and of direct-dyeing colouring matters derived therefrom. April 4.

7538. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of anthracene compounds and of dyestuffs derived therefrom. April 9.

7596. Levinstein, Lim., and I. Levinstein. Manufacture or production of new colouring matters. April 10.

7597. Levinstein, Lim., and I. Levinstein. Production or manufacture of new colouring matter. April 10.

7709. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new derivatives of amido-1 alhyl-2 alkyl-5 pyrazolones. April 11.

7766. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. The manufacture and production of new colouring matter from dinitro-naphthalene. April 13.

7788. O. Imray.—From G. H. Weiss. Manufacture of colouring matters from carbamides or thioearbamides. April 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

9794. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs and materials therefor. March 25.

10,668. H. H. Lake.—From Farbwerk Mülheim. Manufacture of colouring matters. April 8.

10,676. J. Y. Johnson.—From The Chemische Fabrik vormals Goldenberg, Geromont, and Co. A process for obtaining the acetyl derivatives of methyl-aniline, ethylaniline, para-anisidine, and para-phenetidine. April 1.

11,228. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of new azo dyestuffs. April 15.

11,276. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs suitable for dyeing cotton. April 15.

11,757. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of chemical compounds suitable for the production of colouring matters in bulk or on fibre. April 22.

11,843. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs. April 22.

12,221. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of colouring matters dyeing yellow with mordants. April 8.

12,303. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. The manufacture and production of poly-azo dyes of the benzidine and analogous series. March 25.

12,442. Brooke, Simpson, and Spiller, Lim., and W. S. Simpson. Improvements in colouring matters. April 1.

12,529. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Improvements in the manufacture of azo colouring matters. April 15.

13,032. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. Improvements in the production of blue, bluish-black, or greenish-black poly-azo dyes on vegetable fibre or on silk. April 1.

13,460. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. The manufacture and production of new nitrosamine compounds suited for use in the preparation of diazo compounds and of azo dyes. March 25.

14,135. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. The manufacture and production from phthalonic acid of products related to the rhodamine series. April 1.

1896.

5268. O. Imray.—From The Society of Chemical Industry in Basle. Process for the transformation of the thiosulphonates of the indamines and indo phenols into thiazine colouring matters. April 15.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

6519. J. Ingleby and E. Osclere. Improvements in or in connection with the manufacture of linoleum, cork carpets, and the like fabrics, and in machinery or apparatus therefor. March 25.

6527. J. L. Bortomley. Improvements in the manufacture of yarns. March 25.

7405. C. Efros. Improvements in the treatment of vegetable fibres. Complete Specification. April 7.

8235. J. Weiss. A chemical process for the production of white or coloured crape-like designs on cotton, linen, or other fabrics or yarns of vegetable origin. April 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,399. E. Nelson. Manufacture of fibrous bituminous felt. April 8.

24,586. L. Schmiewind and A. Schmidt. Improvements in elastic woven textile fabrics. April 1.

1896.

2213. J. C. Anderson. Improvements in and relating to process of and apparatus for the treatment of wool. April 8.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

5901. A. A. Kuenemann and F. D. Haddon. Improvements in the production of printed designs upon fabrics and in apparatus to be employed therefor. March 17.

6028. E. Deakin. Improvements in kiers for bleaching and similarly treating textile fabrics and other materials. March 18.

7610. T. Lye and W. T. Lye. Improvements in the bleaching or dyeing of chip-chip plait, straw, or straw plait. April 10.

7977. H. W. V. Wilson and W. Brown. Improvements in or relating to apparatus for varnishing or otherwise coating paper, cardboard, or other material. April 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

10,424. R. W. E. McIvor and J. Chester. Improvements in the mode of bleaching reed, ramie, china grass, and other vegetable fibres and undyed fabrics made from vegetable fibres. April 1.

10,716. F. Stehle. See Class XIX.

20,153. T. F. Hassler. An improved process for dyeing and drying yarn. March 25.

21,511. L. Mistoviki. Improvements in the production of ornamental and other designs upon waterproof, textile, and other fabrics. April 8.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

6096. D. A. Peniakoff. Improvements in the manufacture of aluminate of barium and aluminate of strontium, and the production of alumina sulphate of barium and of strontium and other products from the same. March 18.

6270. J. S. Pattinson and Fawcett, Preston, and Co., Lim. Improvements in the treatment of certain earths for the extraction of the soluble matters therefrom. March 21.

6290. D. Peniakoff. See Class X.

6808. F. Bale. Improvements in obtaining the vapour of ammonium chloride alone or mixed with either of its constituent gases (NH_3 or HCl) and obtaining therefrom ammonia and hydrochloric acid, or chlorine, and in the apparatus used. March 28.

6835. B. T. L. Thomson. Improved process and apparatus for the manufacture of carbonic acid gas. March 28.

6856. C. M. Lévy. The manufacture of a washing and bleaching composition. March 28.

6887. R. Addie. Process for extracting cyanides from blast-furnace dust or other crude salts and aqueous solutions containing cyanides. March 30.

7002. H. H. Lake.—From L. Sternberg. Improvements in and relating to the production of ammonia from waste products, such as the waste lyes resulting from the extraction of sugar or the manufacture of alcohol from molasses. Complete Specification. March 31.

7062. A. C. Thomson. Improvements in apparatus for obtaining potassic cyanides. April 1.

7123. A. von Siemens. Process for working metallic sulphides. Complete Specification. April 1.

7124. O. Imray.—From La Société Christiania Minekompani. Process for the production of ammonia and ammoniacal salts, as also nitrous or nitric acid or nitrites or nitrates, by means of the nitrogen of atmospheric air, or of that contained in combustion gases of any kind. April 1.

7464. A. MacNab. An improvement in the treatment of hay salt. April 8.

7796. W. Shedlock. Improvements in and relating to apparatus for obtaining salt from brine and for similar purposes. April 13.

7910. J. Plummer. Process to obtain ammonia and hydrochloric acid from ammonia chloride. April 15.

7969. J. Enright. An improved method of manufacturing sulphurous anhydride and its derivatives, and apparatus therefor. April 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7560. C. Hoepfner. Improvements in the manufacture of chloride of zinc and other metal chlorides, applicable also to the manufacture of acetate or sulphate of zinc. April 1.

9332. T. Twynam. Improvements in the fixation of nitrogen and the production of cyanides. March 25.

10,713. R. Main and W. Donald. Improvements in treating chlorides for the production of chlorine and alkalis or alkaline earths, and the recovery of by-products. March 25.

10,931. O. Imray.—From Goerlich and Wichmann. Process for decomposing sulphuretted hydrogen and obtaining ammonia, compounds of ammonia, oxysulphides, sulphides, and sulphur. April 1.

23,819. R. Main and W. Donald. Improvements in treating nitrates for the production of nitric acid, and the recovery of by-products. March 25.

1896.

3987. W. P. Thompson.—From C. von der Linde. An improved process for obtaining acetic acid from pyro-ligneous salts. March 25.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

7305. T. Reeves. A novel method of applying the art of portraiture to pottery, glassware, and turnery, and of producing some special effects thereby. April 4.

7899. R. Stanley. Improvements in ovens for drying and burning tiles, pottery, and other plastic or semi-dry ware. April 14.

8148. The Coalport China Co. (J. Rose and Co.), Lim., and T. J. Bott. Improvements in or connected with the ornamentation or decoration of china, earthenware, glass, and like ware. April 17.

COMPLETE SPECIFICATION ACCEPTED.

1895.

11,595. J. L. Rawdon and The British and Foreign Patent Syndicate. Improved composition for use in the plastic arts. April 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

6232. F. L. Schauermaun and J. S. Cowper. An improved composition for use in imitation of or in substitution for wood. March 20.

7023. O. J. Owen. Improved manufacture of cement or plaster. March 31.

7032. A. M. Clark.—From The Electric Fireproofing Co. Method and apparatus for treating wood. March 31.

7567. W. C. Lawton. Improvements in the process of manufacturing ornamental strips of soft clay. April 9.

7866. J. Hamblet and I. Parkes. Improvements in or additions to machinery used in the manufacture of coping bricks, terra-cotta building blocks, and the like. April 14.

7892. J. E. Summers and J. H. Ogburn. Improvements in plastering compounds. April 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6866. P. Stolte. Improvements in building slabs or blocks. April 8.

9876. H. H. Leigh.—From F. A. Jumeau. Improvements in and connected with the manufacture of pictures in cement or analogous material. March 25.

10,089. J. Patchett. Time precipitation process of mortar analysis. April 22.

10,090. J. Patchett. Measure process of mortar analysis. April 22.

10,468. A. Roberts. A new or improved substitute for tiles for the coverings of walls, ceilings, and other suitable places. April 15.

11,688. A. W. Lundberg, J. O. Hallgren, and V. F. L. Smidth. Improvements in kilns for burning Portland cement, Roman cement, or other hydraulic cements or lime. April 8.

23,880. P. Jantzen. An improved method of and apparatus for making artificial stone blocks or plates. March 25.

1896.

3985. A. Clery. A new or improved cement. March 25.

4918. R. A. Chesebrough. Improvements in the art of manufacturing cement. April 22.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

5781. S. O. Cowper-Coles. Improvements in and apparatus for applying zinc or other metallic coatings to iron, steel, or other surfaces. March 16.

5845. J. B. Torres. Improvements in or relating to the extraction of gold and other gold metals from ores and the like. March 16.

6009. J. Hill. Improved composition of furnace bottoms for heating iron or steel. March 18.

6033. W. Pearson and J. A. Bott. Improvements in the manufacture of aluminium alloys. March 18.

6242. J. Mait. Apparatus for separating and saving gold. Complete Specification. March 20.

6290. D. Peniakoff. A process for the production of double aluminium sulphides (or sulphurets) with alkaline metals or metals of (the nature of) alkaline earths. Complete Specification. Filed March 21. Date applied for Oct. 22, 1895, being date of application in France.

6473. H. R. Angel. Improvements in the treatment of refractory or other ores. March 24.

6572. J. Inray.—From M. A. J. Roux. Apparatus for separating volatile metals from their alloys. March 25.

6654. A. Karyscheff and S. Demmenie. A new pyrochemical process and apparatus for the direct production of iron and other metals from their ores. March 26.

6701. D. C. Dalzell. An improved process of annealing steel. March 27.

6712. J. Ruffle. An improvement in protecting the surface of the molten metal from the action of air when coating iron in a solid state, or steel in a solid state, with tin or the alloys of tin. March 27.

6713. J. Ruffle. An improvement in protecting the surface of the molten metal from the action of air when coating iron in a solid state, or steel in a solid state, with lead or the alloys of lead. March 27.

6714. J. Ruffle. An improvement in protecting the surface of the molten metal from the action of air when coating iron in a solid state, or steel in a solid state, with tin or the alloys of tin. March 27.

6744. J. G. Daw. An improved method and means for introducing solid or liquid reagents or other materials into molten metals. March 27.

6779. A. de Courey Scott. An improved process and apparatus for treating ore containing gold or silver, or both. March 27.

6921. O. Frolich. Process and apparatus for the extraction of metals from their ores by means of chlorine gas. March 30.

7272. F. B. Last and J. R. Wright. Improvements in the manufacture of steel. Complete Specification. April 1.

7273. D. A. Peniakoff. A process for the manufacture of double sulphides, or double compounds of sulphuret of aluminium with other sulpho-metal or metallic sulphides. Complete Specification. April 4.

7315. J. E. Preston. Improved amalgamating apparatus. Complete Specification. April 4.

7358. H. L. Haas. Improvements in process of nickel plating. Complete Specification. April 7.

7422. R. A. Hadfield. Improvements in the manufacture of steel or alloy of iron. Filed April 7. Date applied for Feb. 17, 1896, being date of application in United States.

7424. J. B. Torres. Improvements in or relating to the extraction of gold and other metals from ores and the like, and in apparatus therefor. April 8.

7436. W. Gibbings. Improvements in blast furnaces. April 8.

7447. H. R. Angel. The recovery of zinc from refractory ores. April 8.

7615. R. Farley and F. Tonks. Improvements in the manufacture of steel and iron sheets. April 10.

7745. W. H. Browning and J. G. Heywood. Improvements in the process of casting partly chilled objects and in means therefor. April 13.

7776. A. Tanxe. A new or improved process for hardening iron, steel, and other hard metals. Complete Specification. April 13.

7783. W. P. Thompson.—From E. Wohlwill. An improved process for obtaining chemically pure gold from fine gold and alloys rich in gold. April 13.

7816. W. Trewitt. Improvements in steel reheating furnaces. April 14.

7941. J. A. Mays. Improved method and apparatus for hardening and tempering steel plates. April 15.

8042. J. B. Torres. Improvements in and connected with the metallurgical treatment of gold and other ores, and in apparatus therefor. April 16.

8064. T. Huntingdon and F. Heberlein. Improvements in the treatment of sulphide ores of lead, zinc, or antimony, preparatory to smelting the same, and incidentally in obtaining sulphurous acid. April 16.

8072. W. T. Whiteman.—From The Compagnie Générale l'Alumine Exploitation des Brevets F. Raynaud (Société Anonyme). A new or improved process for the treatment of aluminous ores and silicious matters. April 16.

8226. W. S. Simpson. Improved means and apparatus for tempering or hardening metal articles. April 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1894.

24,861. T. Parker. Improvements in the treatment of ores known as sulphide ores, for the separation and obtainment of the metals contained therein. March 2.

1895.

10,399. J. J. Christmas. An improved process for the treatment of gold-bearing antimony ores. April 22.

12,102. A. de Courey Scott. Improved process and apparatus for treating ores and liquors containing gold or silver, or both. April 22.

17,143. E. Smith. Improved process or method of producing brilliant effects upon bright metallic surfaces. April 15.

1896.

1146. L. Doig.—From Russel and Erwin Manufacturing Co. An improved method of preparing metal and metal articles for stamping and drawing in dies. April 1.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

6071. W. Rowbotham. Improvements in primary electric batteries. March 18.

6216. C. H. Parker and J. Pullman. Improvements in and relating to the treatment of sodium and potassium chlorides by electrolysis. March 20.

6407. W. S. Rawson. Method and apparatus for electrically coating articles with zinc. March 23.

6509. L. Epstein and F. Marza. A process and apparatus for decomposing sodium or potassium chloride and generating electricity. March 24.

6655. The Chemical and Electrolytic Syndicate, Limited, O. J. Steinhart, and J. L. F. Vogel. Improved process of producing basic lead carbonate and obtaining certain by-products. March 26.

6981. J. Entwisle.—From S. N. Smith and E. S. Baring-Gould. Improvements in electric batteries. Complete Specification. March 31.

7000. L. Epstein and F. Marza. A process and apparatus for decomposing sodium or potassium chloride and generating electricity. March 31.

7162. A. J. Boulton.—From J. Julien. Improvements in or relating to secondary batteries. April 1.

7174. J. C. Green. A metal for heating by electricity. April 2.

7222. A. S. Elmore.—From J. O. S. Elmore. Improvements in apparatus for manufacturing tubes by electrolytic deposit. April 2.

7255. H. H. Lake.—From J. Julien. Improvements in secondary batteries. April 2.

7259. W. P. Thompson.—From J. Julien. Improvements in and in the construction of soluble-metal electrodes for accumulators. April 2.

8080. E. Commaelin and R. Viau. An improved electrical accumulator under pressure. April 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6565. H. Tec. Improvements connected with the electrolysis of chlorides and other salts, and the evaporation of brine and other solutions. April 1.

6565A. H. Tee. Improvements connected with the electrolysis of chlorides and other salts, and the evaporation of solutions. April 1.

8306. C. P. Shrewsbury, F. L. Marshall, J. Cooper, and J. L. Dobell. Improvements in or connected with electric batteries. April 1.

8373. W. S. Rawson. Improvements in conductors for coupling cells of voltaic batteries. March 25.

8876. C. P. Shrewsbury, F. L. Marshall, J. Cooper, and J. L. Dobell. Improvements in or connected with electric batteries. April 8.

10,448. L. Falero and H. Lumley. Improvements in secondary or storage batteries. April 15.

11,016. H. Blackman. Improvements in electrolytic decompositions, and especially in the electrolytic production of bleaching agents and their uses, and in electrodes and apparatus therefor. April 8.

11,032. T. Eremin. Secondary batteries or accumulators. April 8.

11,298. E. Jordis. An improved method or process for obtaining metals or metallic alloys by electrolysis. April 22.

11,659. J. T. Niblett. Improvements in elements for secondary batteries. April 15.

23,852. S. S. Bromhead.—From La Société Anonyme des Anciennes Salines domaniales de l'Est Actien Gesellschaft. Diaphragms or partitions for electrolytic purposes formed of carbonates of alkaline earths. April 22.

24,837. P. Jensen.—From H. C. F. Stormer. Improvement in the method and apparatus for washing alkali amalgam obtained in electrolytic apparatus. April 15.

1896.

477. C. N. Stewart. Electrical storage accumulators. March 25.

5098. G. B. Baldo. Electrolytic processes and apparatus therefor. April 22.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

5791. P. R. de Fauchaux d'Humy. Improvements in or relating to the production of lubricants. March 16.

5792. P. R. de Fauchaux d'Humy. A new or improved manufacture of soap. March 16.

6558. E. Benz. Improvements in soap. March 25.

7269. The Fish Utilisation Syndicate, Lim., and J. C. W. Stanley. Improvements in or relating to the liberation or recovery of oils and the like. April 2.

7379. W. R. Harrison and E. Stephenson. Improvements in the method of and apparatus for extracting oil from seeds or other oleaginous substances. April 7.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7442. A. Lubn. A new or improved soap extract and a process for manufacturing the same. April 15.

9153. G. Mitchell. A new or improved process for the treatment and refining of vegetable oils during or subsequent to their expression from nuts, beans, seeds, and the like. March 25.

1896.

2896. J. Stockhausen. A new or improved soap. April 8.

3312. W. Hanley. Manufacture of soft and other soaps. April 8.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

6393. F. Spiller. Manufacture of multi-coloured or marbled natural or artificial ambers and process therefor. March 23.

6396. K. Thon. Improvements in blacking for leather and the like. Complete Specification. March 23.

6453. G. Wendler. Improvements in and relating to farinaceous and resinous solutions and mixtures. March 24.

6830. W. J. Clapp and F. S. Dauncey. Improvements in the manufacture of india-rubber and in machinery and apparatus therefor. March 28.

7537. P. Cannell-Benn and W. Barrett. Improvements in and connected with the production of pigments. April 9.

7785. J. Sanders. A new or improved composition applicable for covering or protecting ships' bottoms and other structures. April 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

9891. H. R. Gregory. Improvements in the manufacture of sulphate of lead and lead pigments. April 22.

10,715. J. H. R. Paterson. Improvements in treating gutta-percha or its compounds for the manufacture of golf balls and other goods. April 8.

17,108. J. F. Cobbledeik. Improved paint or composition for use on metal, wood, stone, or other substances. April 15.

1896.

4249. W. P. Thompson.—From C. S. Bailey. Improvements in compositions or compounds for removing paint. April 1.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

6209. P. H. Riemer. Chalk glue for all applications on wood, paper, and cardboard, and for all other purposes where glue is employed. March 20.

6323. C. Marter and M. J. Myers. An improved rapid process of tanning skins without acids. March 21.

6410. W. L. Wise.—From Knoll and Co. Improvements in the manufacture or production of an albumen tannin compound. Complete Specification. March 23.

7886. V. Gallien. Improvements in the process of and means for tanning hides. April 14.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

6289. E. Paternotte. Chemical manure mixer. March 21.

6405. N. F. B. de Mercey. Improvements in the manufacture of manure. March 23.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

5844. J. Kantorowicz. An improved process for preparing soluble starch. Complete Specification. March 16.

5953. C. F. Kastengren. An improved method of purifying molasses, syrup, or other solution of sugar. Complete Specification. March 17.

6508. W. Feld. Process for the extraction of sugar from molasses and other saccharine liquors by means of barium hydroxysulphide, and the regeneration of the latter from the by-products produced. March 24.

7337. J. Perichon. Improved method and apparatus for the treatment of bagasse. Complete Specification. April 4.

COMPLETE SPECIFICATION ACCEPTED.

1896.

3565. M. Zahn. Sugar refining. March 25.

XVII.—BREWING, WINES, SPIRITS, ETC.

APPLICATIONS.

5960. A. B. White. An improved appliance for saving beer workings. March 17.

6147. F. B. Pike. An improved method of treating brewers' and distillers' grains. March 19.

7971. S. Pratt. A method of utilising brewers' grains. April 15.

8122. E. Müller and C. Müller. Process for clarifying beer and making it keep. April 17.

COMPLETE SPECIFICATION ACCEPTED.

1895.

8123. W. P. Thompson.—From J. Effront. An improved process for the fermentation of worts which have been rendered antiseptic. April 22.

XVIII.—FOODS, SANITATION, &c., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

6596. W. Nageli. An improved process for sterilising and preserving food products and beverages. March 24.

6647. H. M. Myers and J. T. Myers. Improvements in milk sterilisers. March 26.

6920. C. L. Villar. Improvements in the preservation of meat. Complete Specification. March 30.

7042. H. Higgins. Improvements in or relating to the preservation of foods and other perishable goods. March 31.

7480. A. J. Boulton.—From F. Fritzsche and Co. Improvements in or relating to the preservation of organic substances. April 8.

7880. R. Haddan.—From Kathrein's Malzkaffee Fabriken mit beschränkter Haftung. Improvements in the process for producing coffee substitutes from grain. Complete Specification. April 14.

7894. J. H. Kellogg. An improved alimentary product and process of making the same. Complete Specification. April 14.

8152. A. Huber. Process for preserving eggs. Complete Specification. April 17.

8194. J. C. Uhlenbrock. Improvements in the method of and apparatus for the manufacture of margarine or butter substitute. Complete Specification. April 18.

8232. H. Higgins. Improvements in or relating to the preservation of foods and other perishable goods. April 18.

8233. H. Higgins. Improvements in or relating to the hermetic sealing of vessels. April 18.

B.—Sanitation.

5955. W. E. Adeney and W. K. Parry. The utilisation of by- and waste products from iron and steel industries for the manufacture of improved precipitants for the purification of sewage and other waste liquids. March 17.

6132. H. B. Sharp. Improvements in the manufacture of materials or compounds for use in the treatment of sewage and impure waters. March 19.

7268. The Fish Utilisation Syndicate, Ltd., and J. C. W. Stanley. Improvements in or relating to the treatment of fish and other offal or similar refuse. April 2.

8227. W. D. Scott-Moncrieff. Improvements in or relating to the treatment of sewage and other organically contaminated liquids, and in apparatus therefor. April 18.

C.—Disinfectants.

5793. P. R. de Fauchaux d'Ilumy. Improvements in disinfectants or antiseptics. March 16.

5955. W. E. Adeney and W. K. Parry. See Class XVIII. B.

7333. H. H. Lake.—From Soc. Anonyme de la Fab. de Carton de Grandson et d'éclairage électrique. An improved fumigating composition. April 4.

8236. C. H. Higbee. An improved composition or material for destroying insects. Complete Specification. April 18.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1895.

7508. W. Fraser. New food preparations, liquid and solid, for animal food. April 15.

1896.

3090. C. Kellner. Improvements in the reduction of organic compounds. March 25.

3103. A. J. Boulton.—From W. Meadows. An improved food and processes of preparing the same. April 8.

B.—Sanitation.

1895.

5834. G. Mugna. Improvements in or relating to the purification of smoke and recovery of soot from the products of furnaces. March 25.

10,891. C. A. Burghardt. Production of compositions adapted to be used in the treatment of sewage and other foul waters. April 8.

XIX.—PAPER, PASTEBOARD, ETC.

APPLICATIONS.

5987. S. W. Wilkinson and the Grove Company, Limited. Improvements relating to the treatment of articles of cellulose or cellulose compounds. March 17.

6014. J. Shaw. Improvements in heating engines or machines employed in the treatment of paper pulp. March 18.

6289. M. E. Asselot. Improvements in or relating to the manufacture of celluloid. March 23.

6836. S. W. Wilkinson. The manufacture of an improved substitute for ivory, celluloid, and the like. March 28.

7234. The British Xylonite Company, Limited, and S. W. Brooke. Improvements in the manufacture of xylonite, celluloid, and similar compounds of nitro-cellulose. April 2.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

2709. R. Aitken. Treatment of paper. April 15.

10,716. F. Stehle. Process for bleaching paper pulp. April 1.

12,461. L. de Naeyer. Apparatus for treating paper pulp. April 22.

24,272. A. Duffek and A. Merrel. Manufacture or preparation of cellulose suitable as a raw material for paper. March 25.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

6108. F. Sykes.—From R. Hirsch. A process for purifying saccharine. March 19.

6157. F. Brunjes. An improved process for the separation of silicic acid from argillaceous substances. Complete Specification. March 19.

6858. C. D. Abel.—From E. Bronnert and T. Schlumberger. Manufacture of solutions of tetranitro-cellulose (collodion pyroxyline). March 28.

6929. S. Frankel. A new pharmaceutical product and a process of obtaining the same. March 30.

7298. G. Dallmann. Process for making a preparation of iron applicable as medicament. April 4.

7692. O. Pren. Improvements in the manufacture of vanilline. Complete Specification. April 11.

7712. A. Classen. Production of formaldehyde compounds of the albumen and protein bodies. April 11.

7898. H. H. Lake.—From L. von Lorey, *z.* An improved process for raising permanent pure cultivations of lactic acid bacteria. April 14.

8154. J. C. Mewburn.—From The Chemische Fab. von Heyden, Gesellschaft mit beschränkter Haftung. A new product, being pyrocatechin-anhydro-mono-acetic acid, and a process or processes of manufacturing the same. Complete Specification. April 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6596. M. Otto and A. Verley. Manufacture of perfumes. April 1.

10,946. H. H. Lake.—From The Fabriques de Produits Chimiques de Thann et de Mulhouse. Manufacture of artificial musk. March 25.

11,287. O. Imray.—From Goerlich and Wichmann and Co. Manufacture of rhodan of sulphocyanide salts from nitrates, bisulphide of carbon, and sulphuretted hydrogen. April 1.

1896.

5672. E. Langheld. Ozone compounds for medicinal purposes. April 22.

XXI.—PHOTOGRAPHY.

APPLICATION.

6651. P. E. Schoenfelder and E. Kehle. Improvements in chemical compositions to be used for preparing the surface of suitable material for photographic prints. Complete Specification. March 26.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

5815. G. Craig. Improvements in the manufacture of nitrate of ammonium and in the apparatus therefor. March 16.

6052. G. Schwiening. Manufacture of igniting compound for matches. March 18.

6420. L. Waydelin. Improvements in or relating to detonating- or fog-signals for use on railways. Complete Specification. March 23.

6431. A. V. Newton.—From A. Nobel. Improvements in explosive compounds. March 23.

6555. R. Pierre and W. Pottgiesser. Improvements in the manufacture of safety explosives. Complete Specification. March 25.

6775. G. D. Day. Improvements in wax and other matches. March 27.

6937. W. Greaves and E. M. Hann. Improvements in or relating to explosives. March 30.

7612. E. Davies and H. M. H. Goodfellow. Improvements connected with explosive and non-explosive projectiles, and in an explosive compound to be used with explosive projectiles. April 10.

7711. M. Wagner. Improved manufacture of fuses or match-cords. Complete Specification. April 11.

7744. W. J. Clapp and F. P. Robjert. Improvements in the manufacture in match-boxes and matches. April 13.

8022. W. B. Ballantine, jun. Improvements in and connected with the fuses or projectiles. April 16.

8075. M. I. E. Morris. Improvements in explosives. April 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

9798. H. V. Keeson. Improvements in fuses for projectiles. April 22.

1896.

4714. M. Bals. Process for rendering amorphous phosphorus applicable as substitute for the yellow phosphorus for matches, primings, and the like. April 15.

PATENTS UNCLASSIFIABLE.

APPLICATION.

7793. C. Stahlshmidt. Improvements in or relating to the manufacture of a new product from sugar, brown iron ore, and chloride of sodium. Complete Specification. April 13.

COMPLETE SPECIFICATION ACCEPTED.

1896.

2090. G. L. A. Kuhlmann and J. Baier. A new and improved manufacture of a material suitable as a substitute for whalebone. April 22.

THE JOURNAL OF THE Society of Chemical Industry:

A MONTHLY RECORD

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MAY 30, 1896.

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NOTICES.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those Members whose names are placed in italics in the list of Council will retire from their respective offices at the forthcoming Annual General Meeting.

Dr. Edward Schunck, F.R.S., has been nominated to the office of President; and Mr. Thomas Tyrer has been nominated Vice-President under Rule 11.

Prof. A. K. Huntington, Mr. A. H. Mason, and Mr. G. N. Stoker have been nominated Vice-Presidents under Rule 8; and the Treasurer and Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the Ordinary Members of Council under Rule 18. Nomination forms for this purpose can be obtained from the General Secretary upon application.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten Members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting, to the election to take place at which it refers. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in London on the 15th, 16th, and 17th July next. The programme, with application form for tickets, will be found in this number of the Journal. Tickets of Membership will be issued in time for the meeting, and will form, as heretofore, vouchers for visits to works and excursions.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready in the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

The prices will be as follows:—

To Members (see Rules 25 and 27) who make application with remittance, not later than June 30, 1896.....	Each copy	5s.
To Members (see Rules 25 and 27) who make later application; Libraries, Corporations, and Exchanges on the Society's List, and Past Members (see Rule 30)	Each copy	10s.
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Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. EYRE and SPOTTISWOODE, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,000 per month.

MEMORIAL TO THE LATE PROF. HUXLEY, F.R.S.

This Memorial will take the form of a statue to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science, while the surplus will be devoted to the furtherance of biological science. Donations towards the fund should be sent to Mr. G. B. Howes, Hon. Sec. Huxley Memorial Committee, Royal College of Science, South Kensington, S.W.

MEMORIAL TO THE LATE PROF. PASTEUR.

At a meeting of the Provisional Committee of the British Section of the Pasteur International Memorial, held on March 21st last, Sir Joseph Lister in the chair, it was unanimously resolved, "That application be made for subscriptions towards the erection of a monument to Pasteur in Paris from persons in the United Kingdom, India, and the Colonies, interested in science and the various industries which have been benefited by Pasteur's labours." An Executive Committee was formed consisting of Sir Joseph Lister, Sir John Evans, Sir Henry Roscoe, Dr. Thorne Thorne, and Prof. Percy Frankland (Hon. Sec.). Subscriptions may be sent to Sir John Evans, who will act as Hon. Treasurer, at the Royal Society, Burlington House, W.

ADDRESS TO PROF. CANIZZARO.

At a meeting of Council held on March 23rd it was unanimously resolved to present an address of congratulation to Prof. Canizzaro on the attainment of his seventieth year of age, which occurs on July 12th next. The drafting of the address was placed in the hands of the Hon. Foreign Secretary of the Society.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

This Congress will be opened in Paris, possibly at the Hotel "des Agriculteurs de France," on Monday, July 27th next, and will continue for about ten days. All enquiries and adhesions should be addressed to the General Secretary of the Conference, 156, Bd. Magenta, Paris.

LIST OF MEMBERS ELECTED 22nd MAY 1896.

- Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
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 Marshall, Percy S., School House, Lockwood, Huddersfield, Assistant Chemist.
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 Woodward, Jas., 144, Osborne Road, Forest Gate, Essex, Government Analyst.

CHANGES OF ADDRESS.

- Allred, C. H., 1/o Heavitree Road; 8, St. Margaret's Road, Plumstead Common, Kent.
 Barrie, D. McL., 1/o Johannesburg; retain Journals until further notice.
 Bateson, P., 1/o Wavertree, Cuckoo Lane, Gateacre, near Liverpool.
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 Bischoff, Dr. E.; Journals to 227, East 19th Street, New York, U.S.A.
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 Carmody, Prof. P.; Annual Meeting Notices to 225, Friern Road, Dulwich, S.E.; Journals as before.
 Chadwick, Walter N., 1/o Bayonne; c/o Pennsylvania Salt Manufacturing Company, Natrona, Pa., U.S.A.
 Constable, W. H., 1/o Widnes; The Birches, Seabank Road, Liscard, Cheshire.
 Crompton, Percy R., 1/o Dearden's House; Elton Paper Mills, near Bury, Lancashire.
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 Dreaper, W. P., 1/o Prince's Road; 80, Middle Market Road, Great Yarmouth.
 Flammer, E., 1/o Manchester; Heilbrunn a/N., Würtemberg.
 Haga, T., 1/o Tokyo; Schlüterstrasse 72", Charlottenburg, Berlin.
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 Hewitt, J. Theo.; Journals to 11, Venuer Road, Sydenham, S.E.
 Hill, Jas. Kay, 1/o Irvine; 13, Osborne Place, Copland Road, Govan, near Glasgow.
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Houston, R. S., 1/o Greenlaw Drive; Hawkhead Road, Paisley.

Kershaw, J. B. C., 1/o Streatham Hill; c/o S. Cowper-Coles, 39, Victoria Street, S.W.

King, C. M.; delete "c/o C. D'Oyley Mears" from address.

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Lloyd, Harold T., 1/o Snarebrook; c/o British Aluminium Co., Lim., Milton, near Stoke-on-Trent.

Moore, Dr. G. D., 1/o 25; 21, Catherine Street, Worcester, Mass., U.S.A.

Muir, J. Stanley; all communications to 27, Huntly Gardens, Glasgow.

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Reid, W. G.; all communications to Soapworks, Beaconsfield, Cape Colony.

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Vörster, F.; Journals to Köln-Marienbourg, Germany.

Wates, E. A., 1/o Hyderabad; Coromandel G. M. Co., Oorgaum, Mysore, India.

Whiteley, R. Lloyd; Journals to 20, Beeches Road, West Bromwich.

Williams, David, 1/o St. Helens; 156, Chatham Street, Liverpool.

Williams, D. T., 1/o Morgan Street; Brynawen, Hafod, Swansea.

Wingate, M. M., 1/o Melbourne; Bishopscourt, Ballarat, Victoria.

Deaths.

Curtman, Dr. Chas. O., North 9th Street, St. Louis, Mo., U.S.A.

Hamilton, Prof. Claude C., M.D., Kansas City, Mo., U.S.A.

ERRATUM IN LIST.

For "Kvecht, V.," read "Koechl, I."

London Section.

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The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—Chairman: R. Messel. Committee: W. J. Dibdin, R. J. Friswell, D. Howard, B. E. R. Newlands, B. Redwood, and T. Tyrer.

SESSION 1895-96.

June 1st:—

Mr. W. Gowland. "Japanese Metallurgy." Part I.

Mr. S. Cowper-Coles. "The Electro-deposition of Zinc."

Meeting held Monday, May 4th, 1896.

DR. R. MESSEL IN THE CHAIR.

ARTIFICIAL SILK (LUSTRO-CELLULOSE).

BY C. F. CROSS AND E. J. ELVAN.

The production of a lustrous thread of cellulose in continuous length, by the process of drawing or "spinning" is at this date an accomplished fact, ranking not merely as a technical curiosity, but as a commercial development. The term "artificial silk" by which this product is designated is in some sense an unfortunate one, involving as it does a confusion of the incidental aspects of structure or form with the essential properties of matter or substance. Given a solid homogeneous cylinder of cellulose, there were *a priori* grounds for expecting the substance in this form to show high lustre. Now that the product is before us, and we have to inform ourselves about it as technologists and not as, let us say, journalists, we may very well begin our enquiry by eliminating the term "silk" as involving exclusive title to the properties of high lustre and elasticity. Those who are familiar with vegetable fibres and fibrous products are well aware that the forms of natural cellulose comprise a wide range of variations of these characteristic properties, and that these variations closely correspond with difference of minute structure, being dependent in much lesser degree upon variations of chemical composition.

A superficial comparison of cotton, flax, and the cellulose well illustrates this point. These products are indistinguishable chemically, *i.e.*, may be considered as one and the same substance; in appearance and generally in their characteristics, on the other hand, they are strongly differentiated. Microscopic examination reveals the effective causes of these differences. The cotton fibre is a flattened or collapsed tube with thin membranous side wall; the bast fibres on the other hand, are polygonal or cylindrical in outline, with side walls relatively thick in proportion to the central canal; the side walls, moreover, tend to break up when disintegrated into fibrillae parallel to the axis. These structural features impart a decided capacity for reflecting light, whereas the structure of cotton contributes to the breaking or scattering of light, *i.e.*, to inferior lustre. These points have been systematically dealt with by Vétillard in his "Études sur les Fibres Végétales Textiles" and by O. Witt in his "Chem. Techn. d. Gespinnstfaser" and elsewhere.

Witt has discussed these points by the very suggestive method of what we may term "diagrams in substance." He takes glass as a typical colloid and draws it under heat into forms corresponding roughly with the textile fibres. Thus a solid rod drawn or spun into a solid thread is a crude diagram of silk; a thick walled glass tube drawn into continuous thread roughly represents flax; a thin walled tube of elliptical section would similarly furnish a diagram of cotton, save that the membranous character of the side walls could not be reproduced. It is obvious, however, that in these three forms the glass presents very distinct grades of lustre. The parallel need not be pursued into minute detail. We may revert for further illustration of our text to certain vegetable fibres of less common occurrence in which the approximation in external features to silk is very much closer. Thus the bast fibres of *Calotropis*, and of *Marsdenia Tenacissima*, yield celluloses of quite remarkable lustre; and the seed hair of the *Eriodendron Anfractuosum* is well known as silk-cotton, on account of its resemblance to silk.

By certain chemical treatments also the lustre of the vegetable fibres is considerably increased. Thus on nitrating the *calotropis* fibre, a product is obtained of remarkable brilliancy. The jute fibre by a treatment of a very different kind, *viz.*, immersion in strong solution of caustic soda (12–20 per cent. NaOH) and washing off, is rendered much more silky and lustrous. These effects are due to changes first in the fibre bundle, which is broken up into smaller units, of more regular outline and free from cellular parenchyma; secondly, in the individual bast fibres which present a considerably thickened cell wall, the central

causal being almost obliterated, and a smooth external contour. It is clear, therefore, that vegetable structures composed of nitrogen-free colloids are found in forms closely approximating to silk in respect of its especial characteristic of lustre. In regard to such properties as elasticity and tensile strength, these no doubt depend directly upon substance or molecular constitution and are modified in a secondary degree only by the particular features of external form. Into such questions we make no pretension to enter.

The particular features of interest of this addition to the textile fibres of a lustrous cellulose are: (1) the incidents of its conversion into a soluble form and then into a solution of sufficient concentration to fit the mechanical requirements of continuous solidification to a thread, and (2) the properties of cellulose which enable it to withstand a cycle of severe chemical treatments to reappear in its final form in a condition but little removed from that of the original substance.

We find it necessary to emphasise the fact that this product in its final state, *i.e.*, as put upon the market, is a cellulose, a structureless form of the parent substance, by reason of the appearance quite recently and in this Journal (1895, 720) of the statement that it is an explosive or highly inflammable material. We may briefly recall the steps of the process: (1) the nitration of the cotton, and its solution in ether-alcohol; (2) the drawing of the viscous solution of cellulose nitrate through fine orifices of glass and its precipitation by water (Lehner) or solidification by evaporation of the solvent (Chardonnet), continuously to a fine thread. These threads are thrown or twisted together to form the compound thread or textile yarn; (3) the nitrate yarn thus prepared is next denitrated, *i.e.*, the nitric ester is resolved, the cellulose thread retaining its form and lustre and constituting the artificial silk, or to coin a more suitable term, lustrous-cellulose of commerce.

These processes, considered chemically, are extremely simple no doubt, and in themselves contain no essential elements of novelty. The merits of the achievement of the inventors who have perfected the production of this textile are to be found in other directions. In each stage of the process, formidable difficulties have had to be met and overcome. There have been not merely the difficulties involved in an excessively fine adjustment of chemical and physical properties and conditions both in the material operated upon, and the necessary details of the operations, but there have been the difficulties of ways and means, which from the special character of the undertaking must have been exceptional, and the strain upon the personal qualities of energy and perseverance which cannot have been less considerable. These should not be left out of consideration in view of the apparent and indeed actual simplicity of the perfected scheme.

We do not propose to consider the working details of the processes; we refer below to the pages of the Society's Journal on which abstracts of the patents of Chardonnet and Lehner appear.*

It is the final product to which we wish to direct special attention, and for which we wish to secure recognition as a cellulose.

The investigations we have made of this product were directed to the answering of the following questions upon the points more or less in doubt:—

1. Is the denitration of the nitrate complete in regard to the removal of the nitric groups (NO_2)?
2. Does the cellulose residue in denitration revert to the normal molecular condition of the original?
3. Is the cycle of operations accompanied by hydration changes, or such movements of oxygen as might give rise to an oxy-cellulose of the same empirical formula as cellulose?

(1.) The first question was at once answered in the affirmative by an estimation of nitrogen. The lustrous-cellulose was found to contain only 0.19 per cent. N.

(2.) The elementary composition was determined by combustion, and the following numbers obtained:—

C	43.77
H	6.40

These are in accordance with sufficient approximation with the formula of a normal cellulose. Question 2 is therefore answered satisfactorily and in the affirmative.

(3.) For the presence of oxy-cellulose compounds we examined the product: (a) by the furfural test; (b) by the cupric reduction test. Both gave negative results. On boiling with HCl Aq (sp. gr. 1.06) traces only of furfural were formed; and on boiling with dilute solution of sodium hydrate, with addition of Fehling's solution, no reduction took place. The latter result was confirmed by a quantitative estimation of the loss of weight on long boiling in a solution of sodium hydrate of 1 per cent. NaOH . The loss sustained was 9.14 per cent. This indicates a much higher resistance to alkaline hydrolysis than might have been predicted. As the constituents hydrolysed and dissolved are without reducing action on cupric oxide, they retain the cellulosic character, and represent therefore soluble cellulose hydrates.

The answer to the question propounded is therefore that no oxy-cellulose results from the cycle of operations, and that the permanent hydration changes which take place are of minor importance.

Hence our conclusion that the new "artificial silk," or, as we prefer to call it, lustrous-cellulose, may be considered as substantially a normal cellulose.

In regard to the properties of this textile in other respects, we find that the "hygroscopic moisture" is, as might be expected, much higher than in the "natural celluloses," *viz.*, 10–12 per cent. According to the official comparative tests the tensile strength of the yarn is inferior to that of silk in the proportion of 70 to 100, and its elasticity is in somewhat lower ratio. In regard to its dyeing capabilities, we may say generally they are considerable. A comparative quantitative study of the structureless celluloses with the ordinary fibrous celluloses in regard to absorption of colouring matters of known constitution will be made in due course, and the results cannot fail to throw important light on the "theory of dyeing." We do not propose to anticipate these results by any general statement.

It will be sufficiently evident from the samples displayed that the range of colour effects obtainable is as wide as it is brilliant.

Nor do we propose to say anything as to the commercial prospects of the new industry. We have merely to note that the lustrous-cellulose finds a ready sale at high prices; and the margin between these prices and the cost of production is stated to be large.

Our object in this communication is rather to call attention to the scientific and purely chemical features of a new and in many respects unexpected development of the rapidly widening technology of cellulose.

DISCUSSION.

Dr. S. RIDEAL said that the Society was indebted to Mr. Bevan for bringing the manufacture of artificial silk before them. Some years ago he had had occasion to examine different patents relative to the manufacture of artificial silk, and he came to the conclusion that they were all very similar, and that the chief difficulty was unsatisfactory denitration. Since that time considerable progress had been made in that direction, and the experiments shown by Mr. Bevan had demonstrated that it was quite possible to remove sufficient of the nitrogen to render the product inexplosive. That being the case, it opened out the possibility that treatment with ammonium sulphite would prove equally beneficial in the manufacture of cellaloid. As that material was being largely used for electrical insulating purposes, it necessarily required to be of an inexplosive and unflammable character.

A MEMBER asked what official tests of the tensile strength of silk were referred to. As the members present knew, there were no official tests in England. Probably the author alluded to tests made in Germany or Switzerland.

* Chardonnet:—This Journal, 1887, 139; 1889, 474; 1891, 559 and 566; 1892, 939; 1895, 33.

Lehner:—This Journal, 1892, 680; 1893, 1024; 1894, 1192.

Mr. CROWDER wished to know whether these nitrogenous substances were dyed with or without a mordant. The nitrogen having been almost entirely removed, was the cellulose dyed as a silk, a nitrogenous substance, or as cotton, a non-nitrogenous substance?

Mr. WATSON SMITH asked whether it was the practice to dye the nitrocellulose first and then to denitrate it.

Dr. S. RIDEAL wished to know the actual cost of denitration. He understood that sulphite of ammonium was the reagent employed, and he thought it would be interesting to know in what form the nitrate was eliminated when the sulphite of ammonium was added.

Mr. BEVAN said, in reply, that when he referred to official tests, he meant tests made by officials competent to do so. He did not wish to mislead the members by using that term; there was very little doubt, however, that the tensile strengths were what he stated. With regard to the process of denitration it was a very well-known one, although he could not tell in what form the nitrate was eliminated. The denitration process took place before the dyeing operation; the substance was reconverted into cellulose and then dyed. With regard to Mr. Crowder's observations as to whether the cellulose was dyed as a cotton or as a silk, he might say that the cellulose always behaved precisely as an ordinary cotton and required a mordant to enable it to take a dye properly.

Liverpool Section.

UNIVERSITY COLLEGE, BROWNLOW STREET.

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Hon. Local Secretary:

T. Lewis Bailey, University College, Liverpool.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Chairman:* Charles A. Kohn. *Vice-Chairman:* G. Schack-Sommer. *Committee:* J. Campbell Brown, Eustace Carey, M. Lloyd Davies, and W. Norris Jones.

Meeting held Wednesday, May 6th, 1896.

DR. G. SCHACK-SOMMER IN THE CHAIR.

THE ACTION OF CARBON-MONOXIDE AND COAL-DUST IN PROMOTING COLLIERY EXPLOSIONS.

BY W. J. ORSMAN, F.I.C.

PROF. H. B. DIXON in his classical researches on the combustion of carbon has shown that the tendency of hydrocarbons, and probably carbon, when burnt in air, is to first form carbon-monoxide, and that this gas, if excess of oxygen be present, further burns to form carbon dioxide. Professor Dixon has also shown that carbon monoxide forms explosive mixtures with air and oxygen, the velocity of the explosive wave formed reaching a maximum in the presence of about 5 per cent. of water vapour. The heat of combustion of one gramme of carbon burning to form carbon dioxide is 8,080 units, and in burning to form the monoxide is only 2,473 units; the difference, therefore, of 5,607 will show the number of units of heat evolved in the burning of the monoxide to the dioxide.

Prof. Vivian Lewes has demonstrated the fact that coal-dust will readily burn in mixtures of air and carbon-monoxide, and has shown that a small proportion of carbon-monoxide present in a dusty atmosphere will constitute a most explosive mixture.

It is well known that explosions have occurred in flour-mills and other places in which a dusty atmosphere has been present, but these are of very rare occurrence, and it is a matter of extreme difficulty to cause an ignition of dust by means of a naked flame. If such ignitions were easy, we should have constant explosions in the dusty atmospheres in coal-mines where naked lights are used. We therefore have to look for some further explanation for the disastrous explosions which sometimes occur in mines, in which, as far as could be proved, no inflammable gas was found either before or after the explosion.

Until very lately explosions in mines were always attributed to the presence of firedamp, and for this reason the adoption of safety lamps has been made compulsory in gassy mines. To prevent the accumulation of gas in the workings increased ventilation has been resorted to, and the conditions of safety have materially advanced during the last few years.

In consequence of explosions occurring where the method of working and general circumstances precluded the possibility of gas being present, it was suggested that coal-dust itself might constitute an explosive agent. On investigation it was shown by Mr. Henry Hall, Her Majesty's Inspector of Mines, and Mr. W. Galloway that this was the case, and that an explosion could be initiated by a blown-out shot and carried on in a dusty atmosphere without any firedamp being present.

With regard to the explosions caused by coal-dust and air alone, I would refer you to the second report of the Royal Commission on explosions from coal-dust in mines, published in 1894.

Of great interest, also, are the experiments made by Mr. Henry Hall at the latter end of 1892 and the early part of 1893, and reported upon by him to the Secretary of State on January 23rd 1893, in which he shows by conclusive experiments that dry coal-dust, under conditions frequently present in coal mines, and in the entire absence of firedamp, may be inflamed by a blown-out gunpowder shot, and cause a disastrous colliery explosion.

The above experiments may be briefly mentioned here, as these were conducted on a large scale and under conditions most nearly representing actual mining operations.

The experiments were conducted in a disused shaft at White Moss Colliery, Skelmersdale. The shaft was 50 yards deep and 7 ft. in diameter, and struts of timber were fixed from top to bottom to represent the timbering on an underground roadway. The ventilation was effected by means of a fan at the surface forcing fresh air through 10-in. iron pipes to the bottom of the shaft.

In order to fire the shots, a wrought-iron cannon of considerable strength was used, placed in an upright position. When the cannon was charged, stemmed and ready for firing, coal-dust was sprinkled down the shaft and partially allowed to settle; in this way about 80 lbs. of dust would be available for explosion purposes.

The phenomena presented by these experiments as they progressed, and a careful examination of the detailed results, were productive of the following conclusions, which may be best stated in Mr. Hall's own words:—

1. That the flame from a blown-out gunpowder shot in the presence of dry coal-dust *always* ignites more or less of such dust, and so increases the burning and charring effects of the shot. This is proved by the fact that in almost every experiment which did not result in an actual explosion of dust there was nevertheless severe charring of the electric firing-cable for several yards up the shaft, whilst without dust and with a similar charge of explosive no such charring occurred.

2. That when a large flame (such as that of a blown-out gunpowder shot, or the flame from the ignition of a small quantity of firedamp) traverses an atmosphere containing a very moderate quantity of dry coal-dust, the dusty atmosphere will explode with great violence, and the explosion will continue on and pass through any length of such atmosphere, its violence and force increasing as it progresses. This is proved by the fact, that, in nearly every case, where the cannon was fired whilst there was dust suspended in the atmosphere of the shaft, a violent explosion followed, the force of which was evidently only,

beginning to be developed as it reached the top of the shaft and escaped, spending itself in the outside air, the flame in some cases attaining a height of 70 ft. over the top of the shaft.

3. That coal-dust from several seams in different districts, notably those from Glamorgin, Monmouth, Durham, Lancashire, Yorkshire, and Scotland, are almost as sensitive to explosion as gunpowder.

4. That coal-dust is, as a rule, more sensitive to explosion in proportion to its high quality and freedom from impurities.

5. That a ready supply of oxygen, such as is supplied by a brisk ventilation, has the effect of making coal-dust explosions more probable and more severe.

6. That certain "high explosives" are incapable of igniting or exploding coal-dust. In the experiments charges of roborite, and in two or three cases ammonite, were fired without effect, but as soon as gunpowder was introduced, its explosion was followed by violent dust explosions. The difference in the behaviour of gunpowder as compared with the high explosives was most impressive and convincing.

Having established the fact that coal dust could be easily ignited by a blown-out shot of gunpowder, it was of interest to ascertain the cause of such ignition, and from a number of experiments it is evident to my mind that the initial explosion is due to the presence of carbon-monoxide, produced by the explosion of gunpowder. Ordinary blasting powder varies greatly in composition, but all contain an excess of carbon, with the consequence that large volumes of carbon-monoxide are formed, in some instances as much as 32 per cent. of the total gases. This carbon monoxide comes together with the heated solid products of the combustion in contact with coal-dust, either previously in suspension or stirred up by the force of the explosion, the coal-dust ignites, and in burning produces the intermediate product carbon-monoxide, which, being driven rapidly ahead of the explosion and coming in contact with more dust and more air, produces a new explosive zone, and so traverses the whole of the dust-laden pit.

In order to get some idea of the condition of the air inside the pit whilst an explosion was in progress, I arranged, at the time of Mr. Hall's experiments in 1892, a method of taking samples of the air. Two brass tubes, filled with water, were fastened to the rope that was used to lower the cannon, one 20 yards from the bottom, the other 40 yards from the bottom.

These tubes were so arranged and constructed that the explosion, as it passed the tubes, unsealed the outlet pipe and the escaping water allowed the ingress of a sample of air, which was trapped by a special arrangement and kept in the tube until the rope could be wound up. By this method it was intended that the sample of gas taken should represent the state of the air whilst the flame was passing, or directly afterwards. The lower tube, as the analysis will show, did partly collect the gas in the above condition. The tube at the top, however, commenced to act prematurely, and was probably started by the sound wave which preceded the explosion. This tube simply contained ordinary air.

The following is an analysis of the gases found in the lower tube:—

	Per Cent.
Oxygen.....	3.9
Nitrogen.....	75.9
Carbon-dioxide.....	12.1
Carbon-monoxide.....	8.1
	100.0

In order to test the action of the gases given off on the explosion of different explosives, small cartridges have been fired in a specially constructed steel bomb, and the gas produced mixed with air in a large cylinder. On sprinkling coal-dust in and applying a light, the dust ignited easily and burnt away fiercely. It will be seen, therefore, that the presence of carbon-monoxide in the air of a mine in small quantities is not only dangerous to health (1 per cent. being fatal), but also constitutes, when in the presence of coal-dust, a most explosive mixture, and it is only a matter of time when the use of gunpowder will be prohibited altogether in coal mines.

On examining the other explosives now coming into use, it is found that those which do not produce carbon-monoxide, or other inflammable gases, such as those of the Sprengel class, containing nitrate of ammonium, are very safe in dusty mines; whilst others, which produce inflammable gases, are as dangerous as gunpowder. In experimenting with the bomb, and on a larger scale with blown-out shots from a cannon, some very curious results have been obtained.

In order to render an explosive less liable to ignite fire-damp, it is necessary to lower the temperature of explosion, and in one class, of which the explosive carbonite is a member, this is accomplished by adding an excess of wood-meal. The composition may be taken as follows:—

Nitro-glycerine.....	25 parts.
Wood-meal.....	40 "
Potassium nitrate.....	34 "

The excess of wood-meal has a distinct effect in lowering the temperature, but it causes the production of 40 per cent. of inflammable gases. This explosive, when fired into an explosive mixture of fire-damp, is remarkably safe, and it is difficult to cause ignition. When, however, carbonite is fired into a mixture of air and coal-dust without fire-damp, it has been possible to get repeated and violent explosions.

If the carbonite be fired from a cannon into a gallery or chamber, and, after firing, dust be sprinkled in, and a light be placed near the mouth of the cannon, the gas catches fire, and we can produce a secondary explosion. We have here a curious instance of a mixture of dust and air being more explosive under certain circumstances than the most explosive mixture that can be got of coal-gas and air.

Many theories are held regarding the propagation of explosion in a dusty mine, the principal one being that the coal-dust, by the action of heat, becomes distilled, and yields the inflammable gases necessary to continue explosion. The production of these gases may undoubtedly have some effect, but I am firmly of opinion that the propagation is principally due to the continuous production of carbon-monoxide, which causes rapid combustion of dust and air as long as they are present. It is found that lampblack and other finely powdered forms of carbon burn in the presence of carbon-monoxide as easily as coal-dust.

Further, all coal dusts are sensitive, provided they are in a fine state of division and free from any large admixture of dirt. The reason why certain dusts have been stated to be safe, because they did not catch fire when experimentally tried, is due to the fact that they were contaminated with dirt (by reason of the traffic through the pit), and so yielded a large percentage of ash.

CHLORINE AS A DISINFECTANT.

BY G. C. CLAYTON, PH.D.

By the term "disinfection" we now understand the destruction of the germs which cause disease, and the term "disinfectant" should therefore not be applied to antiseptics, which simply retard their growth, or to deodorants, which destroy, or only mask, the odours caused by them.

It has been proved that light and air, if given sufficient time, will destroy most bacilli, still the fact remains that the virus of scarlet fever and of other diseases has been known to retain its vitality for years, and small-pox has been carried long distances by air-currents, landing in an inconveniently lively condition. Unfortunately, owing to the crowded state of the world, men cannot nowadays allow a sufficient space of air and sunshine between themselves and their neighbours to run even a moderate chance of safety, and are obliged to fall back on artificial disinfection. There are two methods of disinfection open to us—by heat and by chemical means.

Heat is certainly the most satisfactory, but unfortunately it cannot be universally applied, and so one is forced in many cases to make use of chemical reagents.

Chlorine, either in a gaseous form or in combination, has long been used as a disinfectant, and used with undoubted success. My object in reading this paper has been first to record the results of some experiments made on this subject by Professor Boyce, of University College, Liver-

pool, and also by myself, and, further, to collect for general use the results of the chief investigations, which have been done on the disinfecting action of chlorine.

I will treat my subject under three headings—

1. Chlorine as a gas or as chlorine water.
2. Chlorine as bleaching powder.
3. Chlorine as sodium hypochlorite.

Chlorine.—Chlorine acts as an active germicide on account of its affinity for hydrogen, and the consequent release of nascent oxygen when it comes in contact with micro-organisms in a moist condition.

Fischer and Proskauer showed that dried anthrax spores were unacted on, even when exposed to a 44·7 per cent. dry chlorine, whereas, when moistened, 4 per cent. was effective. With an exposure of 3 hours 1 per cent. was sufficient. This proves that chlorine does not act as a poison, but as an oxidising agent.

In the case of anthrax bacilli, not spores, 0·04 per cent. chlorine was fatal in 24 hours.

Koch found that anthrax failed to grow after 24 hours exposure to 2 per cent. chlorine water.

In a paper entitled "A report on Chlorine, Bromine, Iodine, and Sulphurous Acid," by Dr. Cash, F.R.S. (16th Report, Local Govt. Board, 1886-87), I find the following:—

Two parts of anthrax blood are sterilised by 100 parts chlorine water containing 0·0034 per cent. chlorine in five minutes. Anything less than this gave variable results. Again, one part of strong anthrax spore broth was completely sterilised in 24 hours by 0·0355 grms. chlorine.

He found, as a result of a series of experiments, that it was safer to use a strong solution of chlorine for a short time than a weak solution for a long time.

Dr. Klein did some experiments on disinfection by means of gaseous chlorine. He selected swine fever, and found that a healthy animal could safely be placed in the same compartment with a diseased one for so long a time as six hours on five successive days, provided the compartment was fumigated with chlorine up to marked pungency twice within six hours.

Dr. Wynter Blyth, in a paper read before the Society of Medical Officers of Health, March 1885, said: "I consider that the best and most efficient way to disinfect a room after disease is to make it as much as possible like a hermetically sealed box, and in this box to evolve chlorine, 3 lb. of chloride of lime and 3 lb. of hydrochloric acid being used for every 1,000 cu. ft. of space."

German experiments, however, appear to indicate that the quantity of bleaching powder required for every 1,000 cu. ft. is more nearly 15 lb. than 3 lb.

Mr. James Hargreaves lately read a paper before the Liverpool Polytechnic Society dealing with this subject. His idea was the disinfection of sewers by means of chlorine, which he proposed to manufacture by the electrolysis of salt.

Of course the idea of treating, or attempting to treat, the entire sewage of a town by chemical disinfectants is opposed to the theory and practice of all modern sanitary engineers, and quite rightly. With proper arrangements and careful supervision the bulk of sewage can be treated perfectly safely and satisfactorily without disinfection. The use of disinfectants in the present day is to sterilise the sewage of hospitals for infectious diseases, of infected areas in the case of an epidemic, to kill the germs left after infectious diseases in the rooms of houses or hospitals, or likely to be

preserved on furniture or in clothes. Again, disinfectants are required in agricultural districts in cases of anthrax or swine fever.

Gaseous chlorine is not at present, so far as I know, on the English market, and when required for disinfecting purposes it has to be prepared in the way mentioned by Dr. Wynter Blyth.

Bleaching Powder.—Bleaching powder contains about 35 per cent. of available chlorine. The American Health Association, 1885, found that 0·25 per cent. chlorine as bleaching powder was an effective germicide in 1 or 2 minutes.

Bolton found that 1:2000 (available chlorine 0·0125) destroyed typhoid bacillus and cholera spir in 2 hours, while anthrax spores required a 1 per cent. solution (0·3 per cent. available chlorine).

Nissen gives the following:—

	Time.	Bleaching Powder.
	Mins.	Per Cent.
Typhoid and cholera.....	5	0·12
Anthrax bacillus.....	1	0·1
Staphylococcus pyogenes aureus.....	30	0·2
Anthrax spores.....	30	5·0
" ".....	70	1·0

Koch says that a 5 per cent. bleaching powder solution gave doubtful results, even after several days. From the fact that ordinary bleaching powder contains about 44 per cent. CaO, it is not a suitable disinfectant for sewers, nor, indeed, in any case where the material to be disinfected eventually comes into the sewers. This has undoubtedly been one of the factors which has told most largely against bleaching powder, and has prevented its more extended use.

Sodium Hypochlorite.—Sodium hypochlorite combines all the advantages of bleaching powder with fewer disadvantages.

It must not be kept on stock in very weak solutions, as in that case it is very unstable, as described by Sir Henry Roscoe and Mr. Lunt in a paper on "The Hermite Process" (this Journal, 1895, 224); but when the solution contains 10 per cent. available chlorine, or more, it retains its strength for a considerable time.

A sample of hypochlorite, 10·2 per cent. available chlorine by weight, when tested one month later contained 9·9 per cent., which gives a loss of only 2·9 per cent. in one month.

The following are some extracts from work done by Prof. Boyce on the germicidal properties of sodium hypochlorite.

The stock solution used was 10 per cent. available chlorine by volume.

The method adopted was as follows:—

By means of a sterilised pipette 5 c.c. of a known hypochlorite solution were added to 5 c.c. of an abundant broth cultivation in a sterilised flask. This was allowed to stand in contact for 2—2½ hours, with constant shaking to ensure complete admixture, and then sub-cultures were made in three broth-tubes by means of a platinum wire loop, taking every precaution against contamination. The three tubes were then incubated at 35° C., and examined on the next and following days.

The accompanying table shows the results:—

Time of Contact..	1% for 2½ Hrs.	1% for 20 Hrs.	1% for 2 Hrs.	1% for 2 Hrs.	2% for 2 Hrs.	3% for 2 Hrs.
Age of Sub-culture	24 Hrs.	24 Hrs.	24 Hrs. 48 Hrs.	24 Hrs. 48 Hrs.	24 Hrs. 48 Hrs.	No growth.
Bacillus coli.....	Good growth	Very slight growth	Growth Abundant growth.	V. s. g. G.	V. s. g. G.	No growth.
" typhosus	"	"	"	N. g. "	N. g. "	"
" cholerae.	Slight growth	"	No growth.	"	N. g. "	"
" anthracis	"	"	"	"	G. "	Grew ultimately.

This table shows that under a very severe test 3 per cent. solution (0.3 per cent. available chlorine) kills the above-named organisms, with the exception of anthrax when spore-bearing, under which circumstances anthrax is one of the most, if not the most, resistant of all bacilli.

Experiments with putrid egg and broth solution showed that the sterilisation was effected with 2 per cent. hypochlorite (0.2 per cent. available chlorine), while with 1 per cent. (0.1 per cent. available chlorine) all organisms present but the hay bacillus were killed.

A number of experiments were made with albumin as follows:—

1 c.c. pure white of egg was added to 5 c.c. broth culture, and then 5 c.c. hypochlorite solution. It was found that the

hypochlorite decomposed the white of egg without an appreciable retardation of its action.

This is an important consideration, as all sewage contains albumin.

As Prof. Boyce's investigation does not apply to the anthrax bacillus when spore-bearing, I undertook some experiments to find out what concentration and what length of time was required to destroy the organism under these circumstances with sodium hypochlorite. I followed the same method as that employed by Prof. Boyce, but made my sub-cultures after a contact of one, ten, and thirty minutes respectively, using as a stock solution an anthrax broth cultivation, which was incubated until the presence of spores was observed microscopically. My results are given in the adjoining table:—

Method of Experiment.	Percentage of Disinfectant present.	After 1 min.	After 10 mins.	After 30 mins.	—	Remarks.
1. 5 c.c. broth + 5 c.c. (10% av. cl. sol.)	50% stock sol., 5% av. cl.	0	0	0		Gelatine stab culture. Completely sterilised.
2. " " (5% av. cl. sol.)	25% " 2.5% av. cl.	+	+	0		Gelatine streak culture. No. 2 was retarded.
3. " " (2% av. cl. sol.)	10% " 1% av. cl.	+	0	0		Gelatine stab culture.
4. " " (2% av. cl. sol.)	10% " 1% av. cl.	+	+	+		Gelatine streak culture. No. 3 retarded, but not destroyed.
5. " " (1% av. cl. sol.)	5% " 0.5% av. cl.	+	+	+		Gelatine streak culture. Abundant growth.
6. " " " "	" " "	1 Hr. +	2 Hrs. +	3 Hrs. +	4½ Hrs. 0	No. 3 hindered, but not destroyed.

0 Sterilised.

+ Unsterilised.

No. 4, after 24 hours' contact a sub-culture showed a growth in three days, which proved to be anthrax; therefore hypochlorite of soda, 1 per cent. available chlorine, will not kill anthrax spores in 24 hours, but will only retard their growth.

To destroy the spores the solution must contain 2.5 per cent. available chlorine, and must act for 30 minutes. It is almost impossible to compare work done on this subject by one investigator with that done by another, as each man has his own particular methods, so that the figures given have very little relation to each other; also one cultivation differs materially from another in regard to its activity, depending on its attenuation, that is to say, the length of time it has been artificially cultivated since it last passed through a living body.

As far as one can judge from the results I have collected, it seems that chlorine acts equally energetically whether it be gaseous or in the form of bleaching powder or sodium hypochlorite. All three have a great advantage over corrosive sublimate, carbolic, and the numerous cresol disinfectants, in that chlorine dissolves albumen instead of precipitating it, thereby helping to disintegrate solid fecal matter, which is necessary before complete sterilisation is possible.

In cases where there is a large amount of albumen present an excess of the disinfectant is necessary, as a portion of the oxidising power is exhausted in the simple oxidation of organic matter before the bacteria themselves are acted on. This, of course, applies to all disinfectants which rely on oxidation. On the other hand, where phenol, &c. are used, the albumen is made insoluble, and bacteria imbedded in a casing of insoluble albumen never come in contact with the disinfectant, however large the quantity present may be, and these bacteria, when the conditions become more favourable, are a serious source of infection.

I found that a 1 per cent. available chlorine sodium hypochlorite solution dissolved white of egg readily with liberation of chlorine.

Comparison of sodium hypochlorite with other disinfectants gave the following:—

Sodium hypochlorite. { 2.5 per cent. available chlorine acted in ½ hour.
5.0 per cent. available chlorine acted in 1 minute.
5.0 per cent. phenol did not sterilise.
0.5 per cent. mercuric chloride acted in 1 minute.

Unfortunately, owing to its extremely poisonous nature and high price, corrosive sublimate is not generally applicable.

Amongst the many advantages possessed by sodium hypochlorite is the fact that it is miscible with water in any proportion, even in the presence of large quantities of salt, and as it readily gives off chlorine, colonies of bacteria which have been left on the walls of sewers above the present water level are destroyed, which would, of course, have escaped in the case of ordinary liquid disinfectants.

In conclusion I must express my thanks to Prof. Boyce for permission to make use of his results, and for help given me in my own work.

EXPORTS OF HEAVY CHEMICALS.

BY EUSTACE CAREY.

A SERIES of interesting and able articles under the title "Made in Germany" have been appearing recently in the *New Review*, the one in the May number being of especial interest to us. The writer shows how the chemical trade has grown in other parts of the world to a greater extent than in the United Kingdom, and he states why this has been so. But in speaking of "heavy chemicals" the author gives figures showing apparently a great decrease in business in 1895 as compared with 1873. The statement shows that in 1873 the exports of heavy chemicals were to the value of close upon 3,000,000*l.*, whereas in 1895 the exports were only some 1,560,000*l.*—a very considerable decrease. Quantities, however, are omitted, and it is satisfactory to know that the quantity exported has by no means diminished, but, on the contrary, has increased, as the following table shows:—

	Tons in 1873.		Tons in 1895.	
Soda ash.....	133,779	Total alkali at 100 per cent. = 103,910	179,576	Total alkali at 100 per cent. = 177,512
" crystals.....	45,458		27,472	
Bicarbonate.....	8,019		18,887	
Caustic soda.....	33,465		91,388	
Bleaching powder	30,843		69,624	

It must be remembered that 1873 was a year of exceptionally high prices and of high costs, whereas 1895 was perhaps the lowest on record.

Newcastle Section.

Chairman: G. T. France.

Vice-Chairman: A. F. Allhusen.

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John Watson.

Hon. Local Secretary and Treasurer:

Saville Shaw, Durham College of Science, Newcastle-on-Tyne.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—Chairman: F. S. Newall. Vice-Chairman: G. T. France. Committee: A. Allhusen and H. Louis.

Meeting held at the Durham College of Science, Newcastle-on-Tyne, Thursday, April 16th, 1896.

MR. GEO. T. FRANCE IN THE CHAIR.

ON BLISTER STEEL AND SOME POINTS CONCERNING ITS FORMATION.

BY T. W. HOGG.

NOTWITHSTANDING the enormous and increasing quantities of steel now being made by other processes, the higher qualities of steel are still largely dependent upon the old cementation process for their production.

This process is so simple that it has offered little opportunity for alteration or improvement. It is conducted now in the same manner as it was when first introduced into this country, and practically nothing is known of its early history.

Simple as this process is, it has so many points of purely chemical and scientific interest that it has frequently been the subject of prolonged investigation, but it is questionable whether any more definite or important information has been added to our knowledge since Percy wrote his famous treatise on the metallurgy of iron and steel.

Briefly described, the process consists in imbedding bars of iron in charcoal, contained in a suitable rectangular chest. This is then closed effectively to prevent the entrance of air, the temperature is gradually increased until it is considerably above a red heat, and, after several days of this treatment, the iron becomes impregnated with a sufficient quantity of carbon to convert it into steel.

It has occurred to me that a short paper upon this subject would be of some interest to the members of this Section, more especially when it is remembered that steel was made in this locality by this process probably even before it reached Sheffield, and at the present time I believe that the only makers of blister steel left in this district are Messrs. John Spencer and Sons, of Newburn.

An important noticeable peculiarity of the bars of iron after they have been converted into steel by this cementation process, is that they are covered with numerous blisters of varying size, sometimes even a foot in length, but generally they only vary between a quarter of an inch to two inches across.

Although there has always been a certain amount of doubt as to the origin of these blisters, the real cause of them seems to have been known to earlier observers than Percy, who ascribed their production to the presence of intermixed slag or cinder. The gradual action of carbon on steel at a high temperature upon the interposed silicate of protoxide of iron reduces the protoxide of iron to the metallic state with the liberation of carbonic acid, which causes the hot softened metal to expand in the form of a blister. It is a fact that previous fusion of the iron, so as to free it from all intermixed slag, completely prevents the formation of these blisters (Percy, *Journal of Steel Inst.* 1878). I am not aware, however, that anyone

has called attention to the fact that careful inspection of the interior of the blisters under a low degree of magnification seldom fails to reveal the presence of globules of slag or glassy material often in very large numbers. The globules which occur most frequently are very small, perfectly transparent, and colourless. As a rule, the brilliant, metallic, highly-illuminated surface of the interior of the blister is so dazzling that these globules easily escape notice, but they are always present in more or less abundance, and are doubtless due to the metallic constituent of the slag being gradually reduced and deposited. Occasionally there are present brownish, transparent globules, some opalescent with a greenish tinge, and, more rarely, others perfectly black and opaque, possibly these latter are the initial condition, and the colourless globules, the final condition of the interposed slag.

Many years ago I cut out several of these blisters and determined the intermixed slag, and also the silicon present in combination with the iron.

The following table contains some of the results:—

BLISTERS FROM DIFFERENT GRADES OF CEMENTATION STEEL.

Carbon	0.60	0.70	0.95	1.30
Interposed slag .	0.20	0.16	0.19	0.095
Silicon	0.015	0.005	Traces	Traces

In a paper read before the British Association in 1879, Mr. H. S. Bell described some experiments made to ascertain the proportion of silicon present in the blistered and unblistered portions of the bar, and he concluded that his results showed a marked increase in the silicon wherever the blisters occurred. This would be an important fact if true, but I feel pretty certain that this observer has fallen into the error of ascribing the silica obtained in the ordinary method of analysis to silicon, whereas it is in all probability mostly due to the decomposition of the intermixed slag existing naturally in the iron. The intermixed slag of course will be most abundant at the blistered portions of the bar.

In connection with these blisters I have much pleasure in showing you a curious and extremely rare substance which I have only met with upon two occasions. It completely filled the blisters and in appearance strongly resembles a metallic growth. It is a mass of irregular metallic filaments of the same composition as the surface of the bar underneath the skin, excepting that it contains an unusual proportion of interposed slag. I have not determined the exact quantity of this slag, but different portions of the substance have yielded impure silica to the extent of 2.90 per cent., 2.08 per cent., and 1.85 per cent., respectively. It would appear, therefore, that this slag is irregularly distributed throughout the mass.

It is probable that during the early stage in the formation of a blister there will be present numerous metallic threads of steel which have been gradually drawn out between those portions of the metal in perfect contact. The internal appearance of many blisters is strongly suggestive of this. After a time these threads will break and leave the cavity with an exceedingly rough and irregular surface. In what manner the curious spongy-looking mass of steel which I show you is formed I have no opinion to offer. It must be a very unusual occurrence, perhaps it is actually a metallic growth similar to those so well known in the cases of gold, silver, and copper. It contains 1.06 per cent. of carbon.

Coming now to the interesting questions with regard to the method by which the bar of iron becomes gradually impregnated with carbon. The various speculations upon this subject have been so well treated by Percy, that all as his book is, our increase of knowledge upon the properties of iron and carbon has been so slight and uncertain, it may still be advantageously referred to for the consideration of many of the questions involved.

The only attractive addition to our theories concerning the impregnation of the iron with carbon is the diffusion theory of Marsden (*Journal of the Iron and Steel Inst.*, 1881, I., p. 233). This theory, however, does not differ from Percy's otherwise than by concluding that the carbon

really permeates the porous mass of iron and does not combine with it, but remains existing as an extremely finely divided amorphous carbon. No other evidence for this is offered than the fact that carbon can be extracted from, as well as introduced into solid iron by a process of cementation, and that porcelain embedded in finely divided carbon gradually becomes permeated throughout. There is plenty of evidence, taken altogether, showing that it is pretty certain that the carbon in Blister steel is in a state of combination with the iron. The fact, that in all grades of Blister steel, even in the hardest, the carbon is in a condition which readily combines with hydrogen and is evolved as a hydrocarbon on treatment with hot dilute hydrochloric or sulphuric acid; also that it forms a compound on treatment with nitric acid easily soluble in this acid, would seem to indicate the absence of amorphous carbon to any considerable extent. It is not improbable that the small proportion of amorphous carbon sometimes present, is in fact really due to the decomposition during slow cooling of the normal carbide of iron diffused throughout the mass.

The following experiments give a little further information with regard to the actual distribution of carbon in different parts of the bar:—

Portions from each of two cemented bars of different degrees of hardness were taken. These bars were fresh from the furnace and had not been long exposed to the atmosphere. They were well scrubbed with fine sand and water with a hard brush, so as to perfectly remove all loosely adherent matter. These bars were then carefully planed so as to take off as little from the surface as possible. This first layer or skin was kept by itself. Another small thickness was planed off, and this operation continued until the centre of the bar was reached.

The carbon was then ascertained by colour-test in each layer, and the results obtained are given in the following table:—

CARBON BY COLOUR-TEST IN DIFFERENT LAYERS FROM BLISTER STEEL.

	A.	B.
	Per Cent.	Per Cent.
layer (skin)	0.09	0.12
2nd "	0.34	0.34
3rd "	0.81	0.47
4th "	0.68	0.40
5th "	0.62	0.35
6th "	0.57	0.26
7th " (centre)	0.45	0.15
Total carbon by combustion in a section of the bar....	0.78	0.35

The first layer or skin showing the very low carbon by colour test gave a very large quantity of black insoluble matter. At first this was thought to be amorphous carbon; further examination, however, proved it to be black magnetic oxide of iron. The total carbon present in this first layer was then ascertained by combustion, and the quantity found was in A, 0.16 per cent., and in B, 0.18 per cent., thus showing the surprising fact that the actual surface of the bar contains comparatively speaking a very small proportion of carbon. The highest carbon is immediately underneath, and then gradually decreases until the centre of the bar is reached. Of course, in cases of higher degrees of carburisation, there will be less and less difference between the surface and centre as the bar approaches saturation.

The first layer of low carbon steel is easily visible upon an etched complete section of a different bar from the two referred to above. The layer appears to be of such small thickness that very little weathering or rusting would remove it. To detect this first layer of low carbon steel it is necessary to examine a bar which has not rusted. Of course the etching merely shows that there is a first layer of something different from the rest of the bar, and it is highly interesting as a corroboration of the differences which I noticed chemically many years ago. I also show a very beautiful effect obtained by etching a section of an extremely high carbon bar, one containing close upon 2 per cent. of

carbon. This appears to indicate that the iron has reached a certain degree of saturation with a carbide, and then this or some other carbide has commenced to crystallise out in acicular needles, one of which you will notice is three-quarters of an inch in length.

The theory of the formation of steel by the cementation process appears to be fairly comprehensible if we picture the precipitation of amorphous carbon in such a way upon the surface of the bar as to bring the particles of carbon into perfect molecular contact with the iron, combination would then immediately take place. The carbide of iron thus formed upon the surface then slowly diffuses throughout the rest of the bar. The crude bars of iron have always a thin layer of scale or magnetic oxide upon them. This magnetic oxide during the process of cementation will become a thin layer of spongy steel. During the cooling it is possible that this layer of spongy steel will oxidise, and in doing so decarbonise the surface to a slight depth. This may account for the presence of the first low carbon layer which I have drawn attention to.

The alternate heating and cooling several times of a bar of iron embedded in charcoal at length develops an unmistakable layer of spongy metal, if the temperature has not been too high, which actually begins to peel away from the bar, and I show an excellent example of this.

In conclusion, I have not considered the probability of the formation of Mond's ferrocobonyl, $\text{Fe}(\text{CO})_5$, as of any importance in connection with the impregnation of iron with carbon in this process. Undoubtedly it must be present at the earlier part of the process. The temperature at which most of the impregnation takes place, however, is much too high to allow the ferrocobonyl to exist. The presence of this ferrocobonyl at the beginning of the process will account for the fact that the charcoal and the black dust which is always formed contains a considerable proportion of iron in the metallic state. The black dust contains about 25 per cent. mineral matters, the accumulated ash of the charcoal, and 3.9 per cent. iron in the metallic state.

This paper was accompanied by many specimens illustrative of the facts described.

DISCUSSION.

The CHAIRMAN inquired whether the degree of conversion of the iron into steel depended upon the temperature or only upon the length of time that the iron remained in the converting chests. Was the temperature ascertained by a copper ball pyrometer or similar means, and did Mr. Hogg suppose that the temperature influenced the production of the blisters?

Mr. HOGG: The adjustment of the temperature is left entirely to the judgment of the workman, but trial bars are withdrawn from the chests and indicate how far the conversion has proceeded. The extent of the conversion of the iron into steel depends upon the length of time during which the heating is continued. The temperature would probably affect the size of the cavities, and masses of spongy steel, such as those exhibited occupying cavities, would fuse and run down when the temperature was raised.

Mr. JOHN PATTINSON said that the author had not touched upon the question of the form in which the carbon was conveyed into the iron, whether by the direct combination of the carbon of the charcoal or through the agency of a gaseous carbon compound. Since Dr. Percy published his well-known experiments on the subject a good deal of work had been done with reference to the decomposition of carbon monoxide by metallic iron and its oxides, and it occurred to him that these reactions probably played an important part in the process. The charcoal used would contain a good deal of occluded gas, chiefly air, and the oxygen in it would form carbon monoxide when the temperature was raised, and the black oxide on the outer portions of the bars would also give rise to some carbon monoxide, so that the atmosphere in the interior of the chests would consist chiefly of this gas. In his researches on the dissociation of the oxides of carbon by oxides of iron, Sir Lowthian Bell had obtained some remarkable results; by passing a current of carbon monoxide over oxide of iron he obtained deposits of carbon of over twice the weight of the iron employed, and the whole of this

carbon was due to the dissociation of carbon monoxide. He (Mr. Pattinson) had seen quite huge masses of carbon, over a cubic foot in bulk, deposited by a similar reaction in the flues leading from blast furnaces to the heating stoves, and these deposits had generally formed around pieces of iron that happened to be there. Again, in the bricks used as a lining for the blast furnaces themselves the 1 or 2 per cent. of iron in the clay acted in a similar way when exposed to the atmosphere of the upper part of the furnace, resulting in a deposition of considerable amounts of carbon in the substance of the brick itself. The bricks were permeated throughout with carbon and became swollen and quite friable and easily disintegrated. He was inclined to think that a similar reaction would take place in the converting chests and the decomposition of carbon monoxide, which begins below a red heat, would give rise to deposits of finely-divided carbon and from these the iron would take up its carbon and not directly from the charcoal. The whole subject was one of great interest and the members were much indebted to Mr. Hogg for bringing it before them.

Prof. Louis would like to ask Mr. Hogg whether he had ever analysed the gaseous contents of the blister cavities. Mr. Hogg had quoted the statements of Percy with reference to the origin of the blisters but with all due deference to the high authority of his old teacher, he (Prof. Louis) could not believe that ferrous silicate could be reduced by carbon in the absence of a base. He had never yet examined any sample of hammer- or roll-slag without finding in it a considerable amount of magnetic oxide and he would suggest that the blisters were due to gas formed by the reduction of magnetic oxide and not of ferrous silicate; it would be of interest to know whether this gas was carbon monoxide or carbon dioxide.

He quite agreed with Mr. Pattinson's suggestion as to the probability of the carbon penetrating into the iron by the deposition of finely-divided carbon from the dissociation of carbon monoxide; but even admitting that, there still remained the fact that solid iron and solid carbon combined together at a temperature much below the fusing point of the metal. With regard to the fact mentioned in the paper that the extreme outside of the converted bars was poorer in carbon than portions nearer the centre he thought that it might possibly be due to decarburisation having taken place subsequently to the conversion, during the gradual cooling down of the pot, and suggested that it would be of interest to quench a converted bar the instant it was sufficiently carburised, and to then ascertain the amount of carbon at different depths towards the centre of the bar.

Mr. Hogg in reply to Prof. Louis said that he was not aware that the gases from the blister cavities had ever been examined. It was a matter of considerable difficulty to secure a sample of the original gas, as many of the cavities communicated with the air, and in his own endeavours to collect the gases, he had never found either carbon monoxide or dioxide present, but only air, so that he did not for a moment suppose that his samples were in any way samples of the gases really contained in the cavities. With regard to Prof. Louis' objection to the theory based upon the reduction of ferrous silicate, there was no doubt that the black opaque globules found in a large number of the blisters were practically millinder and not ferrous silicate.

Meeting held May 14th, 1896.

On this occasion the President visited the Section, and was entertained at dinner. The proceedings of the meeting will appear in a subsequent issue.

Nottingham Section.

UNIVERSITY COLLEGE, NOTTINGHAM.

Chairman: F. J. R. Carulla.

Vice-Chairman: J. M. C. Paton.

Committee:

L. Archbutt.
F. Clowes.
J. B. Coleman.
H. Forth.
W. G. Johnston.
J. F. Kempson.

T. Mason.
J. O'Sullivan.
C. Taylor.
G. J. Ward.
R. Lloyd Whiteley.

Treasurer: S. J. Pentecost.

Hon. Local Secretary:

J. T. Wood, 29, Musters Road, West Bridgford, Nottingham.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Committee:* R. M. Caven, F. E. Lott, and J. J. Sudborough.

Meeting held in Nottingham, Wednesday, April 15th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

THE CORROSION OF IRON BY RAW TAR.

BY F. J. R. CARULLA.

COAL or gas tar is very extensively used for protecting from rust iron surfaces exposed to the weather, especially in chemical works where the atmosphere is more than normally destructive of this metal. This is the reason for bringing before you a remarkable example—or what appears to be one—of the danger that the careless or ignorant use of raw tar as a substitute for paint may entail. The two bolts here exhibited, originally 12 in. by 1½ in. thick, which are so thoroughly corroded as to present the appearance of having been soaked in some dilute acid for a considerable time were found in this condition when taken out of the valve boxes of a pump through which only water from a well for the general supply of the works had been passed. The bolts which act as stops to prevent the excessive rise of circular india-rubber valves were always completely immersed in the water. The only explanation of this corrosion that has been arrived at is that tar residues known to exist on the surface soil have communicated this undesirable property to the water in the well. A chemical examination confirms this. The water was found to be basic, which might be expected from its strong smell of naphthalene or gas liquor. It yielded on analysis:—

	Parts per 100,000.
Total solids at 110°	82
Free ammonia	0.43
Albuminoid ammonia	6.01
Chlorides expressed as chlorine	12.20
Carbonates expressed as CaCO ₃	22.00

This water has eaten into iron to the extent seen on the surface of these bolts which show indentations in places exceeding ¾ of an inch in depth. That this corrosive action is due to something communicated by the tar would appear to be indicated by the fact that similar bolts in a pump at



the same works used for raising tar, and that only, also show corrosion of a similar character although not quite so pronounced. The bolts in another pump, lifting river water in the same place, show no signs of corrosion, which goes some way to indicate the common origin of the damage in the two other cases.

From a consideration of the analysis of the water given above, one may reasonably suspect that the presence of ammonium chloride, a considerable constituent of some gas liquors and which therefore must be frequently present in crude tar, may contribute to the corrosive properties of this water.

The remarkable character of the corrosion which is so much localised in various places leaving much of the surface of the bolts almost untouched suggests the formation of galvanic couples at a number of points in the neighbourhood of which the whole of the action has taken place. The oxide of iron that is sometimes present in wrought iron in the form of slag left between the laminae of which such iron is composed, may account for this peculiarity.

Whatever the exact explanation may be, the examples before you certainly impress one with the necessity for neutralising the cause of this corrosion before using crude tar as a protection for iron surfaces. Cases could be cited of gas holders that have been quite damaged by having been coated with raw tar without preparing it in any way. A note abstracted from a German source and given on page 480 of the Journal of the Iron and Steel Institute No. II, 1892 is worth quoting as it describes how tar should be prepared for use on iron and is otherwise instructive.

"Raw tar is not adapted for use in coating iron. The coating produced rapidly scales away and destroys the metal, the action being due to the carbolic acid, which is present in the tar. If this tar, however, is heated with 2 or 3 per cent. of lime to neutralise the acid, it may afterwards be used without injury to the iron, and at the same time give a satisfactory coating to the metal."

It will not escape notice that carbolic acid is here given as the injurious constituent whereas the contaminated water first referred to is of a basic character. As ammonia is also generally present in tar it is not unreasonable to suppose that lime possesses a permanent neutralising power for the acid that the volatile alkali does not possess.

It is almost superfluous to add that the carbolic acid so injurious to iron is the very thing wanted for the protection of wood. Therefore when coating with tar a railway tank wagon for example, the proper method would seem to be, first to coat the iron-work with tar that has been heated with lime in the manner described and after that to coat the wooden frame work with raw tar.

DISCUSSION.

Mr. F. CLOWES questioned the accuracy of the inference that carbolic acid was the active agent in the corrosion of iron by crude tar.

Mr. L. ARCHBUTT mentioned a case in which creosote had leaked into an iron boiler and corrosion certainly did take place.

Mr. G. J. WARD said that galvanised sheets corroded

rapidly if coated with tar as usually applied, *i.e.*, simply heated to drive away the ammonia.

Mr. JOHN WHITE said that the analysis of the water that caused the corrosion showed only 0.43 part per 100,000 of free ammonia, whilst the chlorine as chlorides amounted to 12.20 parts. He was hardly disposed to think that under the circumstances any importance could be attached to the presence of ammonium chloride in the water. The amount of carbonate of lime was rather high, being 22 parts per 100,000. The corrosion of the bolts was very similar to that in the spout of a kettle that he once saw, and which he suggested might be produced by the action of dissolved carbonic acid gas. It might be that the action upon the bolts was due to the same cause. Ordinary kettles were only tinned in the body, the spout not being tinned. As this was an isolated instance it could not be attributed to galvanic action from contact of two dissimilar metals, for were this the case the spouts of all similar kettles would corrode in the same manner.

Mr. F. J. R. CARULLA said he concurred in the opinion that the question presented difficulties, but he had been induced to bring the subject forward on account of its practical importance.

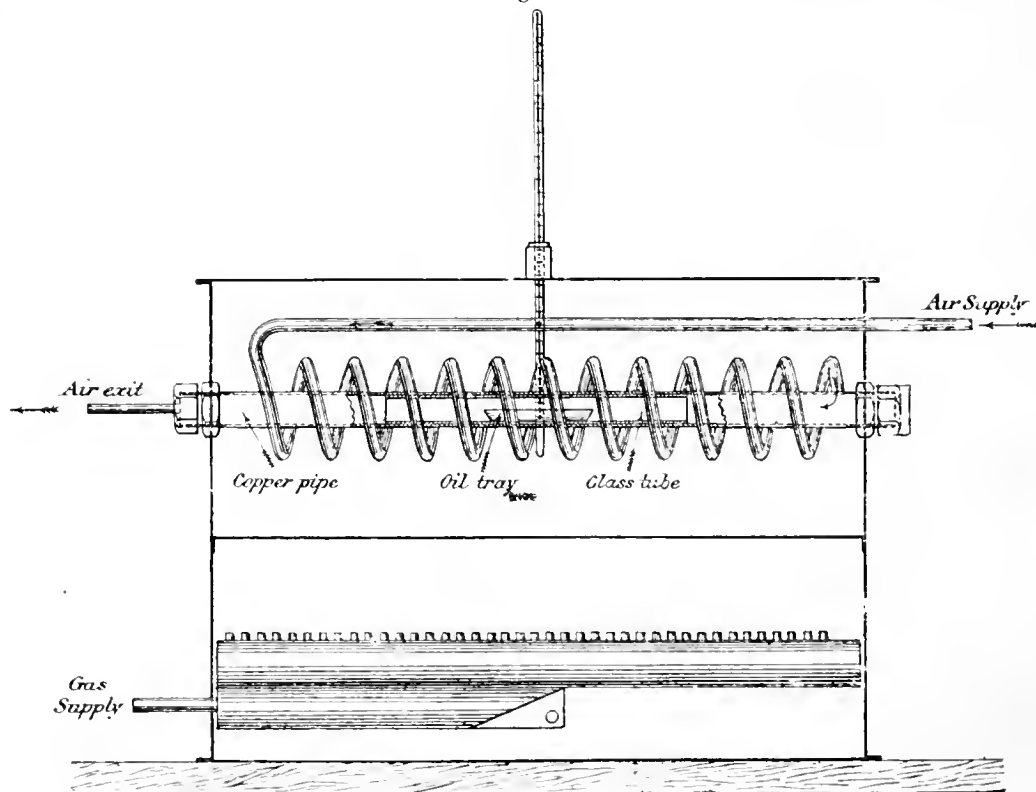
AN EVAPORATION TEST FOR MINERAL LUBRICATING OIL.

BY L. ARCHBUTT, F.I.C.

THE usual method of determining the volatility of mineral lubricating oil is to place a weighed quantity of the sample of oil in a shallow dish or watch glass and expose it in a water or air oven for a certain number of hours, noting the loss of weight. But as the result of such a test must vary according to the number of times the air of the oven is changed during the test, a better plan is to place the receptacle containing the oil in a tube and pass a definite current of air or steam through the tube.

The apparatus which I use (Fig. 1) consists of a straight copper tube, $\frac{7}{8}$ in. internal diameter and 2 ft. long, having a

Fig. 1.



EVAPORATION TEST APPARATUS FOR MINERAL LUBRICATING OIL. One-sixth size.

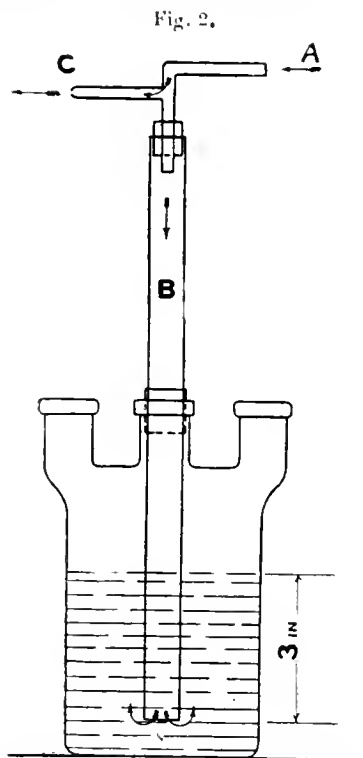
branch tube, $\frac{3}{8}$ in. diameter and about 10 ft. long, entering it near one end, coiled around the straight tube as shown in the figure. This tube and coil are fixed in a rectangular air oven of tinned sheet iron, lagged with asbestos millboard to reduce radiation, and heated by a row of small gas jets. A thermometer is fixed in the oven. The ends of the wide tube which project beyond the oven are closed by brass screwed caps, one of which, at the opposite end to the branch tube, is perforated, and carries a narrow tube in the centre. Air or steam admitted to the coiled tube, after becoming heated in the coil to the temperature of the oven, passes over the oil in the wide tube and out through the short tube in the cap. The oil is contained in a platinum tray, 3 in. long by $\frac{1}{2}$ in. wide by $\frac{1}{4}$ in. deep, which for convenience of manipulation is placed in a glass tube which just slides within the copper tube and serves as a carrier.

The quantity of oil used for a test is 0.5 gm., which forms a thin layer at the bottom of the platinum tray. The temperature of the oven is varied to suit the requirements of the test; for cylinders working at 160 lb. pressure, the oil should be tested at 370° F. The gas passed through the tube may be either air or steam, and of course the speed and volume of the current must be approximately the same in all cases to give comparative results. In my own case having a supply of compressed air, I reduce it to a constant

current of 2 litres per minute by means of the simple regulator shown in Fig. 2, and I expose the $\frac{1}{2}$ gm. of oil to this current for exactly one hour. The compressed air enters the regulator at A (Fig. 2), and a slight excess is kept continually escaping at the lower end of the wide tube B which is immersed to a depth of 3 in. in water. The supply is taken from the branch C, the orifice of which is reduced until just large enough to pass 2 litres per minute against atmospheric pressure under the 3 in. head of water.

If steam be used instead of air, the inlet (Fig. 1), is connected to a flask or boiler, and the exit to a Liebig's condenser. The gas under the boiler is regulated so as to distil a definite volume of water in the hour, 100 c.c. being a convenient quantity, though 92 c.c. is the volume required to give a current of steam nearly equal to the above-mentioned air current. The boiler is then detached, all the steam is blown out of the apparatus, and the platinum tray containing the oil is inserted. After allowing a few minutes for the tray of oil to become heated up, the steam current is turned on. If the tray be inserted without first blowing out the steam, water condenses on the platinum tray, the oil creeps over the edge of the tray, and the test is spoiled.

The figures given in the table show, with five different samples of pure hydrocarbon oil, the kind of results obtained by this test. Bearing in mind the fact that the volume of steam passed over the oil in these experiments was about 8 per cent. in excess of the volume of air, the average loss of weight is very nearly the same in both gases, thus:—



AIR CURRENT REGULATOR. Quarter size.

EVAPORATION TESTS OF MINERAL LUBRICATING OILS.

Description.	Cylinder Oil.			Machinery Oil.	
	A.	B.	C.	D.	Russian.
Specific gravity at 60° F.	0.9021	0.8984	0.8923	0.8794	0.9088
Flashing-point (Pensky)	585° F.	512° F.	424° F.	402° F.	380° F.
Loss of weight per cent. in 1 hour at 370° F.:—					
In air; 2 litres per minute	0.12	(1.) 0.54	(2.) 0.56	(1.) 0.18	(2.) 0.13
In steam; 100 c.c. water condensed in 1 hour.....	..	0.70	0.46	0.68	18.1

DISCUSSION.

Mr. J. M. C. PATON asked if it were certain that both the air and the superheated steam were brought up to the same

temperature? Unless there were a large excess of heating surface there would be a possibility of air and steam not

attaining exactly the same temperature, owing to their different capacities for taking up heat.

Mr. L. ARCHBUTT explained that a very large excess of heating surface had actually been given, and, as a matter of fact, thermometers showed the full temperature was always attained.

Dr. F. CLOWES said it would be noticed that the flashing point was not a measure of the volatility of the oil as determined by Mr. Archbutt's method. There seemed to be absolutely no relationship between them, and it was evidently impossible to infer the general volatility of an oil from its flashing point. In the tabulated statement it would be seen that an oil with low flashing point might show a considerably less loss by volatilisation than another oil which possessed a higher flashing point. There was a similar want of connection between the specific gravity and the volatility as measured by the loss of weight suffered by the oil in an air current at high temperature. This was apparently due to the fact that all these hydrocarbon oils were mixtures of different oils, and contained very variable proportions of heavy and light oils. Accordingly, one oil might consist mainly of heavy oils with high boiling point together with a little very light and volatile oil: such an oil would have a high specific gravity, low flashing point, and low loss in the air current; while another oil containing but little heavy oil and much oil of medium specific gravity would show a high flashing point and greater loss by volatilisation. These considerations pointed to the value of Mr. Archbutt's test.

Mr. G. J. WARD said that Mr. Archbutt, in his paper, stated that he passed 2 litres of air per minute through the oven, but he gave no information as to how he measured the quantity of air. It seemed somewhat difficult to put an appliance for measuring the air on the delivery tube C without causing back-pressure at that point, with the result that less air would pass through C. Perhaps Mr. Archbutt would explain how the air was measured, so that any other person putting up a similar apparatus could obtain figures which would be absolutely comparable with his.

Mr. L. ARCHBUTT said the air current was measured by connecting the exit C to a bell-jar of known capacity, full of water, sunk in a bucket of water. As the air passed into the bell-jar it was gradually raised so as to maintain the same water level within and without the jar.

Yorkshire Section.

Chairman: C. F. Tetley.

Vice-Chairman: J. J. Hummel.

Committee:

H. E. Aykroyd.
J. E. Bedford.
F. W. Branson.
T. Fairley.
N. Farrar.
A. Hess.

W. Leach.
W. Mc'D. Mackay.
A. G. Perkin.
C. Rawson.
Geo. Ward.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, Yorkshire College, Leeds.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Chairman:* Thos. Fairley. *Vice-Chairman:* Christopher Rawson. *Committee:* J. Cohen, J. R. Denison, T. Glendinning, F. W. Richardson, and A. Smithells.

Meeting held at the Queen's Hotel, Leeds, on Monday, April 27th, 1896.

MR. C. RAWSON IN THE CHAIR.

"CACHOU" DE LAVAL.

BY F. W. RICHARDSON, F.C.S., AND H. E. AYKROYD.

THE title of our paper will convey to the uninitiated but little idea of the nature of the substance in question. "Cachou de Laval" is not a sweetmeat or dietary article, but a very remarkable dyestuff made in so peculiar a manner that it may be said to stand alone in the category of colouring matters.

According to the patent of Croissant and Bretonnière, dated April 24th, 1873, the substance we now term "Cachou de Laval" is obtainable by the fusion of a large number of organic substances with alkaline sulphides. The provisional specification with characteristic amplitude includes a very wide range of organic bodies extending from the carbohydrates, starch, cellulose, and sawdust, to such nitrogenous substances as blood, horn, and feathers.

Waste or spent dyewoods are said to be advantageously utilised by this process. Sodium polysulphide is the alkaline sulphide preferred, and this is made by boiling down a mixture of sulphur and a solution of caustic soda. The heat of fusion gives a latitude of 100° C. to 350° C. according to the nature of the substance used and the tint that it is desired to obtain.

We have sought for any literature upon the constitutional nature of "Cachou de Laval," but with only a negative result, indeed, all that seems to have been discovered is contained in the original specification, dated 23 years ago, and there it is stated:—"It is believed that the combination which is developed in this operation, constitutes an organic sulphide. The products obtained by this process are in fact the result of a real combination. Thus if wood sawdust for example be mixed with a solution of potassium sulphide, and the temperature be raised, it will be observed that sulphuretted hydrogen is abundantly evolved, especially when a temperature of about 300° centigrade is obtained. The alkaline sulphide has therefore become decomposed. A portion of its sulphur has taken possession of the hydrogen of the organic body, and the carbon which remains is in a state of particular combination."

It will easily be understood that the reaction is of a very irregular character, and that unless due attention is paid to fixity of conditions and to similarity or identity of substance, colouring matters giving very variable shades will be obtained. "Cachou de Laval" occurs in black porous hygroscopic lumps, quickly alterable by exposure to the air.

It dissolves readily even in cold water, giving a black solution developing brownish colours by aerial oxidation. The dye is substantive and all that is necessary is to immerse the cotton in a solution of the "cachou" at about 60° C., using salt, or still better, bisulphite of soda as an assistant. In from 20 to 25 minutes the desired shade is obtained. To fix the colour, the cotton is worked for a short period in a solution of bichromate of potash, or in a bath containing either sulphate of copper or sulphate of iron. Shades varying from a pale grey to a brownish black may thus be obtained. We find that "cachou" makes an excellent bottom colour and the shade blends well with the ordinary artificial dyes.

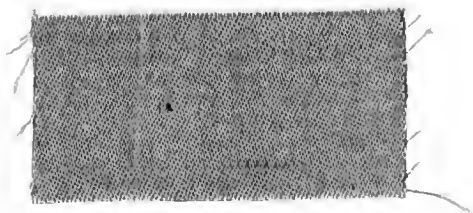
Our inquiry into the nature of this very complex dyestuff has been much further prolonged than we could ever have anticipated. At the very outset we were confronted with the unreliability of existing processes for estimating the sulphides, sulphates, and thiosulphates present, and it was only when we had concluded the investigations reported in the March number of this Journal that this difficulty was overcome. It will readily be seen that the estimation of sulphur salts in a very black alkaline solution, readily changeable even by mere exposure to the air, is not a very easy task. As a general outline of the method we adopted may be of interest and use to chemists we will enter into a few details.

The dye-radical is fortunately completely precipitated by zinc-ammonium-chloride which also removes from solution the whole of the sulphides and polysulphides. The clear colourless filtrate now readily lends itself to our special method described in the March number of this Journal (1896, 171).

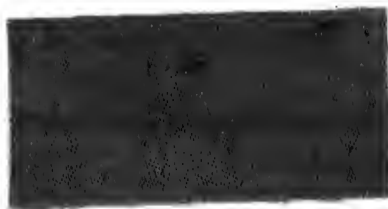
The ammonia is neutralised by dilute hydrochloric acid in the presence of methyl orange, and the resulting solution, after being made to a definite volume, is titrated upon N_{10} iodine. After this operation the solution remains quite neutral showing the entire absence of sulphides. It was only subsequent to this discovery that we noted that sulphur when fused with caustic alkalis gives mixtures of polysulphides and thiosulphates, no sulphite being formed (Watts' Dict. of Chemistry—Morley and Muir).

"CACHOU DE LAVAL."

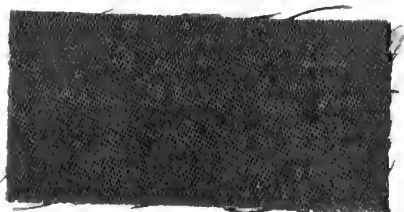
These patterns have been dyed with "Cachou de Laval," made by fusion of the substances named (excepting "Cachou de Laval" itself) with sodium polysulphide :—



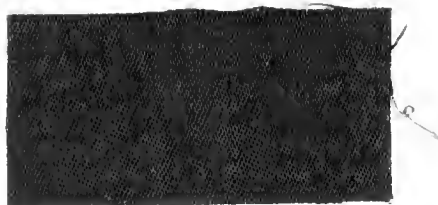
1.—Milk sugar, 5 per cent.



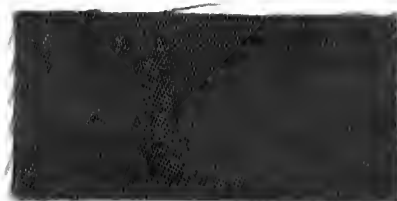
5.—Sawdust, 5 per cent.



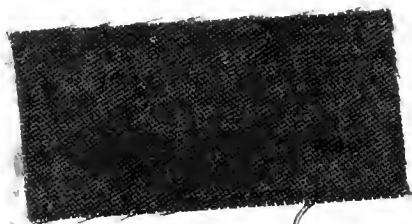
2.—Cane sugar, 5 per cent.



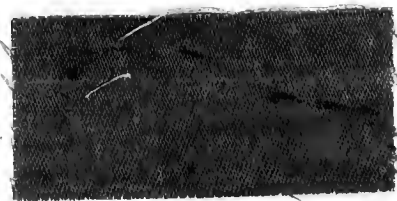
6.—Furfurol, 5 per cent.

3.—Tartaric (oxysuccinic) acid (as sodium tartrate),
5 per cent.

7.—Thiophene, 5 per cent.



4.—Succinic acid (as sodium succinate), 5 per cent.



8.—"Cachou de Laval," 12½ per cent.

The sulphates were readily estimated in another portion of the zinc-filtrate by our tartaric acid process.

The carbonates were separated in the form of BaCO_3 by precipitation with BaCl_2 , the precipitate, after being well washed with boiling distilled water, being treated with HCl and the evolved CO_2 endiometrically determined.

The hydrate appeared in the filtrate from the precipitation with BaCl_2 ; by strongly colouring the somewhat greenish solution with phenolphthalein a titration with $\frac{N}{10}$ HCl was easily affected.

The sulphides and poly-sulphides were determined in the zinc precipitate, which was boiled with dilute HCl in connection with a condenser; all the SH_2 evolved being condensed in ammonia solution, which then gave very delicate indications with Schwarz's standard zinc-ammonium-chloride solution. The free sulphur left in the distilling flask by the decomposition of the polysulphide of zinc was collected with the dye-radical upon a filter and, by subsequent "soxhletting" with CS_2 , was easily determined.

To ascertain the amount of pure dye-radical present necessitated a process which was only developed after repeated experimental failures.

The solution of the "cachou" was filtered, an operation requiring strong paper and a force pump, and the dye left in the paper was removed by washing with solution of caustic soda; by treating the filtrate with excess of HCl and boiling, a precipitate containing the radical with large excess of sulphur was obtained.

To remove the free sulphur the precipitate was thoroughly washed to remove free acid and mineral impurities; it was then dried and "soxhletted" with CS_2 . It was found necessary to grind the dried precipitate to an impalpable powder, and to "soxhlet" some 200 times with CS_2 to obtain a pure result.

The results of our analysis of "cachou" are now submitted for your consideration.

"Cachou de Laval."

Moisture	1.60
Sodium polysulphide (Na_2S_x)	10.50
" thiosulphate ($\text{Na}_2\text{S}_2\text{O}_3$)	19.62
" sulphate (Na_2SO_4)	3.15
" sulphite	None
" chloride	1.20
" carbonate	49.80
" hydrate	1.12
" "cachouate" (dyestuff)	19.00
Insoluble organic impurities, &c. (by difference)	1.60
Ferrous oxide	0.50
Aluminium oxide	1.35
Magnesium oxide	0.16
	<u>100.0</u>

These data are somewhat surprising, inasmuch as they show the presence of what may appear to the uninitiated to be a large proportion of saline impurities, but we must observe that sulphides and thiosulphates are agents essential to the solution and preservation of the dye itself. Solutions of "Cachou de Laval" speedily give a considerable separation of sulphur under aerial influences, and the polysulphides thus gradually decomposed utilise the oxygen which might otherwise too readily attack the colouring matter.

The amount of carbonate of soda would seem to be excessive, but is no doubt unavoidable when we take the mode of manufacture into account.

The Nature of the Dyestuff in "Cachou de Laval."

Our entire stock of information from outside sources as to the nature of the dyestuff present in "cachou" amounted to certain vague statements as to its being an organic sulphide, and a derivative of mercaptoic acid; indeed the proprietors (the St. Denis Société anonyme of Paris), who have very kindly answered a number of questions on the subject, state that "literature says nothing about the formula and constitution."

We were pleased to find that the dyestuff is not one of the mercaptans, the vile odours of this class of bodies being potently in mind. It was also easy to ascertain that mercapturic acids (acetyl compounds of alkyl thio-lactic acids)

(Ber. 18, 258) were absent. Methyl and ethyl groups were absent, and it was therefore evident that no thio-ethers or thio-alcohols were present. The pure dyestuff or radical was only obtained in a pure state after repeated treatment with hot dilute HCl and with hundreds of Soxhlet extractions with CS_2 , the free sulphur being tenaciously held by the hard gritty particles of the dried organic colouring matter.

The colour principle thus obtained is a black powder burning almost like sulphur itself when heated. It is quite insoluble in water, alcohol, ether and acids, but dissolves in hot solutions of caustic soda and potash with the production of colours varying from dark green to greenish-black. These solutions become rapidly brown in the air.

The estimation of sulphur was effected by fusion of the dye principle with over 40 times its weight of a mixture of carbonates of potash and soda and nitrate of potash in about equal proportions; the mixture in the platinum crucible being covered with a layer of potassium carbonate. The barium sulphate subsequently obtained amounted to over four times the weight of the dye taken.

The ultimate organic analysis was undertaken in the knowledge of the presence of so large a quantity of sulphur. Ignitions were made after mixing with large proportions of nitrate of potash in an iron boat placed in the combustion tube, but it was found that nitrogen oxides were evolved, and even a heated layer of copper turnings did not sufficiently prevent their egress.

The chromate of lead method was finally adopted, and this gave very concordant results, every trace of sulphur being oxidised and retained in the combustion tube in the form of lead sulphate. All the combustions were made in a slow stream of air drawn by a filter pump through the tube after all moisture and CO_2 had been removed by passing the air through a series of chloride of calcium tubes and potash bulbs.

The following figures express the average results of several very concordant analyses:—

Sulphur	66.00
Carbon	31.40
Hydrogen	1.30
Oxygen	1.30
	<u>100.00</u>

The empirical formula of this compound is therefore $\text{C}_{33}\text{H}_{16}\text{S}_{26}\text{O}$, and its molecular weight is 1260.

To determine the valence of the radical was not an easy task, for we have to deal with a body insoluble in all ordinary solvents. It seemed to us that the property which the soda salt of the dye possesses for precipitating zinc and silver from ammoniacal solutions would serve us in good stead.

The pure dyestuff was heated with a freshly-prepared carbonate-free caustic soda solution; after filtration the solution was precipitated with ammonium-zinc chloride in one instance and with ammoniacal silver nitrate in another set of experiments. The thoroughly washed and dried precipitates gave us the zinc and silver salts respectively, and the amounts of zinc and silver found in these salts gave us the necessary data for ascertaining the valence of the radical.

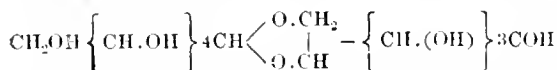
	Zinc Salt.	Silver Salt.
Zinc	26.0	
Silver		54.2
Radical	74.0	45.8
	<u>100.0</u>	<u>100.0</u>

The zinc salt therefore indicates that the molecular weight of the radical $\text{R}^{\text{II}}=185$ or $\text{R}^{\text{I}}=92.5$.

The composition of the silver salt shows that the radical $\text{R}^{\text{I}}=91.3$. These two results are therefore quite harmonious.

Unfortunately we had not sufficient of these salts to determine their degree of oxidation, but this may have been more considerable than that of the radical analysed; thus the molecular weights are greater than that of the oxygen-free base.

In this experiment one third of the sulphur was eliminated as sulphuretted hydrogen and a large amount of the dye was obtained. According to Fischer's researches lactose is thus constituted:—



and the large number of (CH.OH) groups present in this body and in carbohydrates generally would appear to be a very desirable feature for the production of the trithiophenates (*i.e.*, of "eachou").

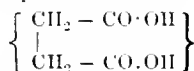
Cane sugar, starch and sawdust also give large yields of the dye and the results upon cotton hanks from these and all the other substances experimented with we submit for your examination. We have treated the hanks with bichromate of potash and blue vitriol respectively, in order that you may see how closely the shades obtained correspond with those yielded by the commercial "eachou" itself.

As it was suggested to us that almost all hydrocarbons would give (CS) groups and eachou on fusion with polysulphides we experimented with the saturated hydrocarbons, particularly with paraffin wax, and with different members of the aliphatic (fatty) series, but in every case with a negative result.

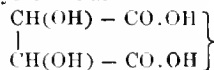
Also formates, acetates and oxalates gave us no particle of "eachou," and from these facts it is evident that compounds of the general formula C_nH_{2n} and $\text{C}_n\text{H}_{2n}\text{O}_2$ are not "eachou"-formers.

It would appear that just in proportion as an organic body contains carboxyl groups, to that extent its powers of forming trithiophenates are weakened.

It is also noteworthy that while succinic acid—



gave us a fairly large yield of "eachou," its congener, tartaric, *i.e.*, dioxysuccinic acid—



gave us scarcely more than a trace of the dye.

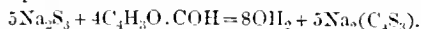
Mucic acid $\{\text{C}_4\text{H}_4(\text{OH})_4(\text{CO} \cdot \text{OH})_2\}$.

Pyrogalllic acid $(\text{C}_6\text{H}_3(\text{OH})_3)$ and gallic acid—
 $(\text{C}_6\text{H}_2(\text{OH})_3\text{CO} \cdot \text{OH})$,

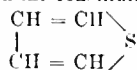
although benzene derivatives gave a very appreciable amount of the dye; while, on the other hand, phthalic anhydride and sodium-benzene monosulphonate gave almost a negative result. These facts show that not all organic bodies yield eachou by polysulphide treatment, and that it is not a simple question of the formation and building together of CS or CSH groups.

We find that the tetramethenyl formation of the CH groups is peculiarly favourable to the production of the dyestuff, as is also the presence of CH_2 groups, and it is probably for this reason that succinic, mucic, and pyromucic acids give so much "eachou."

Furfural in reaction with the sodium polysulphide gave us no sulphuretted hydrogen, and from an analysis of the products formed the following appears to be the only equation possible:—

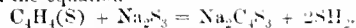


Furfural very readily gives a much larger yield of the "eachou" dye than any body (with the exception of thiophene) with which we have yet experimented, and there can be no doubt that the reaction thus given converts our supposition as to the composition of the dye-radical into proof. Thiophene, $\text{C}_4\text{H}_4\text{S}$, with the constitutional formula—

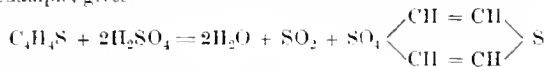


suggested itself as a body which under suitable conditions should give the dye on sulphuration. It is impossible to fuse such a volatile substance as thiophene with polysulphides; yet we have obtained by means of a special treatment an enormous yield of "eachou" from this body and have

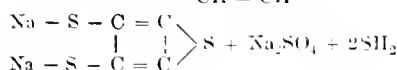
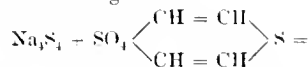
established the equation—



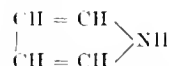
We find that on treatment with strong sulphuric acid, both thiophene and pyrrol become almost solid and evolve heat and sulphur dioxide; the compounds thus obtained are no doubt sulphated and polymerised products and as they are non-volatile it is quite easy to alkalinise them and fuse with sodium polysulphide. It would appear that thiophene, for example, gives—



polysulphide treatment gives—

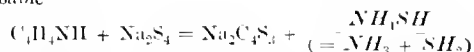


Pyrrol—



although a tetramethenyl compound contains triatomic nitrogen and may react differently to thiophene or furfural. From a few experiments on a small scale pyrrol has given us the dye, but we have yet to investigate the full changes which ensue.

The following equation would appear to be the most probable—



In drawing to a conclusion of our inquiry we would call attention to the reaction ensuing when polysulphides are fused with organic bodies as a distinctive test for tetramethenyl and other "eachou"-forming groups in compounds, and for chemists with the time and the necessary apparatus the inquiry should prove very productive of useful results to chemical theory.

At a later time we hope to investigate the even more complex substances, so closely allied to "eachou," Vidal black and thiocatechin; dyestuffs of high excellence, as those engaged in the dyeing of cotton will allow. The introduction of the aromatic series with nitrogen (diamine) groupings enormously increases the complexity of these bodies.

Our best thanks are due to Mr. Frank Wood and Mr. Adolf Jaffé for valuable assistance in conducting this inquiry.

SUPPLEMENTARY NOTE.

In reply to a number of questions and criticisms, the authors state that:—

In obtaining the dye-stuff from thiophene the preliminary sulphation was not carried so far as to lead to the splitting up of the molecule. After mixing the thiophene with sulphuric acid in the cold the fluid was warmed to 100° F. for a few moments; as soon as solidification ensued the mass was treated with slight excess of caustic soda solution and then evaporated down (for ultimate fusion of the residue) with polysulphide of sodium.

Separate experiments showed that a soluble sulphated product constituted from equal molecules of H_2SO_4 and $\text{C}_4\text{H}_4\text{S}$ was formed; this soluble product gave a large yield of "eachou." It is true an insoluble body was also produced, but this was present in small quantity and gave none of the dyestuff.

Moreover we prepared thiophene α -sulphonic acid, using a 1 per cent. solution of the thiophene in ligroin for treatment with sulphuric acid; here there was certainly no splitting up of the molecule and the $\text{C}_4\text{H}_4\text{S} \cdot \text{SO}_3\text{H}$ (sodium salt) gave the "eachou" dye on fusion with Na_2S_4 . Furfural gave the dye by direct boiling and fusion with the polysulphide, and we regard this fact as weighty evidence in support of our views.

We are aware that furfural, thiophene, and pyrrol are regarded as analogous to benzene, but as the empirical formula of the "eachou"-dye-radical shows carbon in combinations of 4—or multiples of 4—atoms and as thiophene

and furfural act as parent substances for the production of "cachou" we cannot resist the conclusion that the tetramethenyl formation is characteristic.

The (C.O.H) group in furfural may be regarded in the same light as the O₂S and NH in furfuran, thiophene, and pyrrol respectively. We have made several ultimate analyses of the "cachou" radicle, and the results have been singularly concordant and conclusive.

Having carefully analysed the products of the action of sodium polysulphide on furfural we can give no other explanation of the facts than those given in the paper.

According to our researches, the "cachou" dyestuff is not a mercaptan (*i.e.*, a sulphhydrate or hydrosulphide of hydrocarbon radicle); in its pure form it certainly has not and does not yield malodorous effluvia characteristic of this class of bodies, and from reasons to be adduced the absence of alkyl groups precludes the possibility of its being a mercaptan.

The following are some of our reasons for supposing that the "cachou"-dye does not contain alkyl, &c., groups:—

(1.) The presence of so very small a proportion of hydrogen which is entirely replaced by bases.

(2.) Sulphated thiophene and thiophene sulphonic acids, furfural and sulphated pyrrol readily give the dye in large proportions, and these bodies do not contain any alkyl groups.

(3.) From C₁₂H₈S₂O₄.H and Na₂S₂O₄ we obtain a large yield of a body (dyestuff) containing—

S 66, C 31.4, H 1.3, (O 1.3);

surely there is no other interpretation than that which assumes the union of all the S with the C atoms, and this is according to analogy (*e.g.*, trimethyl-trisulphone, &c.).

It will be observed that the simplest statement of the molecular weight deducible from an analysis of the zinc and silver salts of the dye is somewhat different to that of the unoxidised dyestuff; we account for this by the fact that in the making of these metallic salts an alkaline solution of the dye was used, and the oxygenation may have been more considerable than that represented in the ultimate analysis. The data, with allowance for the oxygenation factor, are sufficiently near to support the empirical formula M₂.(C₄S₃)ⁿ.

H₂C₄S₃ is the simplest formula for the dyestuff, just as C₆H₁₀O₅ is the simplest formula for starch, &c. The heavy and solid character of the dyestuff shows that its full formula must be a high polymer of this group and can only be represented as (H₂C₄S₃)_n.

Kopp is said to have obtained "cachou" from sodium acetate, yet we have never yet succeeded in obtaining a particle of "cachou" from this body; all we obtain is a greenish-black liquor which on standing a few hours gives a clear yellow supernatant liquid and a dark black sediment. Attempts at dyeing show that the colour obtained is not a dye.

DISCUSSION.

Mr. C. RAWSON remarked that "Cachou de Laval" was a substance of great interest in the dyeing industry, and that he was somewhat surprised that it was not used more extensively, though doubtless the comparatively high price at which it had been sold had something to do with this. He was convinced that the class of dyes to which it belonged, including Vidal black and thiocatechin, would be of great importance in the future. He asked whether the products obtained from thiophene and furfural had been analysed, or whether the dyeing test alone had been considered sufficient to prove their identity with the colouring matter of "cachou." He also pointed out that "Cachou de Laval" deteriorates somewhat rapidly if not preserved in well-closed vessels; and asked the authors if they had examined the products formed.

Mr. T. FAIRLEY asked the authors whether they had included any aldehydes or ketones among the organic substances from which they had attempted to obtain "Cachou de Laval," since it is known that these bodies readily yield sulphur compounds. He also suggested that it would be of interest to try the action of sulphur on paraffin, pushing the heating as far as possible.

Mr. H. R. PROCTER inquired whether there was any possibility of thiophene being used on the commercial scale in making the dye.

Mr. F. W. RICHARDSON, replying, said that Mr. Aykroyd and himself had analysed the different substances obtained from thiophene, furfural, and pyrrol. They had further proved their identity with the colouring matter of "Cachou de Laval" by means of what appeared to be a characteristic test for that substance, viz.: if the colouring matter be dissolved in excess of baryta water and the barium then precipitated by a current of carbon dioxide, a blood-red solution remains; all the substances gave this reaction. They had also dyed cotton with each of the substances in sulphuric acid, chrome, and copper sulphate baths, and obtained the same shades from all of them.

The price of thiophene was far too high to make any commercial application possible.

They had found that the deliquescent substances contained in "Cachou de Laval" caused it to absorb moisture from the air rather rapidly (as much as 18 per cent. in a night), and that accompanying this an oxidation took place which first caused the colouring matter to dye browner shades and then diminished its colouring power very considerably.

In reply to Mr. Fairley he said that they had used aldehydes in their experiments, but had found that the methyl and other alkyl groups were not "cachou"-formers, and had therefore not considered it to be worth while to try ketones.

Meeting held on May 8th, 1896.

On this occasion the PRESIDENT visited the Section and was entertained at dinner. The proceedings of the meeting will appear in a subsequent issue.

Scottish Section.

Chairman: John Clark.

Vice-Chairman: J. B. Readman.

Committee:

G. Beilby.

R. Cox.

J. Gray.

D. Harris.

G. G. Henderson.

W. I. Macadam.

J. S. Macarthur.

A. Macdonald.

R. C. Menzies.

E. Ostlere.

T. L. Patterson.

Sir R. Pullar.

H. Rose.

P. Rottenburg.

E. C. C. Stanford.

D. R. Stewart.

Hon. Secretary and Treasurer:

J. Stanley Muir, Chemical Laboratory, The University, Glasgow.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—Committee: A. C. J. Charlier, C. A. Fawsitt, R. A. Inglis, and R. T. Thomson. Secretary: Thomas Gray.

Meeting held in Glasgow on Tuesday, March 3rd, 1896.

DR. JOHN CLARK IN THE CHAIR.

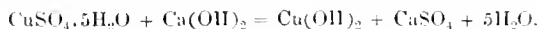
EXPERIMENTS WITH BORDEAUX MIXTURE AS A PREVENTIVE AGAINST POTATO DISEASE.

BY JAMES HENDRICK, B.Sc., F.I.C.

ONE direction in which chemistry has been of service to agriculture has been in the provision of preventives against and remedies for the insect and fungoid pests which are among the most troublesome foes of the farmer. Bordeaux mixture is a preventive. It was first used about 13 years ago, in the *claret* district in France, as a preventive against mildew and other fungoid diseases of the vine. It has since been tried, especially in the United States, upon a great variety of plant diseases, and in many

eases with marked success. It has, in fact, been steadily gaining for itself the position of the most generally useful agricultural fungicide known. In Britain it is practically known only as a preventive against potato disease, which is due to the ravages of the fungus *Phytophthora infestans*. It was used against this disease in France very soon after its discovery, and since then its use has been extending in all parts of the world. Bordeaux mixture is prepared by adding lime to a solution of copper sulphate until the copper is completely precipitated. There have been a great many modifications in the formula used in making the mixture. Solutions of copper sulphate of all strengths have been used, from those which, when precipitated, give a paste, to quite dilute solutions. But for potato disease the generally recommended strength contains 2 lb. of copper sulphate in 10 galls. of the mixture, and is commonly known as the 2 per cent. mixture.

In making the mixture an excess of lime is used so as to ensure not only the complete precipitation of the copper, but that the liquid shall be strongly alkaline. If copper be left in solution, the foliage of the potato plant itself will be injured. The reaction which takes place is commonly represented by the equation—



That is, 249 parts, by weight, of crystallised copper sulphate require, for complete precipitation, 74 parts of pure slaked lime. The chemistry of the change is not, however, quite so simple as is here represented.

If lime be added to a solution of copper sulphate in quantity not sufficient to precipitate all the copper as hydrate, we get a sea-green precipitate containing basic sulphates of copper. Though we may completely remove the copper from solution in this form, it cannot safely be used for Bordeaux mixture. On exposure to the air, carbon dioxide is absorbed, forming some copper carbonate, and liberating some of the copper again in a soluble state as sulphate. If, again, lime be added in excess, we get an azure blue precipitate, which contains all the copper, chiefly in the form of hydrate. The liquid remains alkaline, and, on standing, the precipitate gradually turns almost purple in colour. It is as the azure blue precipitate that Bordeaux mixture should be used. When this is done, the copper sticks firmly to the leaves of the plant, yet it does not injure them. In my own experiments the copper could still be detected on the leaves of the plants weeks after application, although extremely rainy weather, July and August 1895, had intervened. The precipitate ought not to dry to powder and shake off, nor should it wash off with rain, nor should it injure the leaves. In fact the sprayed foliage generally remains green longer than that which is unsprayed. It is probable that some of the inconsistent results which have been obtained with Bordeaux mixture are due to improper preparation of the mixture. Farmers are not generally chemists, and common lime, such as farmers would use, is generally very impure, and might be to a considerable extent turned into carbonate as well. It is generally recommended to use 1 lb. of slaked lime to every 2 lb. of crystallised copper sulphate. This should give a very considerable excess of lime, but I can quite imagine cases arising where the copper is either not completely precipitated or is precipitated in the green state. On this account, and on account of the general aversion of farmers to the trouble of making up a chemical mixture of this kind, which they do not understand, various dry powders of the nature of Bordeaux mixture precipitate have been placed upon the market, and great success is claimed for them.* These have simply to be stirred up in water and sprayed upon the plants.

It is in Ireland that Bordeaux mixture has had its most extensive and successful use in the British Isles. The Irish Land Commission, Agricultural Department, early took the matter up, and have since published annual reports on the subject. The result has been that the use of this fungicide is far better known in Ireland than in either Scotland or England. In Scotland, experiments have been

made from time to time but the results obtained have been very indecisive. This may be partly due to the fact that owing to the use of better and stronger varieties of potato, disease is not nearly so prevalent in Scotland as in Ireland, where this preventive has been found so effective.

Early last year I arranged to have experiments carried out on this subject on Woodilee Farm, Lenzie, by Mr. Weir, the manager; and on Newton Farm by Mr. John Speir. On Woodilee Farm, five plots, and on Newton Farm, six plots, each $\frac{1}{10}$ th of an acre in area, were marked off. The land was chosen as even and free from inequalities as possible. The same variety of potato, Red Bog, was grown on both farms. This potato was chosen as it is one which is very liable to disease. All the plots were treated in every way alike, except in respect of the spraying. Four plots were sprayed. Two of these were sprayed once, and two were sprayed twice. The mixture was made up of two strengths. One contained 2 lb. of crystallised copper sulphate to 10 galls. of water, this will be referred to as the 2 per cent. mixture; the other contained $1\frac{1}{2}$ lb. of copper sulphate to 10 galls. of water and will be referred to as the $1\frac{1}{2}$ per cent. mixture. Each of these mixtures was applied to two plots. The arrangement of plots was as follows:—

1. Unsprayed.
2. Sprayed once with the 2 per cent. mixture.
3. Sprayed twice " "
4. Sprayed once with the $1\frac{1}{2}$ per cent. mixture.
5. Sprayed twice " "
6. Unsprayed.

At Newton the first spraying took place on July 22, the second on August 8, and the potatoes were raised on September 23. At Lenzie, the first spraying took place on July 30 and 31, the second on August 26, and the potatoes were raised October 7 and 8. So far as could be seen, the spray in no way injured the foliage, but neither did it seem to have the effect which has been reported in many other cases,* of causing the foliage to remain green longer than in the unsprayed parts. No disease was noticeable on either farm before the second spraying, either on the unsprayed or on the sprayed plots. In fact, on both farms there was very little difference to be seen between the sprayed and the unsprayed plots at any time. When the leaves began to fall there was no visible difference between the plots, and on both sprayed and unsprayed plots the leaves fell at the same time. The sprayer used in both experiments was a Vermorel Knapsack sprayer.

In both experiments the shaws at the time of the first spraying were very big, and it was not only difficult to make sure that all parts of the foliage were thoroughly sprayed but it was almost impossible to avoid more or less injuring the plants in moving about among them. At the second spraying the foliage was already going down, and was not therefore so liable to injury.

When the time for raising came Mr. Speir found that he could with difficulty spare hands necessary for the long and tedious work of picking all the potatoes from the plots over by hand in order to remove the diseased tubers, and as there was so little sign of disease in the shaws, it was evident that there could not be much disease present. For these reasons, and because there was very little difference apparent between the plots, it was decided to raise one-quarter pole from each plot, pick over the potatoes from these and weigh them. As it was found on doing this that there was little difference in the proportion between diseased and sound tubers on the sprayed and on the unsprayed plots, and the evidence of the eye was thus confirmed, the whole plots were not weighed. It is to be noted that this is the method which has been followed in calculating the results of many of the experiments carried out by the Irish Land Commission and others. Though large plots were sprayed, only a small portion of each was picked over and weighed. The weight of potatoes, of a size too great to pass through a $1\frac{1}{2}$ -inch riddle, divided into diseased and sound, and

* See, for example, report of experiments conducted by the Irish Land Commission during the season of 1895. Blue Book C.—5028.

* See Bulletin No. 6, the U.S. Department of Agriculture, Division of Vegetable Pathology; the Journal of the Royal Agricultural Society of England, 3rd Series, Vol. III.; and the Irish Land Commission's Reports.

calculated to weigh per acre, found by weighing these small plots, is given in the following table :—

NEWTON. WEIGHT OF POTATOES PER ACRE.

Plot.	Sound.		Diseased.	
	Tons.	Cwts.	Tons.	Cwts.
1	9	0	1	17
2	6	3	1	6
3	6	11	1	7
4	6	11	1	14
5	10	3	0	9
6	7	13	2	6

It will be seen from this table that, though the proportion of diseased potatoes is somewhat less on the sprayed than on the unsprayed plots, the result is very unsatisfactory. Plot 5 is the only one on which the diminution of disease is sufficient to make the spraying worth while. It is to be remembered that no reliance can be placed on the weights per acre given here, as the plots raised were far too small to give accurate figures.

At Lenzie the whole of the plots were raised by hand. The potatoes were then thoroughly picked over by hand, and all the diseased ones separated. Every single potato from the whole of the plots was individually examined. The sound potatoes were then put through a riddle of $1\frac{1}{2}$ -in. mesh, and divided into marketable and small. The potatoes from each plot were thus divided into three lots: diseased potatoes, and large and small sound potatoes. Each of these lots was separately weighed. This work, which occupied a considerable number of hands for two days, was all conducted under the personal supervision of Mr. Weir and myself.

The following table gives the weight of potatoes of each kind from each of the plots, calculated to tons per acre :—

LENZIE. WEIGHT OF POTATOES PER ACRE.

Plot.	Sound Potatoes.			Diseased Potatoes.	Total Sound and Diseased.
	Large.	Small.	Total.		
	Ts. Ct. Qs.	Ts. Ct. Qs.	Ts. Ct. Qs.	Ts. Ct. Qs.	Ts. Ct. Qs.
1	6 5 0	1 13 1	7 18 1	1 9 0	9 7 1
2	6 0 0	1 14 2	7 14 2	1 2 2	8 17 0
3	6 7 2	2 2 3	8 10 1	0 7 2	8 17 3
4	6 0 3	1 15 2	7 16 1	0 12 3	8 9 0
5	6 0 2	1 17 2	7 18 0	0 13 2	8 11 2

The diseased potatoes were, as a rule, only slightly attacked by the fungus. Comparatively few were badly rotted with it, and these few were mainly to be found in plots 1 and 2. Indeed, there was very little sign of disease at any time in the shaws, and any disease which attacked the plots must have come pretty late. It is to be seen that in this case the sprayed plots are with one exception, plot 2, nearly free from disease. The explanations of the fact that plot 2 has much more disease than the other sprayed plots is probably to be found in the conditions under which it was sprayed. It was the first plot sprayed. Not only was the man who did the work quite unused to the machine, but something went wrong with the nozzle, and it was only with great difficulty that the spraying of this plot was finished at all on the 30th July. The nozzle was then repaired, and the other plots were successfully sprayed on the next day, 31st July. It is probable, then, that this plot was very imperfectly sprayed. It contains rather fewer diseased potatoes than plot 1, but three times as many as plot 3, which was sprayed twice with the same mixture. The $1\frac{1}{2}$ per cent. mixture does not appear to have been quite so effective as the 2 per cent. mixture. It is curious, too, that plot 5, which was sprayed twice, does not contain less disease than plot 4, which was dressed once only.

We have found, then, in this experiment that the application of the spray has diminished disease to a marked extent, but we are still in disagreement with the experiments of the Irish Land Commission, and others, on a most important

point. It has been almost universally found that the application of Bordeaux mixture increases the value of the crop not merely by diminishing the weight of diseased tubers, and hence increasing in proportion the weight of sound ones, but also by increasing the total weight of the crop. This action may be due to the spray preventing the early decay of the shaws through the ravages of disease. The leaves are first attacked by the fungus, and it is only by propagating itself from them through the stems that the pest finally reaches the tubers. So that if the shaws are early carried off by disease the formation of a heavy crop of tubers may be prevented, although such as are sound may to a large extent never be reached by the fungus.

In this experiment we have no greater weight of sound potatoes produced by the spray than by the unsprayed plots. This can be understood, however, when we remember that any disease which was present only appeared very late when the shaws were beginning to go down in the natural order of things, and when it was therefore impossible that the presence or absence of disease, could have much effect on the weight of crop produced. But this does not explain the curious fact that the total crop is greater on the unsprayed than on any of the sprayed plots. In fact the spraying, while it has diminished the weight of diseased potatoes, has not increased the weight of sound ones.

These experiments then, like all others previously conducted in Scotland, give unsatisfactory results. As in both the Old and the New Worlds the general results obtained with this fungicide have been so good, further experiment seems necessary to explain its comparative failure in this country.

In conclusion I must thank Mr. Weir and Mr. Speir for placing their land and labour at my disposal, and for the cordial and enlightened way in which they co-operated with me in carrying out these experiments. In this country the agricultural chemist has seldom land or means at his disposal of carrying out these large scale experiments, and he is entirely dependent on the public spirit and enlightenment of private individuals. These gentlemen, who are busy practical farmers, deserve the fullest recognition for the trouble and care which they have taken in assisting me with this work. It was only through them that I was able to carry it out at all.

DISCUSSION.

THE CHAIRMAN said they were very much indebted to Mr. Hendrick for bringing this matter before them, because, whilst agricultural papers were not very often brought before the Society of Chemical Industry, anything dealing with such an important question as the potato disease was certainly of great interest. He asked if the sulphate of copper used was absolutely pure; if not, it would contain more or less protosulphate of iron, which was not beneficial to the soil. Mr. Hendrick advocated the introduction practically of copper into the plant. Analysts had frequently to determine the percentage of copper in the plant, and whether this copper had been introduced artificially or naturally. The question whether copper might be thus introduced into the plant would require to be settled. Mr. Hendrick purposely used common commercial sulphate, which certainly contained a small amount of ferrous iron. The action of ferrous iron introduced a much debated subject. He did not consider that small quantities of ferrous iron were prejudicial.

Mr. WILLIAM THOMSON supposed that a wet season or damp surroundings was necessary for the development of this pest. He presumed that copper oxide must be soluble in water to some extent. Was that not so?

Mr. HENDRICK said the copper oxide as it rested on the potato leaves was in an insoluble state.

Mr. THOMSON said the combination of chlorophyll with copper made a colouring matter as permanent as indigo. The slightest trace of copper seemed to fix the dye well. One could not imagine an antiseptic effect being got from an insoluble substance, and it was worth while considering whether it would not be a good plan to spray these plants with an exceedingly minute quantity of sulphate of copper in solution.

THE CHAIRMAN inquired if ammoniacal solution had been used?

Mr. HENDRICK said he believed it had been tried, but an insoluble substance was required. The main point was to have something that would remain on the foliage, because the spores germinated on the leaf. This was prevented by the thin protective coating of the copper compound. If a soluble combination was put on the leaf it rapidly washed off or became absorbed by the tissues with injurious effects to the plant.

The CHAIRMAN: Have the tubers been examined for copper?

Mr. HENDRICK said, so far as he was aware, no copper had been found in the tubers. Where this mixture was used for fruit trees and sprayed directly on to the fruit—grapes, peaches, apples, and pears have been treated—copper was always found on the fruit rind, but so far as he was aware none had been found in the tissues of the fruit. Some American stations had experimented as to whether copper could be introduced into fruit, and so far as he could ascertain they had decided that there was no dangerous introduction of copper from the use of Bordeaux mixture. Small quantities of copper did not appear to be very poisonous.

Mr. THOMSON said copper was a natural constituent in the human body.

Mr. HENDRICK: And in small quantities in various animals. It had been found in the feathers of certain birds. It had also been detected in mangold-wurzel.

The CHAIRMAN: All were agreed that an infinitesimal quantity would do no harm, but what was the limit?

Mr. STEUART asked regarding the cost of the application?

Mr. HENDRICK: It varied from 10s. to 15s. per acre. This process was a prevention, not a cure. By the application of the mixture, spores were prevented from germinating on the leaf.

Mr. STEUART asked if the mixture prevented diseases associated with animal life?

Mr. HENDRICK: It had only been used for fungoid diseases. It prevented spore development.

The CHAIRMAN: It may do that by improving the health of the plant?

Mr. HENDRICK: No, apparently not.

Mr. ANDERSON said in moist weather the copper might be rendered soluble by the carbon dioxide in the rain-water.

Mr. HENDRICK did not think that solution was solely due to carbon dioxide. It did not do to apply the copper mixture without an excess of alkali. No doubt the acid juices of the plant were capable of rendering small quantities of copper soluble. The fungicidal action was probably due to slow solution.

Mr. THOMSON: It would be interesting to try the effect of minute quantities of copper or iron on pure cultures of the disease.

Mr. HENDRICK intended to do this, but had not yet had an opportunity.

THE STANDARD OF FLASH-POINT FOR MINERAL OIL.

BY D. R. STEUART.

(*This Journal*, 1896, page 173.)

DISCUSSION.

Mr. BEILBY was very much gratified to find that Mr. Steuart, had now, by careful experiments, answered a number of questions which were put on the last occasion on which the subject came before the Society. A notable point was the question of mass—the effects produced by larger quantities of oil dealt with in barrels and tanks and in larger vessels than ordinary Abel testers. Mr. Steuart showed that in these cases where the surface and the quantity of oil was increased the flash-point was directly lowered; thus the Abel test in its severe form was none too severe.

Mr. GRAY considered that Mr. Steuart had supplemented his former remarks by further investigations which were of very great importance. He personally found that in trying to explode oils in reservoirs of various sizes by means of the electric spark, he got results which were very

similar to Mr. Steuart's. The bulk of the oil and the explosibility of oil vapour and air in barrels and tanks was, he thought, a point which Mr. Steuart now rightly brought forward, because it was a weak point in the earlier paper. He deemed it advisable that the discussion should be adjourned in order to afford an opportunity of following out Mr. Steuart's experiments more closely.

Mr. BISHOP had experimented with a 9-inch Abel apparatus and obtained similar results to Mr. Steuart.

Meeting held Tuesday, April 7th, 1896.

Mr. D. R. STEUART opened the discussion by reading some supplementary remarks, of which the following is an extract:—

Mr. Spencer, in his recent report on Lamp Accidents and Experiments, takes the increase of temperature from burning between initial and final temperature of the oil. The initial temperature of the oil was always under the initial temperature of the chamber; and the room was heated during burning above ordinary summer evening temperatures, probably from many lamps being burned in the same room; but all is added together as if it were the ordinary heat of one lamp burning by itself. His figures prove that with ordinary lamps, 100° standard leaves a passable margin for safety. Persons who use large lamps or L.C.C. safety ones must use lighthouse oil of 150° flash, or treat the lamps with intelligence so that the explosive-mixture is not reached by a light. He thinks that "absolute security cannot be obtained by raising the flash-point," and no doubt he is right; yet, strange to say, he thinks that "almost absolute safety, no matter what kind of oil is used, is obtained if lamps and stoves are of right construction." He confesses frankly, however, that "if any practicable method can be found for preventing the use in lamps of all oil that is not perfectly safe, it may be desirable to adopt that course in preference to prohibiting the sale of unsafe lamps." That such a method and standard is practicable, and indeed quite easy, gentlemen here will no doubt be able to prove. I have been asked how much this would increase the price. I caused inquiries to be made of refinery managers and chemists in every producing district in America in 1893, and found that the cost at the works of ordinary export burning oil was generally 2 cents per gallon. Sometimes 3 cents was given as the cost, but that, I think, was high-flashing oil. But take 3 cents as cost. To convert ordinary export oil to 100 flash, it is required to take out of it at most 10 per cent. of naphtha and heavy oil. If these fetch as good price in the market as burning oil, then there is no extra cost at the refinery, for there is no extra expense in putting the naphtha into the naphtha tank instead of into the burning-oil tank. The most extreme case possible is if nothing at all could be got for the naphtha and heavy oil, in which case the cost of a gallon of burning oil would be increased about one-tenth. So that $\frac{1}{10}$ per cent., or $\frac{1}{4}$ d., extra at the refinery will far more than cover all extra cost. But if this increased cost does not reduce production, and there is no fear of that, the increased cost at the works in America or Russia does not necessarily mean increased price to the consumer. The price here does not depend on a little increase or decrease of cost at the refinery, but is altogether commanded by competition here. Let there be plenty of competing sources, American, Russian, Indian, and home, and the oil will be cheap; with plenty of competing sources, then, the addition of a farthing to the cost at the refinery will add nothing to the price to the consumer. No doubt if we reduce by one-tenth the yield of burning oil got from crude petroleum, if there was any decrease in production of crude oil, this would add to the price here considerably, but that is a very remote danger at the present time. The result of keeping the standard at its present low point will not have the effect of making oil cheap here; but, on the other hand, will cause the chance of oil being made much dearer.

Paraffin oil was freely used by the people of this country for nearly 10 years before the introduction of petroleum; so much so that when petroleum was introduced it was also called paraffin oil, a name already familiar to all the people. Young's patent was also used in America from 1852, and

the oil made under it. Rock oil gave its name to refined petroleum when it was introduced there. To show the extent of the paraffin oil trade in 1859, Mr. James Young bought 247,431 lamps from one maker alone, and in 1860 the same maker supplied him with 1,200 lamps per day. So that paraffin oil was to a large extent the oil of the common people before the introduction of petroleum.

There is one point on which Mr. Spencer and Dr. Chandler of New York are agreed, viz., that the safety of the people must be brought about by legislation. Attempting to educate them through the newspaper, county council instructions, &c., is found to be utterly valueless. The people most likely to have a lamp accident in London are not likely ever to have seen the L.C.C. instructions.

The CHAIRMAN asked what was the average of the standards in the United States?

Mr. STEWART said that there were 19 States that had no State law. Illinois with 155 tests had an inspection in every town and village on the requisition of five inhabitants. The tests varied from 105° to 150° fire test and from 100° flash-point to 120°. There were four States that had as low a test as England, but they used the low flash-point oil only for export:—

No State law or no State inspection.—Alabama, California, Colorado, Connecticut, Delaware, Idaho, Illinois, Kansas, Louisiana, Mississippi, Nevada, North Carolina, Oregon, South Carolina, Texas, Virginia, West Virginia, Washington, Wyoming (19 States). Some of these have efficient inspection in every city, and some even in every village. Illinois, for instance: 150° fire test; inspection in any town or village on requisition of five inhabitants.

110° Fire.—Maryland, Pennsylvania, Rhode Island, Vermont (4).

120° Fire.—Maine, Minnesota, New Hampshire, North Dakota, Wisconsin (5).

130° Fire.—Arkansas, Florida, Kentucky (3).

150° Fire.—Missouri, cities and towns of Illinois (1).

100° Flash.—Massachusetts, New Jersey (Elliot cup), New York (Elliot cup) (3).

105° Flash.—Iowa (Elliot) (1).

110° Flash.—Montana, South Dakota, Nebraska (Foster cup) (3).

120° Flash.—Georgia, Indiana, Michigan, Ohio (Foster cup), Tennessee (5).

Mr. WILLIAM THOMSON said that the subject had been brought before the Manchester Section some years ago. Mr. Stewart's present contribution was exceedingly opportune, because the matter was presently receiving serious consideration all over the country. The Manchester and Salford Sanitary Association had lately sent a requisition asking the Home Secretary to consider the question of raising the flash-point to 100° or over. He (Mr. Thomson) had been working at the subject for some time, and had an arrangement with the Manchester and Salford Sanitary Association whereby all the lamps which exploded were sent to him for examination, with a view to discover any peculiarities about them. There were a great many lamp accidents in Manchester and the neighbourhood. He had received a number of these lamps recently. The lamps which had apparently exploded *with a bang* had been all of one type, and that type was called the "Queen Anne burner." It was a burner made in America. It had a wick tube, at the side of which was a small tube which went between the flame and the inner portion of the receptacle for the oil, so that with low flash oils producing an explosive mixture inside the receptacle, the flame was put in the position best calculated to fire the vapours—over a touch-hole, as it were. He had called attention to that point in three distinct cases. In one case a woman was holding one of these lamps when some clothes were thrown down a neighbouring stair; this produced a sudden draught, the lamp exploded, and she was burned. In another case the lamp had been standing on the mantelpiece and suddenly exploded *with a bang*; and a third was standing on a kitchen table and suddenly exploded. These all had "Queen Anne burners." In another case with a lamp which had not a Queen Anne burner there was no evidence of it having exploded. A man and his wife were awakened by fire and smoke. The oil receptacle of the lamp had

broken. They had left the lamp turned down. He supposed that the flame had heated the brass work, the brass work had heated the glass oil-vessel, it had broken, and the whole thing had caught fire. He thought that would show that they ought to have metal receptacles for the oil, and not glass.

It was evident that Acts could not compel persons to procure properly constructed lamps. People with lamps could not be expected to discard one type and take to another. Consequently there was only one alternative—to make the oil safe. He hoped that a resolution would again be brought forward and be carried with unanimity again in the Society, and again placed before the Home Secretary.

Mr. J. STANLEY MUIR asked if Mr. Thomson had determined the flash-point of the oils which had caused the accidents?

Mr. THOMSON said he could not obtain the flash-points, as there was no oil left. The oils sold in England were 73°, 75° or 76°.

The CHAIRMAN said it was only by bringing forward from time to time such facts as had been brought before them by Mr. Stewart, proving beyond the possibility of dispute the dangers attending low flash-point as compared with high flash-point oils, that they could hope to induce those in authority to alter their views. There seemed, however, to be no possible doubt that the safety of oils was practically comparative—that was to say, comparative to the flash-point. The higher the flash-point the greater the safety. The temperature which was dangerous, was that at which the oil gave off vapour. To simplify matters he would be inclined to move as a resolution that, in the opinion of the meeting, oil of 73° flash-point was dangerous, and that the flash-point ought to be raised to 100° F., Abel test, with a view to public safety.

The motion, on being put to the meeting, was unanimously agreed to.

Meeting held on May 11th, 1896.

The PRESIDENT visited the Section on this occasion, and discussed various matters of interest with the local committee.

New York Section.

Chairman: Alfred H. Mason.

Vice-Chairman: J. H. Wainwright.

Committee:

T. Lynton Briggs.	E. G. Love.
G. T. Bruckmann.	T. Lungwitz.
V. Coblenz.	Arthur McGeorge.
H. Comer.	John McKesson.
H. Endemann.	Thos. J. Parker.
S. W. Fairchild.	D. Wesson.
Jas. Hartford.	

Hon. Treasurer: R. C. Woodcock.

Hon. Local Secretary:

Hugo Schweitzer, 139, Front Street, New York, U.S.A.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next—*Chairman: Prof. C. F. Chandler. Committee: M. Aisberg, W. F. Foerst, A. H. Mason, W. Jay Schieffelin, and R. C. Schupphaus.*

*Meeting held at the College of Pharmacy,
Monday, April 26th, 1896.*

MR. A. H. MASON IN THE CHAIR.

THE CHLORINATION OF GOLD ORES.

BY J. DAWSON HAWKINS.

THE method of extraction of gold from its ores by means of chlorine is not a new one, although it has been only within recent years that its development has been such as to bring it into the front rank of metallurgical processes.

I will take the Cripple Creek ore as a special example, because my data on it are more numerous and extensive than on any other. The general chlorination treatment of all gold ores is, however, the same, and the statements made in this paper will be found to be of general application.

The crushing of the ore is the first consideration, and as a preliminary to that, the drying of it. The kind of drier to be used depends largely on the physical character of the ore to be treated. If it is hard, a revolving drier will answer, but if it is soft and wet, a shelf drier, such as the Stetefeldt, should certainly be used. In the latter the time of exposure of the ore to heat is under the control of the operator, and the ore is not taken out until dry, while in the former the progress of the ore is unimpeded, and at the end of a fixed time the discharge takes place regardless of the condition. A revolving drier also produces a large amount of dust. Taking all points into consideration, the shelf drier is the most satisfactory for general use.

The coarsest mesh, to which the ore can be crushed and still give satisfactory extraction, must be determined for each class of ore, and then the aim must be to produce a minimum of fines. The machinery must be chosen with this end in view. Rolls with hard steel shells will be found to be the most satisfactory,—with them ore can be crushed to 10 mesh and deliver only 4 per cent. of the material finer than 150 mesh.

In the Cripple Creek ores where the percentages of sulphur vary, it is found desirable to bed the ores before crushing, in order that the work of the mill be uniform. The ore is now ready for roasting. This roasting is a very important requisite in the preparation for the treatment by chlorine. All the sulphur, tellurium, antimony, arsenic, or anything capable of acting as a reducing agent, must be oxidized in order that there shall be no absorption of chlorine for other purposes than solution of the gold. The roasting of the ore accomplishes another important change which is of great importance in the treatment of the ore: it renders all particles porous, thus allowing of coarse crushing, and yet permits the chlorine being brought into contact with the particles of gold. This effect is due to the fact that the heating of the pieces of rock produces cracks all through them and makes channels for the dissemination of the chlorine solution. This fact can be easily demonstrated by taking a piece of rock and heating it in the muffle furnace and then holding with only one end in water. The porosity of the rock will be shown by the water rising in it as in a sponge. Even though the ore contained nothing to oxidize, it would be desirable to roast it in order to produce this effect. The operation of roasting must be a slow and careful one, for it is in the furnace that the real work of the chlorination mill must be done. If the work here is bad, addition of chemicals in the barrels will not overcome it. The time usually allowed for this is about three hours, and the heat at first must be light, gradually increasing to a bright cherry heat. The philosophy of this is that the gold existing in combination is found almost entirely with either sulphur, tellurium, arsenic, or other similar metalloid; and if the initial heat is sufficient to cause a fusion, the particles of gold will run into globules of matte and then resist all oxidation; but if the roasting is done slowly we accomplish a complete oxidation, and leave the metal in such condition that it is accessible to the chlorine solution.

It had previously been held to be true as regard tellurides of gold that roasting them produced loss. I have devoted especial attention to this, and have made very many careful investigations, and I can say authoritatively that this is not true. There is no loss of gold by volatilization in calcining. The loss is due to dust, and with proper arrangements for the prevention and the collection of dust, all the gold delivered to the furnace in the raw ore is turned out in the roasted product. And as regards the dust, in the arrangement of the chlorination mill proper arrangements for dust collection must be provided, as in no class of roasting furnace can its formation be prevented.

I wish to call especial attention to the fact that the roasting of gold ores must be a calcining one, and in no case may salt be added, because a loss as high as 30 per cent. may be produced by the formation of chloride of gold,

and no increased advantage will be attained in the preparation of the ore for chlorination.

There are, of course, many different types of furnace which are applicable to this work. In this, as in all roasting, the most perfect work can be done by the old-fashioned long-hearth reverberatory furnaces. But the cost of labour is so considerable with this type of furnace that it becomes necessary to use a mechanical furnace of some description. The mechanical furnaces can be described in three classes—the shelf furnace, the cylindrical furnace, and the flat-hearth of the reverberatory type. As it is necessary to leave but a very small percentage of sulphur in the roasted ore, the first-mentioned type, that of the shelf furnace, is not applicable to this work, because the ore cannot be roasted dead enough. Of the other two types, the White-Howell and the Brückner cylinder may be considered. A great objection, however, to these furnaces is the large amount of dust which is produced by them, and the consequent difficulties in the collection and treatment of it. The best form of furnace for this work is the reverberatory type, three of which are the Pierce Turret furnace, the Brown Horseshoe furnace, and the Ropp furnace. The Brown Horseshoe furnace is now in operation at the Golden Reward Mill, in Deadwood, South Dakota. As to their satisfaction with it, I cannot make any statement as it has been in operation only about three weeks. The Horseshoe furnace, however, has not given the best of satisfaction in the roasting of ores for smelting purposes. The criticism of this is on the method of operating the rabble arms in the furnace.

The Ropp furnace is a recent device. This also is in operation in only one place, the Selby Works, in San Francisco. An examination of it seems to suggest that it is very applicable to any class of work in which there is no sintering of the ore. It is a Pierce furnace straightened out with the slot in the middle of the hearth.

The Pierce furnace has been in use in this class of work in two chlorination mills—the Lawrence Gold Extraction Company and the El Paso Reduction Company, both of Cripple Creek District. From a great deal of personal experience with these furnaces at the El Paso Reduction Company, I can speak very strongly in favour of its use. It, of course, has defects, as have all forms of mechanical roasts, but the defects are not insuperable nor the cost of operation great.

The next step is the treatment of the ore in barrels. These are lead-lined steel cylinders, ordinarily 5 ft. in diameter and 9 ft. long, provided with a man-head and necessary valves to admit of the use of water pressure. The barrel is also provided with a filter inside. This may either be a sand filter, as described by Rothwell in the *Engineering and Mining Journal*, or asbestos cloth may be substituted for the sand. My own experience inclines me to favour the use of the asbestos as giving a better rate of filtration than the other. The barrel is charged with water to 50 per cent. of the amount of the ore treated, which, in this sized barrel, is a little over five tons. The sulphuric acid is then added to the amount of about 30 lb. to the ton of ore. The cold ore is then added, the bleaching powder placed on top of the ore, the man-head put on, the barrel started revolving and kept so for about three hours, when the revolution is stopped, the proper water connections made, and the gold liquor filtered from the ore under a pressure of between 20 to 40 lb. to the square inch. The number of revolutions per minute which it is most desirable that the barrel shall have, experience shows to be between four and five.

It had been the custom to revolve the barrels 8 to 12 revolutions per minute, but this causes a great deal of wear on the filter-cloth in the barrel and the chemical action is in no way increased.

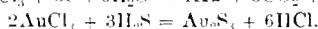
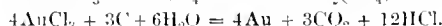
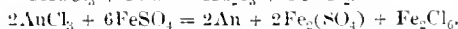
When the gold exists as metallic particles of sensible size, the time of revolution of the barrel, and therefore of the action of the chlorine, must be increased, as the solution of these particles in the chlorine water is quite slow. In the Cripple Creek ores, to be absolutely sure of complete solution, it is necessary to allow this treatment to extend over four hours. In the chlorination mills in South Carolina small barrels, holding from one to two tons of ore, are used

and the filtration is effected in open filters on the outside. There are objections to this in the long time required for the washing of the ore, and in the injurious effect of the chlorine gas on the men. The difficulty in filtration could not have been so seriously felt in South Carolina mills because they treated only roasted concentrates, which, from their nature, must be free from slimes. It is, of course, possible to filter crude ore in open tanks, but the time required is a very important element in the working of the mill. The average time required at the works of the El Paso Reduction Company for filtering a charge in a barrel is between two hours and five minutes and two hours and fifteen minutes. In order that this average may be kept up, it is necessary that the men in charge of the barrel work should pay the closest attention to keeping the asbestos filter-cloth clear of slimes. If this is not properly attended to, after the first few charges in the barrel the time of filtration will increase to as high a point as 24 hours. There is, however, no necessity for anything of this kind taking place when proper precautions are taken with the cloth.

The average amount of water required in the chlorination barrels for each ton of ore treated is between 400 and 450 gallons. This figure is the total amount of water coming out of the mill as gold solution.

We now come to the precipitation and separation of the gold from the solution. There are a number of methods of accomplishing this, viz., treatment by sulphide of iron or copper, precipitation by ferrous sulphate, precipitation by carbon, and precipitation by hydrogen sulphide.

The following are the re-actions which take place—



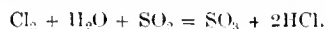
The first two methods are, of course, practicable but not economical, nor is the resulting concentrate of sufficiently high grade; therefore I pass them with simple mention.

The precipitation of gold from its solutions by the use of ferrous sulphate is a method which has been largely used. The gold is thrown down as metallic gold in a very fine precipitate, and considerable difficulty attends its collection. Also in the presence of copper a very considerable quantity of the gold will remain in solution. As illustrative of this, I will cite an experiment I made on Cripple Creek ores. The solution was carefully precipitated with an excess of sulphate of iron and the precipitated gold carefully filtered off. The filtrate from this, which gave no further re-action with the iron solution, on being precipitated by hydrogen sulphide gas gave 30 per cent. of the gold originally in the solution. I will describe the apparatus and procedure in the precipitation of gold solution by means of carbon in the form of charcoal. The carbon filters employed are upright cylindrical vessels, about 4 ft. high and 30 in. in diameter, provided with an opening in the bottom for the escape of the waste liquor. The charcoal is crushed and the portion of it between 4 mesh and 10 mesh is collected and thoroughly water-soaked. It is then packed quite solidly into the cylindrical vessels. These are then filled with water, a heavy perforated lead plate placed on top of the charcoal, and the filter filled with water. They are now set in pairs, one above the other, and are ready for operation. The gold solution is heated to about 140 Fahr., and is then run on to the upper filter at a rate of from one to three gallons per minute. The waste liquor is allowed to run from the upper filter into the lower filter at the same rate of speed at which the liquor is fed, and the lower filter operated the same as the upper, allowing the waste liquor from the bottom of it to run outside. The gold is precipitated on the charcoal in a metallic form very finely divided, and is perfectly and definitely done unless the flow of liquor is made too rapid for the temperature. When the carbon-filter is sufficiently saturated with gold, it is washed, dried, and then the charcoal burned in open cast-iron pans. The heat is communicated by a fire from below. Although the reduction of the gold from the solution is perfect, the metal is not firmly enough held to the particles of charcoal to

resist being carried off by the current. Therefore, the properties of the charcoal as a filter must be depended on to prevent the escape of particles of metallic gold in suspension in the waste liquor. Some metallic gold, however, will be carried out into the lower filter, and there again the filter, as a filter, must be used to prevent the escape of these particles below. But in any case, taking all precautions, it is impossible to prevent the escape at the bottom of the lower filter of a small amount of gold in suspension. This amount the experience of the El Paso Reduction Company shows to be from five to ten cents per ton of ore treated.

Another objection to the use of carbon as a precipitant is in the burning of the carbon and the collection of the ash. The ash, although very high grade, consisting of about 70 per cent. gold, is a very fine powder, which cannot be handled without the production of dust, and therefore of a certain amount of loss. The gold is obtained from the ash by mixing it with proper amounts of sodium carbonate and borax glass and melting it down in a crucible. The metal produced is very fine, frequently going as high as 995. The precipitation of gold by means of hydrogen sulphide is the most satisfactory one in that it is absolutely definite and perfect in its work, and the cost of it is less than in any of the other methods. It is conducted as follows:—

The clear solution is run into the precipitating tank, and sulphurous acid, produced by burning sulphur in a current of air, is forced into the liquor. By this means all of the free chlorine in the gold liquor is reduced to the form of hydrochloric acid. The reaction which takes place is as follows:—



The sulphurous acid gas must not be allowed to act too long after reducing the free chlorine; it would reduce the gold to the metallic state as a very finely divided precipitate. The point at which the sulphurous acid must be shut off is distinctly indicated by the appearance of white fumes at the surface of the tank. The hydrogen sulphide gas is produced by the action of dilute sulphuric acid on iron matte in a closed lead-lined vessel, and the action is accelerated by a current of air forced in under pressure. This hydrogen sulphide gas is forced into the gold solution, thereby precipitating all of the gold as Au_2S_3 in the form of a flocculent dark brown precipitate. The precipitate is allowed to settle for a short time, then all the supernatant liquor is passed through a filter-press. The tank is then filled up with fresh gold solution and the operation repeated. When it is desired to thoroughly clean out the gold from the precipitating tank it is all run through the filter-press, where the gold sulphide collects as a mud. This is dried, roasted in muffle furnace, mixed with the proper amounts of sodium carbonate and borax glass, and melted down in a crucible. The gold produced in this way is not of as great fineness as that produced from the carbon ash, but the cost of the operation and the absolute definiteness of the precipitation and collection, joined with the fact that the value of the metal is not increased by its fineness, makes this no argument against it. This method of precipitation is pronounced by all those who have had experience in chlorination works as being the proper one for use.

I have thus far not referred to chlorination in open tanks, because the barrel process is the one most economical and easy of application. There are, however, several establishments where concentrates are chlorinated in open tanks. I will briefly outline the way in which this is done, but will not go into any detail of the work. The open tanks are lined with lead, and are provided with either a false bottom of wood or one of coarse sand. The ore is put into the vat and the chlorine gas forced into it from beneath the false bottom. When the gas makes its appearance at the top and has acted for a sufficient length of time, it is shut off, the tank filled with water, and the gold solution washed out. Another method for open tank chlorination is allowing a solution of chlorine to percolate through the ore from above. The solution is collected below in any ordinary manner. The precipitation in these cases is effected by one of the above-mentioned methods.

An ore to be particularly adapted to chlorination work should be free from silver, as there are but few cases in which the silver can be subsequently recovered by amalgamation

or by lixiviation with hyposulphite of soda. Some ores, however, permit of this. The Cripple Creek ore, although assaying too little in silver to consider saving it, has given as high as 77 per cent. metallic extraction. The gold, however, nearly always yields itself to the chlorine when the proper conditions have been complied with in the crushing mill and the roasting furnace.

Gold chlorination, however, is yet but an infant industry, but the advances which have been made in it within the last few years promise a future development which will bring it into the front rank of metallurgical processes.

DISCUSSION.

Dr. D. WOODMAN alluded to the use of bromine as a substitute for chlorine.

Dr. M. ALSBERG stated that in some of the Western States chlorine was produced electrolytically, liquefied, and then used for chlorination with apparent success.

Prof. L. STEVENS also detailed some of his experiences in the Venezuelan gold districts.

THE EFFECT OF COMPRESSION OF ILLUMINATING GAS UPON ITS CANDLE-POWER.

BY E. G. LOVE.

THERE are four systems at present in use for the artificial lighting of cars, namely, oil-lamps, carburetted air, compressed gas, and electricity. The first of these is the oldest, and admittedly the most unsatisfactory, while the electric light, on account of its cost, has not come into any extended use except on those lines which employ the electric current as a motive power. Carburetted air, that is, air mixed with the vapour of some volatile hydrocarbon, as gasoline, is used to some extent by several railroad companies, but it is open to many objections. The relative merits of the oil and compressed gas systems are very apparent to one who has occasion to travel up and down Manhattan Island after dark; and no one would hesitate to choose between the ample illumination on the cable roads, which is effected by compressed gas, and the rather poor twilight of the oil-lighted cars on the elevated roads.

The compression of illuminating gas for the lighting of cars, buoys, &c., has of late years become an important branch of the gas industry. The English and German engineers have been the pioneers in this direction, and to them is due the main credit for the present degree of perfection which this system has attained.

In the practical working of this system two methods have been followed. One consists in the compression of ordinary illuminating gas having a candle-power of from 16 to 28, while the other involves the manufacture of a special gas of from 40 to 60 candle-power, which, even after a certain loss by compression, furnishes a gas of far greater candle-power than that obtainable by the first method. With this latter the name of Pintsch will always be associated.

It is to be expected that the compression of an illuminating gas which owes its luminosity in part to benzol and other hydrocarbon vapours will result in the throwing down in a liquid form of more or less of this material, and thereby impoverishing the gas, the extent of this depending mainly upon the degree of its compression.

In practice it is customary to compress the gas in large cylinders to from 10 to 16 atmospheres (150 to 240 lb.), and afterward draw it off into smaller cylinders which are attached to the cars to be lighted. The pressure in these small cylinders seldom exceeds 10 to 12 atmospheres. In Germany we believe the law does not allow a railroad company to carry gas-cylinders beneath its cars charged to a greater pressure than 120 lb., or eight atmospheres.

It is apparent that by this plan of transferring from storage to service cylinders, any liquid products would be retained in the large or storage cylinder, and that gas from the small cylinders would presumably have about the same candle-power, whether tested when full or nearly empty. If, however, the gas is compressed in a

cylinder and afterwards used from the same cylinder, the probabilities are that as the pressure diminishes the gas will take up more or less of the liquids, and give a higher candle-power than when the gas is at the maximum pressure.

It is also evident that this difference in the quality of the gas will depend upon the quantity and nature of the condensed hydrocarbons in the cylinder; or, in other words, whether the original gas contained a large or a small quantity of those illuminants reducible to a liquid at the original pressure in the cylinder.

Several years ago Mr. C. E. Botley reported the results of a large number of experiments on the compression of coal-gas for the lighting of railroad carriages. His conclusion was that this gas lost little by compression, a gas of 16.32 candles, for example, when compressed to 13½ atmospheres (200 lb.) being reduced to 13.58 candle-power, or a loss of 16.79 per cent. He also found that the candle-power improved as the pressure was reduced, and that rich gases suffered more than poor ones by compression. In one case a coal-gas of originally 16.10 candles was reduced to 13.35 candles by compression to 13½ atmospheres, or a loss of 17 per cent. This would represent the value of such a gas when compressed in storage tanks and drawn off into small cylinders. The same gas was also tested at various pressures from 13½ atmospheres to the normal pressure. At 10½ atmospheres, or 155 lb., the candle-power was 14.56; at 6½ atmospheres, or 95 lb., it was 15.30; at 2½ atmospheres, 35 lb., the gas had regained its original candle-power of 16.10, and when the pressure became normal the value was 18.41 candles, a gain of 2.31 candles. With regard to the loss in volume it was found that a coal gas of 16.5 candles lost 1.16 per cent. in volume when compressed to 5 atmospheres, 2.54 per cent. at 9 atmospheres, and 7.47 per cent. at 13½ atmospheres.

His experience with oil-gas was that it lost from 23 to 25 per cent. in bulk and from 10 to 12 per cent. in candle-power by compression to 10 atmospheres. It is to be remarked, however, that for the reasons already stated there would be considerable variation in the loss in candle-power in the cases of samples made by different processes or under different conditions by any one process. It is stated on the authority of Pintsch that the loss of candle-power of oil-gas made from crude petroleum is 2.4 per cent. when the compression is carried to 5 atmospheres, 7.4 per cent. at 10 atmospheres, 16.3 per cent. at 15 atmospheres, and 21.5 per cent. at 20 atmospheres.

Not very long ago I had occasion to make a great many tests of railroad lamps using compressed gas, and in the course of the work an opportunity was afforded of making some observations on the loss which some of these gases suffered by compression. The object of this paper is to bring before you some of the results thus obtained, and I venture to do this more especially because in the majority of the tests water-gas was used, while the published results on this subject refer for the most part to coal-gas.

In the photometric work the burners used were Bray's Slit-Union No. 7, and Sugg's London Argand No. 1, the former better adapted to develop the candle-power of the richer gases, while the latter, which is the standard burner for coal-gas in London, is better suited to gases of 18 candles and less.

As the tests of the water-gases before compression were made with the flat-flame burner, it was necessary for the purpose of comparison to retain the flat-flame burner in testing the same gases after compression, although the Argand form was better adapted to develop the candle-power of the compressed, and thereby impoverished gas. The only tests made with a coal-gas were on a sample which was originally of about 16 candles, and which was compressed to 16 atmospheres or 240 lb. After compression the cylinder was placed on end and any liquid it contained was blown off through the valve. This gas was tested with the Argand burner, and when the cylinder pressure was 15 atmospheres gave 10.93 candles, at 7 atmospheres the candle-power was 11.07, and at 5 atmospheres it was 10.93. The loss was therefore nearly 32 per cent.—a figure considerably larger than that reported by Botley on gas of this candle-

power, although it must be remembered that in the present instance the pressure was nearly three atmospheres greater.

Of the many experiments made with water-gas I will mention only a few, as illustrating the results obtained under somewhat different conditions in the compression of the gas.

The first was with a sample of the gas as compressed by the Pennsylvania Railroad for use in the lighting of its cars. In this case the compression was carried to 17.5 atmospheres, or 262.5 lb., and the gas was removed from contact with any liquid products. The original candle-power of this gas was claimed to be 25, although I have reason to believe it was considerably less than this. The compressed gas had a specific gravity of 0.630, but no tests of its candle-power were made until the pressure in the cylinder had fallen to 6 atmospheres. From this point frequent tests were made until the pressure fell to 2.5 atmospheres, and the results were very uniform through this range of pressures, the average being 12.65 candles by the Argand burner. Another sample of water-gas was compressed under my direction to 11 atmospheres, but no attempt was made to remove the liquid from the cylinder. The uncompressed gas gave 18.34 candles by the Argand burner. The compressed gas had a specific gravity of 0.614, and gave the following photometric results:—

	Candles.	Loss per Cent.
At 9.5 atmospheres	12.39	32.4
" 6.0 "	14.29	29.1
" 2.5 "	15.72	14.3
" 1.75 "	17.51	4.5
" 1.0 "	18.21	0.7
" 0.5 "	18.28	0.3

These tests show that as the pressure diminished there was a steady improvement in the candle-power, until at last the value became the same as in the original gas.

A sample of water-gas from another source, which originally had a candle-power of 28 by the flat-flame burner, gave, after compression to 12 atmospheres, 13.20 candles at 10.5 atmospheres, and 15.92 candles at 6 atmospheres, with a specific gravity of 0.614. An effort was made to eliminate the effect of any liquid products by the use of two cylinders, much after the plan followed in the compression of gas commercially, but the results were not satisfactory. The method was to compress the gas in one cylinder to 16.5 atmospheres, then draw off half an atmosphere into the second cylinder, compress the first one again to 16.5, and so on until the second cylinder was full. In this way no gas entered the second cylinder which had not already been subjected to a pressure of 16 atmospheres. It is probable that the deposition of the hydrocarbons is a more or less gradual process, although in no case in which this plan was followed was I able to obtain any appreciable quantity of liquid from the second cylinder, possibly because the scale on which the experiment was made furnished no more liquid than would be retained by the rough interior of the cylinder.

To give a single case, a certain water-gas of 29.3 candle-power was compressed to 16 atmospheres. With this cylinder pressure the gas had a candle-power by the flat-flame burner of 16.09, and a specific gravity of 0.594, the candle-power increasing to 11.59 candles at 8 atmospheres, and 13.76 candles at 5 atmospheres.

Numerous other experiments might be cited much of the same nature as those already given, but I think enough has been said to show the very serious loss which water-gas suffers when compressed to the degree usual in car-lighting in this country.

In view of this fact, and the attendant circumstances that a much greater space is required for the quantity of this low-quality gas necessary to produce any given lighting, it is evident that the choice of such a gas in preference to an especially manufactured oil-gas of very high candle-power is a matter of very doubtful economy.

DISCUSSION.

Dr. D. Woodcock emphasized the influence of temperature in all analyses of gas.

The CHAIRMAN suggested the employment of liquefied acetylene for illuminating railway carriages.

Messrs. R. C. Woodcock, F. E. Dodge, and H. Schweitzer took part in the discussion.

A resolution of sympathy with Dr. C. F. Chandler (Chairman-elect) in his late severe illness, and of congratulation upon his recovery after a surgical operation rendered necessary thereby, was passed unanimously.

ERRATUM.

This Journal, March 1896, 179.—The initials of the author of the paper on "Analysis of Alloys" should be "G. W." not "C. W. Thompson."

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Gases, Washing; Improvements in Apparatus for. P. F. Holmes, Huddersfield. Eng. Pat. 5113, Mar. 11, 1895.

A HORIZONTAL cylindrical casing is divided by vertical partitions into a number of compartments, every alternate one containing a brush or its equivalent, revolving on a horizontal shaft passing through the casing and preferably arranged slightly below the centre. The gases enter at one end, and pass from one compartment to the next through openings arranged near the centre of each dividing partition. The washing liquid enters at the opposite end, and flows to the end where the gases enter in such a manner that, after passing to any compartment, it is impossible for it to pass backwards and mix with the purer liquid therein. This may be done by providing the liquid outlet from each compartment containing a revolving brush, with a weir, from which the liquid overflows to the next compartment. By this arrangement the level of the liquid is gradually lowered as it passes through the apparatus. Other arrangements may be made, but in all cases the apparatus has compartments alternating between those containing the revolving brushes, &c., in which the liquid is comparatively still.—R. S.

Gases, Refrigeration of; Improvements relating to the Progressive. W. Hampson, Chester. Eng. Pat. 10,165, May 23, 1895.

THE gas to be liquefied is first freed from moisture, if it contain any, then compressed, and afterwards cooled. It is next led to the top of a casing and passes downwards through a number of small tubes, which are arranged in horizontal layers connected by curved ends, partitions nearly crossing

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reade Lick, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

the casing and alternately fixed at opposite sides thereof, dividing off each horizontal set of tubes. At the bottom end, all the tubes lead to one orifice, which may be contracted at will. The gas thence passes into an expansion chamber, from which it ascends completely through the casing containing the tubes, its course being a zigzag, in consequence of the partitions already referred to, whereby it is kept in close contact with the small tubes carrying the incoming compressed gas. It is finally led away for use or sent back to the pumps. By this means an interchange of heat takes place, resulting in the gas which passes downwards becoming continuously colder, until at last it liquefies in the expansion chamber, and may be drawn off therefrom by a tube. The casing is provided with a double jacket, which is lightly filled with animal wool or cotton, and exhausted by means of a pump. The process is termed "self-intensive refrigeration of gas."

—R. S.

Evaporating Apparatus, Improvements in. J. Lee, New Ferry. Eng. Pat. 6491, March 29, 1895.

THE improvements consist in the application of one or more annular steam cylinders mounted on hollow trunnions on which they may be caused to rotate in the liquid contained in an evaporating chamber or pan, steam being introduced into the cylinder during rotation, through the trunnions. Within each annular cylinder a spiral conveyor is fitted so as to revolve in the opposite direction to that of the cylinder, in order to remove any deposit or incrustation from the inner surface of the cylinder and convey it to the end, where it can fall to the bottom of the pan or evaporating chamber. For the same purpose fixed scrapers are attached to the pan to remove incrustation from the outside periphery of the cylinder. A conveyor is also arranged at the bottom of the evaporating pan to convey the deposited crystals or substance to suitable openings in connection with apparatus where the crystals may be drained from the mother-liquor and removed, without interference with the evaporation.—O. H.

Evaporating Apparatus, Improvements in. H. H. Lake, London. From W. F. Jobbins and J. van Ruymbeke, Aurora, U.S.A. Eng. Pat. 4418, Feb. 27, 1896.

THE improvements more particularly relate to apparatus for evaporating waste soap lyes, where during evaporation, the liquor is liable to be mechanically carried over into the condenser. To prevent this, the patentee fixes a suitable number of superposed "dash plates" in the cylindrical evaporator above the level of the liquor, each dash plate being provided with a short pipe reaching nearly to the next "dash plate," and so arranged as to give a circuitous or zigzag course to the vapours. Return pipes are fitted over each plate to return the arrested liquor to the base of the evaporator. An intermediate vessel fitted in like manner may also be employed and placed between the evaporator and condenser if desired.—O. H.

Envelope or Covering for Use in Preserving Soluble Bodies, An Improved. A. Le Chatelier, Paris, France. Eng. Pat. 7192, April 8, 1895.

THIS invention has for its object the provision of an impervious envelope for preserving from dampness blocks of salt or other soluble bodies intended for export. To effect this, the covering of the envelope is formed of a resisting fabric which has been silicated or steeped in a solution of gelatin and then treated with alum. A coat of tar or pitch, or another impervious material, is then applied over this, and outside, a covering of coarse sacking or a sheet of waterproof paper is used.—H. S.

Coal and other Minerals, Washing; also applicable for Washing or Separating Chemicals, Vegetable and other Solid or Liquid Matter; Improvements in Apparatus and Appliances for. P. Muschamp, Barnsley, and S. Burridge, Sheffield. Eng. Pat. 8526, April 30, 1895.

THE apparatus consists of an inclined rocking trough, channel, or tube, having within it a concentrically arranged spiral conveyor. The coal, &c. is preferably fed into the trough, &c. near its lower end, while a stream of water is introduced near the upper end. The conveyor revolves in

a direction against the stream of water, whereby the lighter portions of the coal, &c. are carried by the water over the blades or through their open portions to the lowest end, where they are discharged through a hopper, while the heavier portions, shale and earthy matter, are carried upwards by the conveyor and discharged from the top end of the trough. The inclination of the trough is adjustable.

—R. S.

Lifting, Forcing, Circulating, or Heating Liquids, or for Propelling Air or other Gases, Improvements in Apparatus for. W. Allman, Handsworth, and J. Millward, Birmingham. Eng. Pat. 9593, May 15, 1895.

THIS invention relates to the construction of injectors and similar appliances for forcing gaseous liquids, and consists in constructing the passages at such angles that simple removal of a cap or plug will enable the whole of the nozzles to be inspected, and the passages freed from any obstruction, without breaking any pipe connections or joints.

—O. H.

Brewers' Refuse, Grains, and the like, Improvements in or relating to Apparatus for Drying. E. Makin, Manchester. Eng. Pat. 9835, May 18, 1895.

See under XVII., page 367.

Drying by Means of Furnace Gases and Air; Improvements in Apparatus for. F. D. Cummer, Cleveland, U.S.A. Eng. Pat. 16,052, Aug. 27, 1895.

THE material to be dried, as sulphate or carbonate of soda, potters' clay, salt, lime, malt fertilisers, corn, &c., is charged into an inclined rotary cylinder having a series of openings arranged spirally, and provided with hoods over the openings on the inside. The hoods are provided with fine wire gauze or the like over their inner ends, and with flaring shields, to prevent the passage of material out of the cylinders. The gases from a furnace mix with the air which enters through openings in the floor, and is heated, in some cases, by coiled pipes through which passes the exhaust steam from the engine which rotates the cylinder. The hot mixture of air and furnace gases then passes through openings in the furnace arch, and thence into the cylinder, after leaving which the gases may at once pass to the stack. They may also be drawn up a flue, and then forced by a blower to a cylinder arranged within a dust chamber. The dust which deposits is removed by a conveyor, and the products of combustion pass to the flues.

The cylinder is arranged so that on heating or cooling it can expand or contract.

The rotating cylinder is shown in one form as being provided with longitudinal lifters for raising the material to be dried to the top of the cylinder and tossing it down again.

—R. S.

Inking Rollers, Letterpress Printers', An Improved Composition for. W. Murray and J. Speirs, Glasgow. Eng. Pat. 22,449, Nov. 25, 1895.

THE composition contains, per cwt., 71 lb. 15 oz. of glycerin, 32 lb. of gelatin, 4 lb. of glucose, 4 lb. of glue, and 1 oz. of methylated spirits. The gelatin and glue are soaked in cold water for from one to two hours, the water is then decanted, and the gelatin and glue are left to soften for from 10 to 12 hours; they are then cut into pieces and melted in a glue boiler. The glucose, glycerin, and methylated spirits are then added, and when the ingredients have been thoroughly mixed and dissolved, the composition is allowed to season for four or six hours, and then cast into the form of rollers, the pin or stock for which should be heated for the better adhesion of the composition. The rollers made in this way retain a uniform elasticity, and do not shrink; they are not affected by change of temperature.

—A. G. B.

II.—FUEL, GAS, AND LIGHT.

Petroleum Lamps, Composition of the Gaseous Mixture formed. Flashing Points of Petroleum. H. Kast and F. Rose. Dingler's Polyt. J. 300, [4].

REVIEWING the standards of flashing point established in various lands, and the opinions expressed by a number of

chemists on the subject, the authors consider that the German standard, (21° C. Abel) is too low for safety. In order to test the security afforded by the existing standard, they carried out the experiments herein recorded, the results of which confirm that opinion, and they recommend the adoption of 40° C. Abel as being the minimum limit of flashing point consistent with safety with the class of lamps now in use, and in view of the difficulties in the way of rendering compulsory the employment of lamps of an absolutely safe character.

In the first place the experiments were directed to ascertaining the composition of the gaseous mixture formed above the surface of the oil in the lamp. To approximate as closely as possible to the ordinary conditions prevailing in practice, a 14-line "Kosmos" circular burner—without burton—was fitted on a glass receiver holding about 800 c.c. and provided with a tubulure at the top for the reception of a thermometer. The consumption of the oil was read off by the aid of a graduated scale attached to the receiver, outside. The collection of the gas for examination was effected by means of a metal tube soldered over the aperture existing at the base of the burner, and forming the connection between the interior of the receiver and the outside air, the gas being expelled by the introduction of a quantity of mercury into the receiver through a second tubulure at the bottom—a method which, in conjunction with the luting of a metal cap over the wick during the removal of the gas, effectually prevented any influx of air into the mixture.

Seven different kinds of petroleum were examined, viz., three American oils flashing at 22.5° , 23.5° , and 26.5° C. respectively; two Russian oils, one being Nobel's petroleum, 30.5° C. flashing point, and the other "Kaiser" oil, flashing at 50° C.; and two Scotch oils—Petroline of 54.5° , and lighthouse oil of 66.5° flashing point. Samples of the gas in the receiver were taken after 200, 400, 600, and 800 c.c. of the oil had been consumed—fresh oil being used in each case—and tested for explosibility as well as constitution, the temperature of the oil and vapour being also recorded.

The authors find that the inflammable constituents of the vapour consist solely of unsaturated hydrocarbons, all the saturated hydrocarbons capable of forming gas at lamp temperature having apparently been driven off in the distillation of the oil. The actual volume of the hydrocarbons present in the vapour is small, averaging between 1.4 and 1.8 per cent. in the case of American oils, 1.4 from Russian petroleum, 0.4 to 0.6 from the "Kaiser" oil, and 0.2 to 0.4 per cent. with the Scotch oils; or varying in inverse ratio to the flashing point. The absence of any inflammable gases other than those capable of absorption by bromine was proved by direct experiment. A small amount of carbon dioxide (about 0.3—0.4 per cent.) was also discovered and its presence ascertained to be due to oxidation, since pure air passed through glass wool moistened with petroleum caused a precipitate with barium oxide solution.

With regard to the temperature attained by the oil and vapour in the lamp, the highest points (34° and 37.5°) were reached by the American oil flashing at 22.5° , with a room temperature of 21° C. With a room temperature of 17° the American oils became heated to 27° — 32° , the "Kaiser" oil to 26° , and the Scotch oils to 27° — 29° , so that there is very little difference in their behaviour in this respect. When, however, the matter is viewed in relation to the flashing point, it becomes apparent that the heat attained by the American oil flashing at 22.5° is 11.5° above the flashing point, whereas, in the case of the oil of 26.5° flash, this overheating no longer occurs, and the higher flashing oils do not attain the temperature at which sufficient vapour to give a flash in the Abel tester is evolved.

The temperature of the vapour was found to exceed that of the oil by from 2.5° to 6.5° C., the average being about 4 — 5° C. Further examination showed that the upper layers of both vapour and oil reached somewhat higher temperatures than were attained by the middle and lower layers, the difference between the extremes being from 2° to 3° C. It was also ascertained that the percentage of hydrocarbons in the gaseous mixture was greatest in the upper layers, a circumstance probably referable to the

increased volatilisation of the oil adherent to the walls of the receiver adjacent to the burner.

A special series of tests with modern burners of large size and metal receivers showed that the oil is heated to a greater extent under these circumstances, the temperatures attained (room heat 21° C.) ranging from 32° (15-line "Sun" burner) to 42.5° (16-line "Central Vulcan" burner). With the great 30-line "Doppel Blitz" burner, giving a light of 77 candle-power (or three times that from the "Sun" burner), the temperature did not exceed 38.5° C.

The explosibility of the vapour was tested in a Hempel pipette by sparking from a powerful induction coil. A powerful explosion was occasioned by the vapour from the American oil flashing at 22.5° , particularly at 34° , or 11.5° above the flashing point, and when 800 c.c. of the oil had been consumed. Similarly, as regards this latter condition, an explosion of some violence occurred with the oil flashing at 26.5° , the temperature having reached 31° , but with the oil of 23.5° flash no explosion took place, although the percentage of hydrocarbons in the vapour amounted to 2.1, as compared with 1.8 per cent. in the other instances cited. This failure is considered to be probably due to some defect in the apparatus or performance of the test.

The authors are of opinion that the circumstances under which these experiments were made were less favourable for the production of explosions than the conditions actually obtaining in lamps, some reduction of temperature having ensued on the compression of the vapour in the pipette; and they believe that, where higher temperatures prevail in lamps, there is a probability that explosions of sufficient violence to shatter a glass receiver may occur. When radiation was checked by surrounding the lamp with a shield, the temperature (that of the room being 21°) of the oil rose to 38° and that of the vapour to 41° , the amount of hydrocarbons therein increasing concurrently to 2.2 per cent. Sparking with the induction coil produced a powerful explosion.

In order to ascertain the lamp temperature necessary with different oils, for the production of an explosion, a lamp receiver filled with oil was heated on a water-bath, and by the aid of a ring burner over the mouth of the receiver, the mouth being corked, but provision made for access of air, and also for replenishing the oil as fast as it would under ordinary circumstances be consumed. The American oil flashing at 24° gave an inflammable mixture of vapour (containing 1.6 per cent. of hydrocarbons) when the upper layer of the oil indicated 30° — 35° , and an explosive one at 35° — 40° (2.2 per cent. of hydrocarbons). With the oil flashing at 26.5° the temperature reached 35° — 40° before the gas (1.5 per cent. of hydrocarbons) ignited, and 45° to 50° (hydrocarbon percentage 2.0) for the explosion. In the case of Nobel's petroleum (30.5° flash) the results were similar, save that the explosion temperature lay between 50° and 55° , but the Kaiser oil gave off only 1 per cent. of hydrocarbons in the gas, even when heated to 95° , and neither ignition nor explosion could be induced.

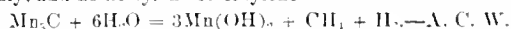
The fact that lamp explosions are less frequent than might be supposed, is considered due to the gradual escape of the vapours and their dilution by the air current to below the explosion limit. Attempts made to ignite the vapour by means of burning fragments of wick dropped over the aperture in the base of the burner, or by lighting the accumulated scrapings lying there, failed, although when a light was inserted into the receiver an explosive ignition was produced. On the other hand, explosions were easily caused, both with the American and Russian petroleum, at 28° to 32° , when wicks too small to fill the duct were used, the intensity being in inverse proportion to the height of the flashing point. The explosion began by a flickering of the flame, succeeded by several slight explosions in the duct, and finally extended to the vapour in the receiver, the shock extinguishing the flame. It is however, admitted that authentic lamp explosions are of comparatively rare occurrence, although accidents resulting from the careless handling of oil are frequent enough. The German statistics cited (1888 to 1890) show that the fires occasioned by petroleum, amount to an average of only 1.53 per cent. of the total fires from all causes, and in those for London,

90 out of 448 petroleum fires in 1894 were ascribed to lamp explosions, the remaining 337 being occasioned by the overturning of lamps.—C. S.

Manganese Carbide. H. Moissan. *Comptes rend.* 1896, 122, 421.

This compound, Mn_3C , made by Troost and Hautefeuille in the wind furnace, is now prepared by heating a mixture of Mn_2O_3 and sugar charcoal in a carbon tube closed at one end, placed in the electric furnace. With a current of 350 amperes and 50 volts the operation lasts five minutes, with 900 amperes and 50 volts the reduction is almost instantaneous.

The carbide has the density 6.89; fluorine attacks it in the cold, producing a violet-coloured fluoride; the action of chlorine commences at a somewhat high temperature, but as soon as the incandescence begins it continues unaided. Gently heated, it burns in oxygen, nitrous and nitric oxides. Ammonia reacts at a dull red heat with production of a nitride and evolution of hydrogen; dilute hydrochloric acid produces liquid hydrocarbons; gaseous hydrochloric acid below a red heat gives manganous chloride and hydrogen mixed with a small quantity of hydrocarbons. The action of water on the carbide is to produce a mixture of equal volumes of methane and hydrogen only, and no acetylene or ethylene—



Flames, On the Temperature of Certain. W. N. Hartley. *Proc. Chem. Soc.* 1896, [164], 98.

THE author measured the temperature of flames by means of gold-leaf and with fine wires of platinum $\frac{1}{10000}$ in. diameter, such as were drawn by Wollaston and used by Faraday, also with pure platinum wire $\frac{1}{10000}$ in. thick. He furnishes evidence of the high temperature of a candle flame, not only from the melting of gold and of platinum in the flame, but by an examination of the spectrum to be seen in the mantle. Experiments made with platinum wires heated in a bat's-wing gas flame are described, which proved that the carbon does not lower the melting point of the platinum, at any rate in any appreciable degree. A small carbon monoxide flame melts platinum wire $\frac{1}{10000}$ in. in thickness, and a cyanogen flame was shown to be intensely hot, for it melted such wire with extreme ease. The author believes that his experiments have dissipated the doubt that was cast on Prof. Smithells' statement of the high temperature of the mantle of the Bunsen flame, and confirm his own estimate of the high temperature of the Bessemer flame (this Journal, 1895, 1037).

Spirit, Incandescent, and Petroleum Lamp: A Comparison of the Illuminating Powers of the. Hayduck. *Zeits. für Spiritusind.* 1896, 80—81.

THE spirit incandescent-lamp consists of three parts: the vaporiser, the burner, and the mantle. The latter is similar to those in use with gas-burners. A spirit (alcohol) of fair strength must be used, which is vaporised and then burnt. By the flame thus produced the mantle is raised to incandescence. The author has compared the cost of lighting with this lamp and with a petroleum lamp producing the same amount of light, and finds that it is from 12 to 33 per cent. cheaper.—A. L. S.

Acetylene, Commercial Value of. Engineer, 1896, 81, 417. ONE kilo. of calcium carbide and 500 grms. of water will produce 300 litres of acetylene gas, and this, it is stated, will provide a light equal to 15 ordinary gas jets for 6 hours. The burner used has a smaller orifice than an ordinary burner. In France, acetylene is now produced on something like a commercial scale, and its cost can therefore be compared with that of ordinary gas. The price of coal gas per carcel hour is one centime, while acetylene gas costs 3.2 centimes; but acetylene being much more powerful, the cost works out in practice to about the same as that of coal gas.

Acetylene gives off very little heat in burning, and thus cannot well be employed for heating purposes and for driving motors.

Acetylene producers are now being supplied by a company in Paris at the price of 6*l.*; they have a capacity of 1 kilo. of calcium carbide, and will provide a light equal to 10 ordinary gas burners for 6 hours.

A large number of works are now being built on the Continent for producing calcium carbide, and when in full operation, the present price of 70 centimes to 1 franc per kilo. of carbide is expected to fall to 50 centimes. It is possible now to obtain large supplies of carbide at a lower price than that quoted, but it is of very inferior quality, producing only 150 litres of acetylene per kilo. instead of 300 litres.—A. S.

Light-Standard, Acetylene. J. Violle. *Comptes rend.* 122, (1896), 79—80.

THE acetylene flows into a conical chamber, carrying with it the air necessary for its combustion, then enters a narrow tube in which the mixture takes place, and issues through a steatite burner, which gives a large flat flame. The whole of the flame may be employed, or a sharply limited portion of it. In the standard pattern the flame is enclosed in a kind of box, one face of which carries an iris diaphragm so constructed that any required candle power can be used and read off. Under a pressure of 0.3 m. the whole flame has a candle-power somewhat greater than 100, the amount of acetylene consumed being 58 litres per hour. Thus the illuminating power of acetylene is more than 20 times that of coal gas burned in a Benger burner (giving 1 carcel = 9.6 candles per 105 litres), and at least six times that of coal gas in an Auer burner (giving 1 carcel per 30 litres). The spectro-photometer shows that throughout the spectrum from C to F the light given by the acetylene differs but slightly from that emitted by fused platinum, with reference to which the absolute unit is defined.—D. E. J.

Coal in Kent. Ironmonger, May 2, 1896, 171.

AFTER some years of patient investigation, the making of various trials, and the expenditure of a good deal of money, it has been established that coal exists in workable seams in the vicinity of Dover. The seams are deep, and some of them are not very thick, but they are said to be worth working, and accordingly they are to be developed forthwith. The Kent Coalfields Syndicate has been formed to work the pits, has bought some 575 acres of land with the minerals thereunder, and has arranged for the sinking of two pits, capable of raising some 2,500 tons of coal daily. The seams are stated to be as follows:—

1,229 ft. deep.....	2-ft. seam.
1,279 ft. "	2-ft. " "
1,456 ft. "	2-ft. 6-in. seam.
1,570 ft. "	2-ft. 3-in. " "
1,763 ft. "	2-ft. 9-in. " "
1,831 ft. "	1-ft. 8-in. " "
2,177 ft. "	4-ft. seam.

Of these, two are said to yield good, bright house-coal, and the thick seam a good bituminous quality. It is estimated by the syndicate that the coal can be put into railway trucks at 6*s.* to 6*s.* 6*d.* per ton, and the full output can be readily absorbed within an area from the pits covered by a 2*s.* 6*d.* per ton railway rate. At present good house or gas coal realises 14*s.* per ton and upwards, even when seaborne, so that if the figures are correct, there should be good profit on the working of the pits. The opening of collieries in Kent will not improve the district from a tourist or artistic point of view, but that will not count for much if the mines can be run at a profit. It would be odd if the whirligig of time, as thus evinced, should lead to a revival of the long disused Sussex iron trade. If there is coal in the locality, even that would not be impossible.

PATENTS.

Electrodes [for Heating Purposes], Improvements in the Construction of. A. B. Woakes, London. Eng. Pat. 23,637, Dec. 6, 1894.

THE inventor has worked out some calculations relative to the action and efficiency of electricity as a heating, cooking, and sterilising agent. He deals with his subject under

such heads as Electrodes; Circulation of Water in Electrodes; Resistance of Water Diminishes with Increase of Heat; Glass Water Boiler; Action on Impurities in Water; Latent Heat of Electrolysis; Efficiency of Water Boilers; Calculations for Electric Egg-Boiler, &c. His claims are for the construction of platinum-foil electrodes stiffened or supported by vitreous enamel, or toughened glass, or plates of china; supporting sheets of platinum-foil between perforated china plates, or plates of celluloid or ebonite; and for other apparatus described in drawings, of which there are seven sheets. Eng. Pats. 259 of 1892 and 11,749 of 1893 are referred to.—J. C. R.

Vapour from Oils and Hydrocarbons [Oil - Vapour Lamps]. Improvements in and connected with Apparatus for Automatically Producing and Simultaneously Burning. R. A. Poirimol, Paris. Eng. Pat. 6245, March 26, 1895.

The oil is contained in an annular receiver surrounding the chimney, and is fed by capillary attraction through tubes filled with a suitable spongy material into a vaporising chamber, the latter being situated immediately over the flame. The vapour issuing from it under pressure, mixes with air automatically drawn into the burner. The latter is of ring-form, the flame passing outwards and upwards through a central chimney.—R. B. P.

Gas-Burners, Incandescent; Improvements in. A. Besson, Paris. Eng. Pat. 6690, April 1, 1895.

The Bunsen burner has adjustable gas- and air-inlets, and at its upper end is provided with a combustion chamber containing an inverted cone which deflects the mixture of air and gas outwards. The combustion chamber also contains a strip of sheet metal, bent into a star-shape, which acts as a recuperator. Fitting over the outside of the combustion chamber is a collar with two lugs on it, into which fit the legs of a U-shaped rod, supporting the mantle. —R. B. P.

Gas-Burners, Incandescent; Improvements in. D. W. Sugg, London, London. Eng. Pat. 6870, April 3, 1895.

The essential features of this burner are (1) the use of an open-topped mantle, (2) the supply of an independent draught of air to the Bunsen flame, (3) an automatic disc valve in conjunction with the pilot flame. (1) and (2) promote more nearly perfect combustion, thereby preventing the deposition of carbon on the upper part of the mantle, and also prevent the flame being deflected through the mantle on to the glass chimney and cracking it.

The object of (3) is to enable a single tap to be used with a pilot flame.

The tap is provided with a second, removable stop-pin, which, when in position, prevents the tap being quite closed, so that a quantity of gas sufficient for the pilot flame, but insufficient to lift the disc valve, through which the main flame of the burner is fed, is allowed to pass.—R. B. P.

Gas Apparatus [Incandescent] for obtaining Light and Heat, Improvements in. J. W. Mackenzie, London. From F. de Mare, Paris. Eng. Pat. 7481, April 11, 1895.

A BUNSEN burner giving a flat vertical flame in which is suspended a hanging fringe of refractory threads capable of incandescing.—R. B. P.

Gas Lamps, Incandescent; Mantles, Improvements in the Manufacture of, or Luminous Bodies for, and in Compounds for Use in such Manufacture. H. Reeser, Amsterdam, Netherlands. Eng. Pat. 10,129, May 22, 1895.

The following ingredients are taken in about the proportions named: 3 to 4 parts by weight of boron nitride, 25 to 30 of thallium nitrate, 2 to 3 of titanium nitrate, 2 to 3 of samarium nitrate, 2 to 3 of neodymium nitrate, and 3 to 4 parts of magnesium nitrate. The nitrates are dissolved together in water to form a concentrated solution and the boron nitride, dissolved in heated nitric acid, is, after

filtration, added thereto. The usual cotton fabric is then used for dipping, drying, and igniting in the ordinary way. A more intense light is said to be obtained with the mixture of oxides so produced.—A. W.

Mantles, Improvements in, for Incandescent Light. S. H. Crocker, London. Eng. Pat. 19,202, Oct. 12, 1895.

To the nitrate or other salt of thorium hitherto used is added about 1 or 2 per cent. of the corresponding salt of ytterbium, scandium, or thulium, or a mixture of two or more of these substances. The mantle is made in the usual way, and is stated to be flexible and capable of giving an improved light.—A. W.

Mantles (Glow Bodies) for Incandescent Gas Lighting. C. Kortwich, Berlin, Germany. Eng. Pat. 2000, Jan. 28, 1896.

Boron, arsenic, or antimony, or any salt thereof in small quantity, is included in the mixture for producing the mantle, which is thus rendered less liable to fracture, by being more cohesive and less sensitive to atmospheric dust. The following mixture is given as an example, the chloride of antimony therein forming with the earthy bases, on ignition, a small quantity of antimonate of high basicity, which renders the mantle more cohesive without lowering its melting point.—Thorium nitrate, 22.25 parts; lanthanum nitrate, 2.75; cerium nitrate, 1.50; yttrium nitrate, 0.35; chloride of antimony, 0.75; zircon nitrate, 2.00; pyrotartaric acid, 2.00; and water, 70.00 parts.—A. W.

Lamp, An Improved Incandescent Oil- or Spirit- H. Hempel, Berlin, Germany. Eng. Pat. 2576, Feb. 4, 1896.

This patent is for a lamp in which the spirit is burnt as such in direct contact with a mantle instead of being previously gasified. The wick is a circular one, and round its upper end is a metal ring or collar on which the mantle mainly rests. Inside the mantle is a perforated cylinder, closed at the top, and of smaller diameter than the wick, through which the air is supplied. The device is so arranged that in lifting the chimney and upper part of the burner to light the wick, the mantle with the ring on which it rests is also raised. The air enters through the perforations at right angles to the inside of the flame and forces it into the mantle, which is thereby rendered luminous.—A. W.

Hydrocarbons, Heavy; Improvements in Apparatus for Treating by Means of Heat, especially applicable for Distillation and the Manufacture of Oil Gas. S. Pitt, Sutton, Surrey. From La Société Internationale des Procédés Adolphe Seigle of Levallois Perret, Seine, France. Eng. Pat. 23,235, Dec. 4, 1895.

The apparatus is characterised:—(1.) "By the use of a bath of lead heated in any suitable manner, its object being to maintain the apparatus at as constant a temperature as possible." (2.) "By the separation of the apparatus into elements of two kinds, namely, elements vaporising by circulation and elements for treating, by means of heat, the vapours generated by the first." (3.) "By a specially constructed apparatus, having for its object both to permit the unequally liquefiable vapours to be collected at different levels, to separate by condensation the vapours not yet sufficiently heated, and to progressively heat the heavy hydrocarbon to be treated, which does not enter the vaporising elements, and the apparatus for treatment with heat until it (the heavy hydrocarbon) has fallen in thin streams in a contrary direction to the ascending vapours and has been charged with those vapours, which should be returned to the heating apparatus." (4.) "By an automatic arrangement for regulating the temperature of the metallic bath by means of a pyrometer acting upon the delivery mechanism of the gasifier of the heavy hydrocarbons serving as fuel." The heating elements are grouped in batteries, that is to say, the vapours are led out separately from them into a single collector, whilst the vaporising elements, each of which is fed separately, are grouped in series, the heavy hydrocarbon being made to successively traverse the vaporisers before

entering the apparatus for treatment by heat. The heating elements are filled with such material as iron chips or pumice stone. In its passage the hydrocarbon deposits tar in the heating elements, which must be removed from time to time.—D. B.

Gases, Washing; Improvements in Apparatus for. P. F. Holmes, Huddersfield. Eng. Pat. 5113, March 11, 1895.

See under 1, page 340.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum Deposit in the Kouban Province of the Caucasus. H. H. Nidenführ. Chem. Zeit. 1896, 20, 69–70.

THE Kouban petroleum zone, which has hitherto, it is said, suffered neglect, is about 220 versts in length, extending from the Black Sea, near Anapa, in a northerly direction to the German colony Michael'sfeld, and from there to the White River and to Maikop. At many points the oil is brought to the surface by the mountain streams, especially in the neighbourhood of the Kouban River and its tributaries. In spite of the extent of this district, its industrial importance is limited to the Ilin district, which is seven versts from Ilinskaja on the Vladikavkas Railway. The naphtha-bearing strata consist of soft, gritty, argillaceous deposits of the lower tertiary period, and of the ejections of the mud volcanoes, but the distribution of the petroleum in them is very irregular. The oil varies in colour from light green to colourless; its sp. gr. is 0.755–0.815, and it yields 80 per cent. of illuminating oil. In the Ilin district, which is worked by a French company, there were 100 derricks in 1893. The uppermost oil-bearing stratum consists of magnesians limestone, containing petroleum, and water tainted with hydrogen sulphide. The specific gravity of the oil varies between 0.920 and 0.990, and the thickness of the oil-bearing dolomite is 60–80 ft., the upper portion being richest in oil. Beneath the dolomite are two more zones bearing light oil, both consisting of sandstone, the lower one being of considerable magnitude. The heavy oil of the upper strata is reached at a depth of 300–350 ft., and yields on distillation about 13–17 per cent. of inferior illuminating oil. Petroleum is also found in the valley of the Kudako River, 17 versts from Krimskaja. A well which in 1886 was sunk here to a depth of 120 ft., yielded at first 1,500 poods daily, and on increasing the depth to 183 ft., this rose to 3,000 poods. The depth was subsequently increased to 225 ft., and during two months the daily yield then rose to 5,000 poods of oil of sp. gr. 0.865. The seven wells which were working in 1890 only yielded 38,568 poods of crude oil in the year. The Kulako petroleum gives 10–12 per cent. of benzine, 6 per cent. of gasoline, and 33–37.5 per cent. of illuminating oil.

—A. K. M.

Galician Petroleum in Germany. Board of Trade Journal, May 1896, 597.

Kuklow's states that Galician oil has now begun to compete with the American product in Germany. (See this Journal, 1895, 698.) For the first time the export of refined petroleum from Austria-Hungary to Germany has been made possible by the decline in the price of the Galician crude oil, caused by the greatly increased production in that country. The price of Galician crude was formerly 4 florins, but since the opening up of the great wells at Schodnica it has fallen below 2 florins. This made it possible to produce refined petroleum at a figure which allowed an export to Germany. In fact, several refineries, especially that at Pardubitz, Bohemia, have commenced to compete with the American petroleum in the German market, and large quantities of refined oil have been exported already to Germany, mostly to Bavaria and Saxony. The Austrian railroads are assisting the refiners in their export trade by reducing the freight rates. Since 1st November a specially reduced freight tariff for refined petroleum and crude benzine has been in force for the export to Bavaria. The export of crude oil to Germany is

impossible at present, because the German import duty is the same on crude as on refined petroleum, namely, 6 marks (6s.). But as in Germany the desire becomes steadily stronger to supply the home demand by home production, that is refining, and to renounce the American oil, it may be possible that the import duty on crude will be reduced so as to allow the export of Austrian (Galician) crude oil to Germany.

Petroleum, Valuation of. K. Charitschkow. Jour. Russ. Phys. Chem. Ges. 1895, 1, 196.

POZILITZIN and Bernstein have stated that a sample of petroleum from Tschengelek contains 43.8 per cent. of kerosene. This statement is apparently founded on observations of the quantity of oil distilling between 150° and 300° C. The author contends that an upper limit of 270° C. should be adopted, and he further points out that a single distillation is inadequate, it being necessary to collect first the fraction passing over between 140° and 270° C., and then to distil this fraction between 150° and 270° C. Concordance between laboratory experiments and manufacturing results can only be obtained by conducting the distillation in a current of superheated steam or under diminished pressure. It is generally true that all varieties of petroleum begin to decompose between 250° and 275° C., and there is no reason to suppose that the particular sample now in question is an exception to this rule.—B. B.

Petroleum, Effect of Sunlight on the Oil, and on its Capacity for absorbing Air. R. A. Ostrejko. Trudy bak. otd. imp. russk. techn. obschtsch. 10, [4], 19.

THE experience of the author with regard to the acid process in refining, leads him to conclusions contrary to those expressed by Charitschkow (this Journal, 1896, 24), oil refined in this manner having a more agreeable odour, and being less inclined to become cloudy, absorb air, and oxidise, than when the alkali method alone is practised. This is due to the removal by the acid of the substances from which the petroleum acids are formed. More exact experiments show that well-refined oil on exposure to the air becomes at first lighter in colour, up to a certain limit, after which point it begins to darken again, the extent of the initial transformation being in one sample of Russian oil examined, 18 mm. in $\frac{3}{4}$ hour (measured by Stammer's colorimeter). Further tests were made with Baku oils examined at intervals, and stored in the dark, when the colour (initially 12 mm.) registered 152 mm. The next day, the register was 115 mm., and receded to 106 mm. in another 24 hours, although protected from all light. Air was found to be absorbed throughout the whole period. Sun-bleaching is therefore an unsuitable process for Baku oils.

The influence of various shades of glass on the alteration of the colour of the oil was also studied. Starting with an initial colour degree of 115 mm. Stammer, it was found that the maximum decoloration was reached between 3 and 9 hours, after which darkening set in, with the following comparative results as to the colour at the end of 43 days' exposure:—

	Deep Orange.	Orange Yellow.	Green.
Colour in mm. Stammer	Mm. 75	Mm. 26	Mm. 21
Acidity	0.06	0.33	0.45
	Pale Green.	Blue.	Colourless Glass.
Colour in mm. Stammer	Mm. 9	Mm. 7	Mm. 6
Acidity	1.71	2.7	3.6

the initial acidity having been in each case 0.03.

With regard to the absorption of air by crude and refined petroleum (this Journal, 1896, 26), oil of sp. gr. 0.855 at 28° C. from a well at Balakhany, absorbed air

rapidly at first, and in 10 days, the whole of the air in the eudiometer tube employed for the experiments. The decreased absorption in the later stages being probably due to the presence of gaseous hydrocarbons or water vapour in the testing vessel, the experiment was repeated with oil previously heated to 110° and filtered, as well as with cylinder oil distillate, machine oil distillate, spindle oil distillate, and residuum, with the result that in the case of the first-named oil, the time required for absorption was reduced to 4 days, the spindle oil required 10 days, and the remaining qualities much longer.—C. S.

Benzene, Preparation of, from Petroleum and Residuum.

A. Nikoforow. Chem. Zeit. 20, 8—9.

In this process the material employed is twice subjected to decomposition, the first time at about 525°—550° in cast-iron retorts, under ordinary conditions of pressure. The heating arrangement is such that the receiver is kept at about 200°, so that only the distillates boiling above that temperature are collected there, the lighter fractions (sp. gr. 0.800—0.810) being condensed in a worm and redistilled, and the uncondensed gases passing into a gasometer. In the second distillation, which is carried on in an upright still with small dephlegmator, the fractions are divided into those boiling at 100°, 130°, 160°, 180°, and 200°, each of which is again decomposed in retorts similar to those employed in the Pintsch process for making oil gas, the lightest at about 700° and the heaviest at 1,200°, under a pressure of 2 atmospheres. The temperature in the receiver is maintained at 150°—200°, so that only the heavier portions of the aromatic tar are retained. The lighter distillates are condensed, and contain 30 to 35 per cent. of benzene. In order to obtain fractions with a smaller range of boiling point, these are united with the contents of the receiver and redistilled. The resulting fraction passing over at 120° constitutes the crude benzene, whilst those between 160° and 200° are returned to the second decomposing still, and the fractions of higher boiling point are employed for the production of naphthalene, anthracene, &c. The heavy distillates from the initial stage can also be re-decomposed for benzene, but require a much higher temperature than the lighter fractions, and yield less benzene, the production of carbon being greater. The total yield of benzene obtainable by the process is about 12 per cent. of the weight of the original oil.—C. S.

Petroleum and Bitumen, Preparation of Solid Resins and Aromatic Hydrocarbons from. A. W. Adiasiewitsch. Zap. imp. russk. techn. obschtsch. 29, 93.

Thick resins have been prepared from lubricating oil residuum in Baku for the English market since 1891, by driving off the more volatile portion of the residuum at about 400°, either by direct fire or superheated steam. This method yielded a large percentage of coke, and quickly corroded the plant, besides giving rather unsatisfactory products, those from the steam process containing much paraffin and being difficult to refine, whilst dry distillation resulted in readily decomposable products of no practical value.

The yield being low and the product little adapted to replace asphalt, by reason of its deficient elasticity and viscosity, the author has elaborated a process which is carried out at between 150° and 200° in an ordinary still by means of a blast of de-oxygenated air with the simultaneous discharge of electricity. Treated in this manner, a residuum of sp. gr. 0.930, acquired in 3 hours a density of 1, with an increased flashing point, and on continuing the process for 10 hours the product, amounting to 75 per cent., had a specific gravity of 1.06. This and the intermediate products obtained by curtailing the process, are very viscid and completely soluble in petroleum spirit and turpentine.

The absence of distillation products indicates that the thickening of the oil must be due to chemical change. When treated in the usual manner for the preparation of aromatic hydrocarbons, a larger proportion of anthracene and benzene is obtained from this resin than from ordinary heavy-oil residuum, which points to the elimination of hydrogen during the formation of the resin.

Experimenting with a natural asphalt consisting of 83 per cent. of sand and 17 per cent. of bitumen soluble in carbon bisulphide, it was found that the only methods of treatment whereby the natural elasticity of the bitumen remained unimpaired, were, distilling with superheated steam and the de-oxygenated air blast. The specific gravity of the distillates increased from 0.936 to 0.972, the consistency varying in proportion. When refined they corresponded to the Baku lubricating oils. The residue, amounting to 50—75 per cent., yielded products varying with the duration of the treatment, 12 hours' distillation leaving a fluid tar, and 20 hours a solid residue.

With the new air process from 4 to 10 hours is sufficient. Only half the usual amount of fuel is necessary; there is no distillate, the evolved gases being permanent and incombustible, but the yield of resinous products amounts to 85—95 per cent. and the resins retain their natural viscosity, the more solid bodies being elastic. There are four products, exhibiting the following characteristics:—

	Yield.		Specific Gravity.	Flashing Point.	Burning Point.
	Steam Distillation.	New Process.			
No. 1. Fluid	80	95	1.005	202°	295°
No. 2. Soft	70	90	1.02	227	256
No. 3. Semi-solid.	60	85	1.04	254	271
No. 4. Solid.	50	80	1.06	276	302

All are soluble in petroleum distillates, ethyl ether, carbon bisulphide, turpentine (30 per cent. of No. 4), and benzene, but insoluble in ethyl alcohol, and can be precipitated thereby from ethereal solution. They part readily with hydrogen, and the No. 4, warmed with sulphur, gives off hydrogen sulphide, leaving residual carbon.

With sulphuric acid in the warm, sulphur dioxide is evolved and carbon left, the ash in both instances containing potassium ferrieyanide, but powerful oxidising agents like chromic and manganic acid and chlorine have no effect even at the boiling temperature.

For industrial purposes the resins have many applications. The No. 4 is used for making asphalt lac by boiling 10 parts along with 12 parts of varnish, and 50 parts of a solvent (turpentine or petroleum spirit) with a little white lead (see this Journal, 1896, 267). Mixed with a solid body and treated with sulphur while being passed through rollers and then vulcanised, the same resin gives a product resembling ebonite. These resins can be incorporated with caoutchouc in large proportion without affecting its quality, and they are all suitable for preserving wood and as material for the manufacture of anthracene and benzene.

—C. S.

Charcoal, Methyl Alcohol, and Acetic Acid, Quantities yielded by Different Species of Wood. E. Barillot. Comptes rend. 1896, 122, 469.

The following are the results of experimental trials in the laboratory:—

About $\frac{1}{2}$ cb. metre of the wood was placed in a small retort and subjected to heat, the gases evolved being aspirated through a condenser and washing tower. The distillation was conducted very slowly and regularly, and the quantities obtained are to be regarded as the highest possible.

After addition of lime to the distillate the alcohol was driven off, again distilled after acidification with sulphuric acid, and finally rectified over excess of lime with a Le Bel-Henninger column or other similar apparatus. The density of the alcohol so obtained, containing acetone and ethers, was found by the alcoholometer, and calculated to pure methyl alcohol. The total acidity of the distillate was determined and calculated as acetic acid.

The following table gives the amounts of charcoal and acetic acid in kilos. and the alcohol in litres obtained from 100 kilos. of wood:—

Species of Wood.	Pollard Oak. Elm. Beech. ½ each.	Birch. Willow. Aspen. ½ each.	Old Oak.	Aspen. Willow. ½ each.	Dry Oak. Split.	"Moulée."		Beech.		Elm.		Oak. Saw- dust.	Oak. Saw- mill Waste.
						Round.	Split.	Round.	Split.	Round.	Split.		
Acetic acid	5.90	4.34	3.75	4.42	3.72	6.40	6.15	4.18	5.71	5.00	6.24	1.31	4.31
Methyl alcohol	2.15	1.50	1.46	1.69	1.37	1.95	1.95	1.39	1.76	1.41	1.38	0.38	0.93
Charcoal	23.00	22.00	24.00	22.00	22.50	26.00	26.00	23.00	24.39	24.50	25.00	20.00	24.00

—A. C. W.

Wood, The Products of the Distillation of (Industrial Experiments). E. Barillot. Comptes rend. 1896, 122, 735.

These experiments, on an industrial scale, were made in retorts of 4½ e.m. capacity. The same woods were used as those employed in the laboratory experiments described in preceding abstract. The delivery of the jets of the distillate as it came over was indicated every 15 seconds in cubic centimetres, and frequent examination of the acidity was made, especially each hour. The acetic acid was converted into calcium acetate. The following table gives the details of the distillation from hour to hour:—

Hours of Distilla- tion.	Distillate, c.c.'s per 15 Seconds.	Acetic Acid.	Hours of Distilla- tion.	Distillate, c.c.'s per 15 Seconds.	Acetic Acid.
		Per Cent.			Per Cent.
1	250	0	8	300	17.0
2	200	3.5	9	350	16.0
3	220	5.0	10	300	15.0
4	300	11.0	11	250	13.0
5	375	13.0	12	250	12.0
6	340	13.0	13	300	10.0
7	300	15.0	14	0	0

REMARKS.—Wood distilled, beech, 1,560 kilos. Coal used, 300 kilos. Crude pyroigneous liquid obtained, 795 litres.

Nature of Wood.	Weight of Wood.	Products obtained.		Products obtained per Cent. of Wood.		Remarks.
		Methyl Alcohol.	Calcium Acetate.	Methyl Alcohol.	Calcium Acetate.	
	Kilos.	Litres.	Kilos.			
Small pieces, entire	1,400	16	116	1.14	8.29	Green wood, eight months cut, small, and in poor con- dition.
Two-thirds grey wood, one-third barked ..	1,600	21	143	1.39	11.59	
Barked	1,800	26	197	1.44	11.10	
Hornbeam logs	1,750	24	211	1.57	12.00	Of good quality and well dried.
Split oak (measured)	1,840	30	195	1.60	10.60	
Beech, split large	1,800	33	198	1.80	11.60	Saw-mill waste.
Oak waste, dry	1,900	16	163	0.84	8.50	

This second table shows the actual quantities of methyl alcohol and calcium acetate obtained, the latter after drying.

These results confirm those obtained in the laboratory, described in the preceding abstract. But the final production of calcium acetate, after drying and baking, does not vary in accordance with the yield stated as acetic acid, the difference being due to variation in the nature of the acids yielded by the different sorts of wood.—E. S.

Pyroigneous Products. The Determination of the Acidity of. Note by Scheurer-Kestner. Comptes rend. 1896, 10, 619.

See under XXIII., page 384.

Acetone, Improvements in Processes of and Apparatus for making Pure. O. Porch, New York, U.S.A. Eng. Pat. 5255, March 12, 1895.

See under XX., page 374.

Paraffin and Mineral Oil Manufacture, The Gases and Effluents from, Viewed from a Hygienic Standpoint. Chem. Zeit. 29, 2251.

See under XVIII. B., page 368.

Petroleum, Sulphur in. C. Engler. Chem. Zeit. 1896, 20, 197.

See under XXIII., page 383.

Petroleum, Estimating Sulphur in Burning Oil. R. Kissling. Chem. Zeit. 20, 199.

See under XXIII., page 384.

Anthracene Testing, Improved Method of. H. Basset. Chem. News, 73, 178.

See under XXIII., page 385.

PATENTS.

Kerosene Shale, Improvements in the Treatment of, for the Production of Hydrocarbons and other Products therefrom. C. H. McEuen, London. From J. C. Alexander

and R. C. Beveridge, Sydney, New South Wales. Eng. Pat. 14,617, August 1, 1895.

It has been found that the temperature necessary for the distillation of shale and the generation of the hydrocarbons produced may be attained with great certainty by the employment of a molten metal bath, either lead, zinc, tin, or the like. For carrying out the improved method, different modifications of known means may be employed, by which the shale may be brought in contact with the source of heat required to liberate the desired product. For instance, by means of mechanical conveyors the shale may be passed over, through, or along the molten metal, whilst the products are collected by an air-tight covering placed over the conveyor.—D. B.

Wood, Wood-Waste, and the like, Improvements in and Apparatus for the Dry Distillation of. A. Schmidt, Cassel, Germany. Eng. Pat. 4598, Feb. 29, 1896.

The method consists in blowing, through an injector, heated air at a suitable point, into the discharge pipe of the distilling retort, in order to draw the products of distillation out of the retort immediately they are formed, and to carry them at once into the condenser. By this means a greater yield of products, especially acetic acid, is obtained.—D. B.

ERRATUM.

This Journal, 1896, page 106, col. 2. Line 7 above Table, for "ton" read "1,000 lb." In Table, heading of last column, for "ton" read "1,000." On page 107, col. 1; last line and line 4 from bottom respectively, for "ton" read "1,000 lb."

IV.—COLOURING MATTERS AND DYES.

Coal-Tar Colour Industry, The Recent Aims of the. L. Gans. Chem. Zeit. 20, 53–54.

THE more recent aims of the coal-tar colour industry have been to supplant dyewoods and dyewood extracts by artificial products. To supersede dyewoods, the author regards of even greater importance than to find substitutes for indigo, inasmuch as better products may be, and in many respects already have been found for the former, whereas indigo cannot be replaced. It is in the azo-dyes

that the author sees promise of ultimate success in supplanting the dyewoods as completely as artificial alizarin has supplanted madder. For most purposes, more especially for the dyeing of cotton, the dyewoods may already be dispensed with, their artificial substitutes giving superior results and being more easy of application.—I. S.

Hæmatoxylin and Brasilin. J. Herzig. *Monatsh. Chem.* 16, 906—918.

FURTHER research has thrown doubt upon the analogy drawn by the author between hæmatoxylin and brasilin on the one hand, and xanthone and allied compounds on the other (*Monatsh. Chem.* 15, 139; this Journal, 1894, 797). The resemblance is due to the fact that all the hydroxyl groups which the compounds contain do not behave similarly on methylation. Hæmatoxylin with five hydroxyl groups, gives a tetra-alkyl derivative insoluble in KOH, and incapable of further alkylation; brasilin with four hydroxyl groups yields a tri-alkyl derivative of similar properties. It is now shown, *firstly*, that these properties hold good for a much larger number of substances than was formerly supposed, and, *secondly*, that the methylation phenomena of hæmatoxylin, &c., and xanthone differ materially.

—R. B. B.

Dyestuffs, Vegetable, Direct Dyeing, Certain Artificially Prepared. V. H. Soxhlet. *Chem. Zeit.* 19, 2295—2296.

Two classes of preparations exist capable of dyeing in a single bath, both being true metallic lakes of vegetable colouring matters. The more soluble lakes are known as "carmine colours," and are suitable for dyeing cotton and other vegetable fibres; the less soluble lakes may be applied in wool dyeing. The latter are unsuitable for cotton, since it is necessary to dissolve the lake in acid, and cotton cannot take up the colouring matter from an acid solution. The carmine colours are sold in the form of liquid extracts and are completely soluble in non-calcareous water. They are prepared by mixing with the dyewood decoctions metallic salts, usually compounds of tin, copper, or chromium, and heating the mixture until a uniform combination ensues. Yellow carmine is made from quercitron bark decoction and stannate of soda; the addition of 1 per cent. copper sulphate yields a greenish-yellow. Red carmine is obtained if stannous chloride replaces the stannate of soda; the colouring matters of the red woods are not suited for lake formation owing to their insolubility. Blue carmine is best prepared from 12.27 per cent. CuSO_4 , 14.15 per cent. $\text{K}_2\text{Cr}_2\text{O}_7$, 25.31 per cent. alum, and 52 per cent. hæmatein. In all cases a slight excess of the metallic salts is employed to ensure the maximum amount of lake being formed. By mixing the three colouring matters described, a variety of intermediate shades is obtained. All the colours are fast to washing and, with the exception of the blue, fast to acids. Dyeing takes place at 50°—60° C., and the dyed material preserves its soft handle. The dye-bath is not exhausted.

Wool cannot be dyed with the carmine colours, and on heating the dye-bath to the boiling point, decomposition takes place. If, however, oxalic acid be first added, the decomposition is prevented and wool is readily dyed in the solution. On the fact of the solubility of the colour-lakes in acid, depends the preparation of the products which dye wool directly. The most important is "direct black," prepared by precipitating logwood decoction with chromium, copper, or iron. Yellow and red dyestuffs are similarly made from quercitron, peachwood, &c. The chief difficulty in their application is that of choosing exactly the right amount of acid. A deficiency causes dyeing to be too rapid and consequently it proceeds unevenly, and the dye rubs off. An excess of acid tends to prevent dyeing, and the colours are extremely fugitive to light. Such an amount of acid should be chosen that the lake is not completely in solution at the beginning of the operation, but is dissolved later on, during the dyeing process.

The nature of the metallic salts used, also influences the fastness to light, iron lakes being more fugitive than those of chromium or copper.—R. B. B.

Indigo-Red and Indigo-Red Sulphonic Acid. J. Fasal. *Mitt. k.k. techn. Gewerbemuseums (Vienna)*, 1895, 307—309.

THE amount of indigo-red (indirubin) present in commercial indigo varies from 1 to 8 per cent. Like indigotin, it is capable of dyeing by the reduction-vat method, and it has been therefore supposed to influence the shade of vat indigo dyes. The production of indigo-red from indigo is long and tedious, as is also its synthesis from indoxyl and isatio. It can be more readily obtained from indophor, a new commercial product introduced by the Badische Anilin und Soda Fabrik, consisting of indoxyl carbonic acid. Indophor is heated with water until evolution of CO_2 ceases, the solution is filtered hot, and the filtrate treated with caustic soda. Indigo-red in a chemically pure state at once separates, in the form of fine red needles. It is only reduced with difficulty, but most easily by means of zinc powder and alkali. The reduced solution can be used for dyeing in the same manner as an indigo vat, and dyes red-violet shades equal in fastness to vat blues. On standing, however, the contents of the vat suffer a change, and the shades dyed become bluer and bluer; the presence of indigotin can be clearly shown. The dyes do not oxidise in the air as quickly as ordinary vat dyes, and this fact, together with the observed greenish fluorescence, indicate the presence of indoxyl, and not indigo-white. It would thus appear that, under the conditions which convert indigotin into indigo-white, indigo-red is changed to indoxyl. Indigo-red has therefore no effect on the shade of vat blues.

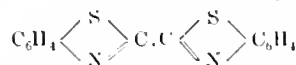
A solution of indigo-red sulphonic acid similarly reduced, shows the same alteration on standing, and, on subsequent oxidation, indigo-carmine is obtained. The colours yielded by this sulphonated product are not fast, even to washing with water.—R. B. B.

Colouring Matter [Brown] obtained from Dibromogallie Acid. A. Biétrix. *Bull. Soc. Chim.* 1896, 235—236.

WHEN dibromogallie acid in an alkaline aqueous solution is exposed to the air, a pink coloration is produced, which rapidly turns brown. For the preparation of larger quantities, the acid is dissolved in an excess of ammonia, and a current of air is passed through the solution. After evaporation to dryness on the water-bath, the residue is washed with alcohol to remove impurities, and the ammonium salt remaining, is converted into the colouring matter acid by treatment with dilute hydrochloric acid. The colouring matter dyes wool and silk brown. It is, however, probably of little industrial value, since, according to Koechlin, 1 kilo. of silk requires 300 grms. of the colouring matter to give a good shade.—T. A. L.

Dithiazole Derivatives. C. Lauth. *Bull. Soc. Chim.* 1896, 82—87.

IN 1880, Hofmann obtained oxalamidothiophenol—



by heating acetanilide with sulphur. The constitution of this substance shows it to be allied to dehydrothiitolmidine and primuline, and it was expected that valuable cotton colouring matters would be obtained from it. The compound, after purification and sublimation, melts at about 306° C. On nitration with nitric acid in sulphuric acid solution under varying conditions, a mixture of two dinitro products is obtained, which can only be imperfectly separated. The mixture was therefore reduced with stannous chloride, and the two diamines can be separated by means of the difference in solubility of their hydrochlorides. The bases obtained therefrom both crystallise in yellow prismatic needles, and one of them shows a fine greenish fluorescence in an alcoholic solution. Prolonged boiling of the bases or their salts with alcohol or water causes decomposition; reducing agents act similarly, with evolution of sulphuretted hydrogen. By stopping the reduction as soon as the yellow colour has disappeared, the solution of one base shows the reactions of an ortho- and the other that of a meta-diamine; no *p* diamine could be

detected. Both bases are colouring matters, dyeing unmordanted cottons and animal fibres a bright yellow, which, on oxidation, turns brown. The colouring matter can be diazotised on the fibre and combined with various amines and phenols and their derivatives, giving a variety of shades. The colours are fast to acids and alkalis, but fugitive to light.—T. A. L.

Benzidine and Tolidine, Valuation of. W. Vaubel. Zeits. anal. Chem. 1896, **35**, 163.

See under XXIII., page 385.

Naphthols and Naphthylamine, Behaviour towards Nascent Bromine. W. Vaubel. Zeits. anal. Chem. 1896, **35**, 164.

See under XXIII., page 385.

PATENTS.

Orange to Brown Colouring Matters, Manufacture of. O. Murray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 5114, March 11, 1895.

WHEN aromatic *m*-diamines are condensed with formaldehyde, benzaldehyde or its substitution products, so-called "hydro-acridines," are obtained. The present specification describes the preparation of colouring matters from these products by the action of alkylating agents. For instance, 10 kilos. of diamidodimethyldihydroacridine (leuco acridine yellow), 25 kilos. of methyl alcohol, and 10 kilos. of hydrochloric acid are heated in an enamelled autoclave at 140°–150° C. for four hours with agitation. The melt, after cooling, is diluted with water, the colouring matter being precipitated from the filtered solution by salt and zinc chloride. The colouring matters can also be obtained from the methane bases themselves (resulting from the condensation of 2 or 3 mols. of a *m*-diamine with 1 or 2 mols. of formaldehyde or benzaldehyde) by heating them with methyl or ethyl alcohol and sulphuric acid. The colouring matter obtained by heating 20 kilos. of tetramido-ditoly-methane, 60 kilos. of sulphuric acid (66° B.), and 20 kilos. of methyl alcohol for eight hours at 200°–210° C., and separation as in the previous example, forms a brown powder easily soluble in water, giving reddish-brown shades on leather and on cotton mordanted with tin and tartar emetic. The shades can be altered by modifying the proportions and temperatures.—T. A. L.

Colouring Matters [Azines], The Manufacture of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 5797, March 19, 1895.

WHEN α -amido or α -hydroxy-azo sulphonic acids of the naphthalene series containing the azo group meta to a sulphonic acid group are heated with a primary aromatic amine, a substituted eurhodine is obtained, and on prolonging the action at a higher temperature a further substitution takes place in the azine ring, resulting in the formation of a rosinduline derivative, the final product in any case being sulphonated if necessary. The process is thus allied to that already described in Eng. Pat. 8898 of 1893 (this Journal, 1894, 511), but differs essentially from that referred to in Eng. Pat. 21,205 of 1890 (this Journal, 1891, 359). One kilo. of the azo compound obtained by combining diazobenzene chloride with 1,4,3'-naphthylamine disulphonic acid is mixed with 4 kilos. of aniline and 1 kilo. of aniline hydrochloride, and heated with constant agitation for 5 hours to 140°–150° C. When sulphur dioxide is no longer evolved, the temperature is raised to 160° C. until a sample dissolved in alcohol is no longer decolorised by alkalis. The melt is then poured into hot dilute hydrochloric acid, filtered, and the precipitate washed with hot water. The azine sulphonic acid obtained, can be converted into the soluble sodium salt, or by heating with five times its weight of sulphuric acid (66° B.) at 100° C. it yields a readily soluble disulphonic acid, which gives red shades on wool.

—T. A. L.

Dyestuffs [Orange, Red, and Yellow], Derived from Phenolic Bodies, The Manufacture or Production of Chemical Compounds and. P. A. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 8988, May 6, 1895.

AROMATIC hydroxy compounds will condense with primary and secondary amines of the fatty series in presence of formaldehyde under various conditions. For example, 7.5 kilos. of a 40 per cent. formaldehyde solution, 9.4 kilos. of phenol, 50 litres of alcohol, and 13.5 kilos. of a 33 per cent. dimethylamine solution are added together. The formation of the new compound is completed in a short time, and, after distilling off the alcohol, the residue is extracted with hydrochloric acid, the solution filtered, and the filtrate is precipitated with caustic soda, when a colourless oily substance separates out, having the formula $C_{16}H_{13}OCH_2N(CH_3)_2$. The specification contains a list of several substances which have been prepared according to this method. These substances can be obtained in another way by condensing phenols and their substitution products with certain halogen derivatives of primary, secondary, or tertiary fatty alkylamines by means of caustic potash lye. By condensing *p*-nitrophenol according to either of the foregoing methods and reducing the product, it can be converted into *p*-amidophenol- ω -dimethylamido-ethyl ether which can be employed in the production of dyestuffs. By diazotising 1.8 kilos. of the compound with 0.7 kilo. of sodium nitrite and a sufficiency of hydrochloric acid, it will combine with 1.57 kilos. of *p*-xylylene hydrochloride to form a dyestuff which gives brownish-yellow shades on tanned cotton. By substituting β -naphthol for the phenol, a red basic colouring matter is obtained, having the formula $HClH_2NC_2H_4.OC_6H_4.N : N.C_{10}H_6(O)H$, which gives scarlet-red shades on cotton mordanted with tannin. If *m*-amido-phenol be used, more orange shades are produced.—T. A. L.

Chemical Compounds [Stable Diazo Salts], suitable for the Production of Colouring Matters, in Bulk or on Fibre, and other Purposes, the Manufacture of. P. A. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 8989, May 6, 1895.

CERTAIN β -naphtholtrisulphonic acid salts, when added to acid or neutral solutions of tetrazo compounds of *p*-diamines, give crystalline orange-coloured precipitates, which are the β -naphtholtrisulphonates of the tetrazo compounds. For brevity these compounds are termed tetrazo salts. By adding a solution of one of these tetrazo salts to an alkaline solution of β -naphthol, an insoluble diazo compound is at once formed, and the β -naphtholtrisulphonic acid remains in solution, showing an intense green fluorescence. The same process can be carried out on the fibre, the β -naphtholtrisulphonic acid being displaced and combination taking place with the particular dyestuff component employed. For the preparation of one of these tetrazo salts, a solution of 45 kilos. of 2,3,3',1'-naphtholtrisulphonic acid is allowed to run into as concentrated a solution as possible of dimethoxytetrazodiphenyl chloride obtained from 12.3 kilos. of diarsidine and 7 kilos. of sodium nitrite in presence of hydrochloric acid. The tetrazo salt begins to separate immediately, but the precipitation is accelerated by adding salt. The tetrazo salt so obtained, after filtering off, is tolerably stable, and will keep for some time. In place of the above-mentioned β -naphtholtrisulphonic acid, the isomeric β -naphtholtrisulphonic acid may be used, which is obtained, together with an α -naphtholtrisulphonic acid, according to Eng. Pat. 25,074 of 1893 (this Journal, 1891, 1191), by sulphonating 2,3'-naphthalenedisulphonic acid and fusing the naphthalenetetrasulphonic acid so obtained with alkalis. The method of the tetrazo salts serves as a process for separating these α - and β -naphtholtrisulphonic acids, since only the tetrazo salts of the latter are sparingly soluble, and may be filtered off from a mixture of the two which has been treated with a tetrazotised diamine, the filtrate being worked up subsequently for the α -naphtholtrisulphonic acid.—T. A. L.

Amido Bases and Amido Sulpho Acids belonging to the Naphthalene Series, and of Colouring Matters therefrom, Improvements in the Manufacture of. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 9103, May 7, 1895.

By heating 1.3-naphthol or naphthylamine sulphonic acid, or their sulphonic, hydroxy, or amido-derivatives, in an autoclave with ammonia to 160° — 180° C., 1.3-naphthylendiamines or their derivatives are obtained. For instance, 65 kilos. of 1.3.3'-naphthol disulphonic acid are heated in an autoclave with 30 kilos. of caustic soda lye (40° B.), 50 kilos. of ammonium chloride, and about 300 kilos. of ammonia liquor to 160° — 180° C. for 20 hours. After expelling the excess of ammonia, the residue is acidulated with sulphuric acid and filtered, when the 1.3.3'-naphthylendiamine sulphonic acid crystallises out on cooling. In a similar manner, 1.3'.3-dihydroxynaphthalene sulphonic acid gives 1.3.3'-triamidonaphthalene, and the same product is obtained from 2.1'.3'-amidonaphthol sulphonic acid G; 1.3.4'.2'-naphthol trisulphonic acid yields 1.3.4'.2'-naphthylendiamine disulphonic acid. All these products can be employed for the manufacture of azo colouring matters by combining them with diazo or tetrazo compounds, or else for the production of azines by condensing them with alkylated nitroso derivatives, or oxidation together with alkylated *p*-amido anilines. The tetrazo compound from 9.2 kilos. of benzidine is run into a cold solution of 28 kilos. of 1.3.1'-naphthylendiamine sulphonic acid and 10 kilos. of sodium carbonate in 500 litres of water. After agitation for some hours, the formation of the colouring matter is complete, when it is salted out, filter-pressed, and dried. It dyes a fast red on cotton. The following example describes the formation of an azine colouring matter:—24 kilos. of 1.3.4'-naphthylendiamine sulphonic acid suspended in 100 litres of alcohol are mixed with 19 kilos. of nitrosodimethylaniline and heated on the water-bath for 3—4 hours. The colouring matter separates on cooling in bronzy needles, and dyes wool and mordanted cotton violet.

—T. A. L.

Fast Azo Colouring Matters, especially adapted for Dyeing on Wool, Improvements in the Manufacture of. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 9454, May 13, 1895.

THESE colouring matters, which are said to be very fast to milling and light, are obtained by sulphonating the disazo compounds from *o*-nitrotetrazodiphenyl and two molecular proportions of a phenol, naphthol, or a carboxylic acid thereof. The mixed disazo compounds are of course equally applicable for the purposes of this invention. 20 kilos. of the product from *o*-nitrobenzidine and two molecular proportions of β -naphthol are dissolved in 200 kilos. of 100 per cent. sulphuric acid and heated to 50° — 60° C. until a sample is completely soluble in dilute sodium acetate solution. The melt is then run into 2,000 litres of water, the sulphonated product filtered off and dissolved in soda-lye. The sodium salt is precipitated from the hot solution, and is filter-pressed and dried. It gives bluish-red shades on wool. A yellow colouring matter for wool is obtained by stirring 20 kilos. of the disazo compound from equimolecular proportions of *o*-nitrobenzidine, cresotic acid, and phenol into 100 kilos. of 100 per cent. sulphuric acid. When all is dissolved, 100 kilos. of fuming sulphuric acid containing 30 per cent. of anhydride are added and the mixture agitated at the ordinary temperature until a sample dissolves in hot water. The melt is then worked up as before.

—T. A. L.

New Azo Dyes, and of Materials for Producing the same, The Manufacture of. S. Pitt, Sutton. From L. Cassella and Co., Frankfort a. M., Germany. Eng. Pat. 9645, May 15, 1895.

THE specification refers to the production of nitro-amido-salicylic acid ($\text{NH}_2 \cdot \text{NO}_2 \cdot \text{OH} \cdot \text{CO}_2\text{H} = 1:3:4:5$), which is obtained by nitrating *p*-amido-salicylic acid in sulphuric acid solution at a low temperature. 77 kilos. of 1.4.5-amidohydroxybenzoic acid are dissolved in 3.50 kilos. of sulphuric acid (66° B.), cooled to 6° — 5° C., and nitrated at a low temperature with 110 kilos. of a mixture of

nitric and sulphuric acid containing 30 per cent. of HNO_3 . When all has run in, the temperature is raised to 15° C. within half an hour, and the melt is then diluted with ice. The nitro compound separates out almost completely, and melts with decomposition at 240° C. It is sparingly soluble in water and gives with sodium nitrite an almost insoluble diazo acid, which reacts very readily with amines and phenols. 20 kilos. of 1.3.4.5-amidonitrohydroxybenzoic acid, after conversion into the sparingly soluble yellow diazo compound, is combined with a solution of 36 kilos. of R salt kept alkaline with sodium carbonate. The colouring matter, which forms at once, separates as a brown precipitate, and dyes wool red from an acid bath. If the nitro-amidosalicylic acid be combined with α -naphthylamine, the amido-azo compound produced can be further diazotised, and on combination with R salt a bluish-black colouring matter is obtained which dyes wool blue-black, fast to washing, and if mordanted with chrome or alumina, the dyeing is perfectly fast to milling. Similar colouring matters of a somewhat bluer shade may be obtained from the 1.5.2.3-amidonitrohydroxybenzoic acid melting at 220° C.—T. A. L.

Dyestuffs [Azines] and Materials therefor, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co." Elberfeld, Germany. Eng. Pat. 9794, May 17, 1895.

IN Eng. Pat. 6176 of 1895 (this Journal, 1896, 269) the patentees describe the preparation of so-called aliphyl-*p*-amidobenzyl-*o*-toluidines. According to the present specification, it is shown that the benzyl group may be replaced by other alkylating groups, such as methyl or ethyl. A solution of 20 kilos. of phenyl-*p*-amido-*o*-toluidine, 11 kilos. of ethyl bromide, and 40 kilos. of alcohol, is heated in an autoclave for 10 hours to 150° — 175° C. The product is mixed with a small quantity of hydrochloric acid and dissolved in boiling alcohol. The base is precipitated by means of sodium carbonate and is purified by crystallisation from petroleum ether, when it melts at 60° C. having the formula $1.2.4.\text{C}_6\text{H}_3(\text{CH}_3)(\text{NH}\cdot\text{C}_2\text{H}_5)(\text{NH}\cdot\text{C}_6\text{H}_5)$. Colouring matters of the azine series are obtained from this and analogous compounds by similar processes to those given in the specification already referred to. As an example of one of the methods employed, 21 kilos. of phenyl-*p*-amido-methyl-*o*-toluidine and 43 kilos. of benzene-azo- α -naphthylamine hydrochloride are heated on the water-bath in presence of 20 kilos. of glacial acetic acid until the azo compound is no longer distinguishable. About 2 litres of hydrochloric acid (20° B.) and a sufficient quantity of water are added, and the dyestuff is salted out, being purified, if necessary, by dissolving in water and again salting out. The colouring matter gives bluish-red shades on tanned cotton fast to alkalis, acids, and light.—T. A. L.

New Colouring Matters [Azo-Dyestuffs], Manufacture of. C. D. Abel, London. From A. Fischesser and Co., Lutterbach, Alsace, Germany. Eng. Pat. 10,470, May 27, 1895.

THE colouring matters described are obtained by combining diazo or tetrazo compounds with the 1.1'-amido-naphthol disulphonic acid of Eng. Pat. 13,203 of 1894 (this Journal, 1895, 479). Aniline, nitraniline, α - or β -naphthylamine after diazotisation may be combined with the acid in an alkaline or acid solution, the colouring matters obtained, dyeing wool red to reddish-violet shades from an acid bath. Amido-azo compounds such as amido-azobenzene or naphthalene, give red to dark violet-blue shades. Tetrazo derivatives from benzidine, toline, or diaminidine, &c., when combined with two molecular proportions of the amidonaphthol disulphonic acid, give colouring matters dyeing unmordanted cotton violet-blue to greenish-blue. Instead of employing two molecular proportions of the same acid, different acids may be used, one being the new acid, the resulting diazo compound dyeing still darker shades. Finally, reddish-violet cotton-colouring matters are obtained by combining the diazo compounds of dehydrothiitoluidine and its homologues and sulphonic acids with the acid sodium salt of the 1.1'-amido-naphthol disulphonic acid.—T. A. L.

Colouring Matters, Improvements in the Manufacture of. H. H. Lake, London. From "Farbwerk Mülheim," Mülheim a M., Germany. Eng. Pat. 10,668, May 29, 1895.

THE mono-acidyl derivatives of *m*-phenylene or *m*-tolylene diamine combine with diazo or tetrazo compounds to form colouring matters and new intermediate products which can be diazotised and combined further with other components. Some of these reactions can be carried out on the fibre, and the compounds produced yield, on saponification, other azo dyes which it has not hitherto been possible to obtain. One molecular proportion of β -naphthylamine disulphonic acid G, after diazotisation, is combined with one molecular proportion of acetyl-*m*-tolylene diamine. The resulting compound is again diazotised and combined with one molecular proportion of β -naphthol in an alkaline solution. After salting out the dyestuff, it is saponified by dissolving 1 kilo. of it in 30 litres of water and 15 kilos. of 33 per cent. soda lye and boiling for two hours. After neutralising the greater part of the alkali with hydrochloric acid, the new dyestuff is salted out. The saponification can also be effected by dissolving, for instance, 1 kilo. of the dyestuff derived from β -naphthylamine disulphonic acid, acetyl-*m*-tolylenediamine, and β -naphthol disulphonic acid R in 25 litres of water, adding about 5 kilos. of 30 per cent. hydrochloric acid, and boiling under an inverted condenser. The violet liquid which is obtained after some time, deposits the saponified dyestuff on cooling. This is converted into its sodium salt in the usual manner, and dyes wool bluish-black from an acid bath. The tetrazo derivative from 38 kilos. of diamido-stilbene disulphonic acid is poured into an alkaline solution of 34 kilos. of acetyl-*m*-tolylene diamine. After salting out, the colouring matter dyes unmordanted cotton red from an alkaline bath, and can be further diazotised and combined on the fibre, giving with β -naphthol a violet-black, with α -naphthylamine a black, and with *m*-phenylenediamine a brown colour. In addition to the acetyl compounds, the use of benzoyl-*m*-phenylene diamine and of *m*-phenylene and *m*-tolylene oxamic acid is also claimed.—T. A. L.

Methyl Aniline, Ethyl Aniline, Para-anisidine, and Para-phenetidine, Lactyl Derivatives of. J. Y. Johnson. From "The Chemische Fabrik vorm. Goldenberg, Geronmont, and Co.," Winkel. Eng. Pat. 10,676, May 29, 1895.

THE preparation of the lactyl derivatives of methyl and ethyl aniline, para-anisidine, and para-phenetidine by heating the α -halogen propionyl derivatives of the bases with salts of carboxylic acids in aqueous or alcoholic solution under pressure or otherwise, is claimed in this patent. The process is carried out briefly as follows:—5 kilos. of α -brom-propionyl bromide are dissolved in 20 litres of well cooled and dry ether, and 6.34 kilos. of para-phenetidine added. The ether is distilled off and the product washed with water and re-crystallised from boiling alcohol. Other similar compounds are prepared in an analogous way.

They are converted into lactyl derivatives by boiling with sodium acetate; for example, 20 kilos. of α -brom-propionyl para-phenetidine and 12–20 kilos. of crystallised sodium acetate are dissolved in 90 per cent. alcohol and boiled with reversed condenser; the reaction being complete, the alcohol is distilled off and the residue washed with water; it consists of pure lactyl para-phenetide.—T. E.

Colouring Matters Dyeing Yellow with Mordants, Manufacture of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 12,221, June 24, 1895.

By combining the diazo compounds of aromatic amines containing an alkylated hydroxy group, with phenol carboxylic acids, yellow mordant dyestuffs of considerable strength and solubility are obtained. The solution of the diazo compound from 42 kilos. of *m*-amido-*p*-cresol methyl ether ($\text{CH}_3 : \text{OCH}_3 : \text{NH}_2 = 1 : 4 : 3$) is run into a cold solution of salicylic acid kept alkaline. The mixture is heated to boiling, the excess of alkali neutralised with an acid, and the colouring matter is salted out in yellow crystalline needles. It dyes chrome-mordanted wool a

bright yellow. More greenish shades may be obtained by employing *p* or *m*-amidophenol ether in place of the *m*-amido-*p*-cresol ether mentioned in the example.—T. A. L.

Polyazo Dyes [Cotton Dyes] of the Benzidine and Analogous Series, The Manufacture and Production of. J. Y. Johnson, London. From "The Badische Anilin and Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 12,303, June 25, 1895.

THIS is an extension of Eng. Pat. 6697 of 1895 (this Journal, 1896, 195), and describes the application of the process, oxidation of simple azo dyes of the benzene series, to more complex derivatives. Such derivatives are:—(1.) Secondary diazo dyes of the general formula B.N:N.Z.N:N.X , where B is the radicle which undergoes oxidation, Z is a middle component, which after combination is capable of further diazotisation, such as α -naphthylamine or aniline, and X is any dyestuff component. (2.) Primary disazo dyes of the formula B.N:N.U.N:N.B' , where U is an end component capable of combining with 2 diazo groups, such as *m*-phenylene diamine or resorcinol. (3.) Polyazo dyestuffs of the formula—



(4.) Disazo dyes with *m*-phenylene diamine as first component. Mixtures of the simple azo dyes with any of the above polyazo dyes may also be employed. The following example, illustrating the process, is given. About 10 kilos. of amido-azobenzene-azo- β -naphthol disulphonic acid is dissolved in 150 kilos. of concentrated sulphuric acid at -5°C ., and, with constant agitation, about 3 kilos. of manganese peroxide (80 per cent. MnO_2) is stirred in. The solution, at first yellowish-red, changes to violet, and when the reaction is complete, the melt is poured on to ice together with a little sodium bisulphite. After filtering, washing, and pressing, the colouring matter is converted into the sodium salt, and may be purified if necessary by redissolving. It gives red shades on unmordanted cotton. A blue-black dyestuff for unmordanted cotton is obtained by oxidising the disazo dyestuff obtained by combining diazotised aniline and naphthionic acid with dihydroxy naphthalene disulphonic acid H.—T. A. L.

Colouring Matters [Primuline], Improvements in. Brooke, Simpson, and Spiller, Ltd., and W. S. Simpson, Hackney Wick, London. Eng. Pat. 12,442, June 27, 1895.

IN the manufacture of primulose (obtained by sulphonating the product of the reaction of sulphur on *p*-toluidine), the sulphonic acid hitherto has been dissolved in an alkali and the solution evaporated to dryness. According to the present specification, the patentees wash the primuline sulphonic acid and, after drying it in a hydro-extractor or in a drying-room, grind the free acid with a definite proportion of sodium carbonate sufficient to convert the insoluble primuline sulphonic acid, when dissolved in the dye-bath, into the soluble alkaline salt known as primuline.—T. A. L.

Polyazo Dyes, Blue, Bluish-Black, or Greenish-Black, on Vegetable Fibre or on Silk, Improvements in the Production of. J. Y. Johnson, London. From "The Badische Anilin and Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 13,032, July 5, 1895.

IN Eng. Pat. 1002 of 1895 (this Journal, 1896, 28), the production of black shades on vegetable fibre or silk is described, consisting in padding the goods with a solution of an azo dye, and combining this on the fibre with a diazo or tetrazo compound. It has now been discovered that the black dyestuffs obtained by means of tetrazo compounds are capable of further combination with dyestuff components, such as β -naphthol or *m*-phenylene diamine. The process is carried out as follows:—About 100 kilos. of cotton are dyed in a nearly boiling bath for an hour, containing 1 kilo. of the dyestuff from one molecular proportion of 1.1'.4'-amidonaphthol sulphonic acid, 5 kilos. of calcined soda, and 15 kilos. of sodium sulphate in 3,000 litres of water. Wash out with cold water, and pass the goods through a 2 per cent. solution of tetrazo ditolyl acetate, taking sufficient of the tetrazo compound for the dyestuff present. During this process the blue colour is converted into a greenish-

black. After well washing in cold water, the goods are passed through a solution containing 15 kilos. of β -naphthol, 50 kilos. of Turkey-red oil, and 4 kilos. of caustic soda in 1,000 litres of water. The combination takes place at once, and bluish-violet to bluish-black shades are obtained.

—T. A. L.

Diazo Compounds and Azo Dyes, New Nitrosamine Compounds suited for Use in the Preparation of; The Manufacture and Production of. J. V. Johnson, London. From "The Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 13,160, July 12, 1895.

This is an extension of Eng. Pat. 20,605 of 1893, and of Eng. Pat. 2397 of 1894 (this Journal, 1894, 1189, and 1895, 147), and describes the production of nitrosamines from amido-azobenzene or its homologues, and from benzene-azo- α -naphthylamine. As described in the second of the above-mentioned specifications, it is necessary to employ a strong alkali lye and a tolerably high temperature. One kilo. of a 15 per cent. paste of diazo-azobenzene chloride is stirred into 2 kilos. of caustic soda-lye (40° B.) below 5° C., 3 kilos. of powdered caustic soda are then stirred in below 10° C., and the mixture is heated until a sample gives no trace of a dyestuff when mixed with β -naphthol in a solution only slightly alkaline. This occurs at about 130° – 150° C., and the nitrosamine sodium salt floats up, when it can be mechanically separated from the melted caustic soda. It can be further purified by crystallisation from water.—T. A. L.

Rhodamin Series, Products related to the; The Manufacture and Production from Phthalonic Acid; J. V. Johnson, London. From "The Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 11,135, July 24, 1895.

By condensing phthalonic acid (obtained by oxidising naphthalene with potassium permanganate, Ger. Pat. 79,693) with alkylated m -amidophenols, the final products obtained are rhodamines. The reaction takes place in two stages, and if one molecular proportion of phthalonic acid be heated with 2–3 molecular proportions of a di-ethyl- m -amidophenol to about 105° C., a crystalline powder is obtained very sparingly soluble in water and alcohol, but easily in glacial acetic acid, dilute hydrochloric acid, alkalis or carbonates, and melting at about 175° C. When this intermediate product is heated to a higher temperature, with or without a condensing agent, it is converted into a rhodamine dyestuff. It follows, of course, that the two operations may be combined, and the melt raised at once to the higher temperature. An alternative method for obtaining the rhodamines is to treat the intermediate compounds with oxidising agents, the following being a typical example of the method employed. About 50 kilos. of dialkyl- m -amidophenol and 20 kilos. of phthalonic acid are heated for six hours to about 105° C. until a solid mass is obtained. In order to isolate the intermediate product, the melt, after extraction with water, is dissolved in dilute hydrochloric acid containing about 16 kilos. of pure HCl, filtered, and the intermediate product is separated by adding a solution of 90 kilos. of crystallised sodium acetate, when it is filtered and dried. About 50 kilos. of the intermediate product, either crude or purified, is dissolved in 750 kilos. of dilute acetic acid (containing 30 per cent. pure $C_2H_3O_2$). To this solution, 21 kilos. of potassium persulphate are slowly added, and the mixture is heated on the water-bath until a sample made alkaline with dilute soda lye is no longer blue or violet. After cooling, the dyestuff is salted out and purified by any well-known methods.—T. A. L.

Organic Compounds, Improvements in the Reduction of. C. Kellner, Vienna, Austria. Eng. Pat. 3030, Feb. 11, 1896.

See under XI. A., page 361.

ERRATUM.

This Journal, 1895, page 28, col. 1, top line. For "compound with α -naphthylamine monosodium sulphamate" read " α -naphthalene sulphonic acid salt."

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Cellulose, Increase in Temperature of, on Absorption of Atmospheric Moisture. Clayton Beidle and O. W. Dahl. Chem. News, 73, 1896, 180.

The authors have determined the gain in weight and also the rise in temperature when the following anhydrous celluloses are exposed to the air:—(1.) Cotton wool. (2.) Cotton wool mechanically pulverised so as to reduce the fibres to about one-twentieth of their former length. (3.) Coarsely ground viscid (an amorphous cellulose). (4.) Finely ground viscid.

(1) and (2) take about 60 minutes to come to a constant weight. (1) gains considerably less than (2). The two viscid samples took nearly four hours to come to a constant weight, but the finely powdered gained considerably less than the coarse. The curves given for the increase in weight show that there is increased regularity with the increased subdivision of the cellulose. The results show also that this holds good whether the cellulose is in a fibrous or amorphous condition.

The temperature curves in which the temperature of the air is reduced to a straight line, show that cotton reaches a maximum of about 4.5° F. in 10 minutes. The temperature gradually falls, and reaches the atmospheric temperature in about 60 minutes. Disintegrated cotton reaches a maximum of 7° F. in 20 minutes, and takes much longer to fall. The curve is also much more regular than that of cotton wool. Both kinds of viscid fall suddenly below the atmospheric temperature during the first minute. They reach the atmospheric temperature again in about two minutes. They reach a maximum of 7.5° F., and fall slowly but somewhat irregularly. It appears that each cellulose has a characteristic temperature curve. In each case the degree of fineness affects the regularity of the curves.—C. B.

PATENTS.

Soluble Bodies, Envelope or Coverings for Use in Preserving; An Improved. A. Le Chatelier, Paris, France. Eng. Pat. 7192, April 8, 1895.

See under I., page 341.

Textile Fibres on Slubbing, Intermediate, or Roving Bobbin or Cop Tubes, Preparing or Spinning, and subsequently Bleaching, Improvements in and in Means for. J. H. Lees-Milne, Oldham. Eng. Pat. 7685, April 17, 1895.

The fibrous material is prepared in the form of a bobbin on a perforated tube fixed detachably on the tube of a slubbing, intermediate, or roving frame, or it is spun on the perforated tube in the form of a cop. The bobbins or cops are placed in a bag and boiled with water, and subsequently bleached in a vacuum kier. The perforated tubes are preferably made of sheet metal rolled into the form of a tube with a longitudinal division or split.—R. B. B.

Textile Materials, Treating, in order to Render them less liable to be Spotted or Soiled, An improved Process for. J. B. Rapetout, Asnières, France. Eng. Pat. 8053, April 23, 1895.

The materials, after having been washed, are immersed in a clear aqueous bath containing 3 per cent. of alum, and 0.8 per cent. of carbonate of soda. After that they are plunged into a solution of acetate of alumina of 5° B., this latter solution being compounded with 30 grms. of Marseilles soap per litre for cotton and silk, and the latter being further treated in a bath of 10 grms. of acetic acid of 7° B. per litre of water.—H. S.

Flax and other Textile Materials, Retting and Drying; Improved Process and Apparatus for. W. P. Thompson, Liverpool. From R. C. L. E. de Swarte and J. M. E. Doumer, Lille, France. Eng. Pat. 8642, May 1, 1895.

The apparatus consists of a closed cylindrical basin enclosed in an open metal tank, and is so constructed that a vacuum can be produced in the inner vessel, or a current of hot air can be drawn through the same. By producing a vacuum, the air is removed from the substance to be treated so that

the liquid subsequently thoroughly penetrates the material. The retting is accomplished by a fermentation, the agent being a microbe "amylo bacteria." It is developed in hot water of 38°—48° C. Drying is effected by filling the outer vessel with hot water and producing a vacuum in the inner vessel, or a current of hot air is drawn through the latter. In an alternative process the vacuum is dispensed with.

—R. B. B.

Jute, Retting or Steeping; Improvements in. C. Bergmann, Meissen-on-the-Elbe, Germany. Eng. Pat. 10,450. May 27, 1895.

THE jute is treated with the retting or steeping liquid in closed steam-jacketed vessels. The advantages over the ordinary process are said to be:—(1) the influence of external temperature is removed; (2) there is no loss of liquid by evaporation; (3) there is no difference in the activity of fermentation between the inner and outer layers of material.—R. B. B.

Felt, Fibrous Bituminous; Improvements in the Manufacture of. E. Nelson, London. Eng. Pat. 16,399, Sept. 2, 1895.

THE material described is composed of alternate layers of fibrous felt and ductile sheet metal. The metal is coated on both sides with pitch or other bituminous substance, and pressed between the layers of felt, to which it adheres. The sheets so formed are especially suited for damp-course materials in the foundations of buildings, roofing, &c.

—R. B. B.

Noils and other Wool and Hair Waste, Stained with Pitch, Tar, and other Colouring Material, Cleansing by Chemical Means; Process for. E. Balatsch, C. Herold, A. Bayer, all of Brunn, Austria. Eng. Pat. 16,766, Sept. 7, 1895.

THE material is treated with an aqueous emulsion of heavy or light oils of tar, prepared by means of soap. It is stated that the tarry clumps or clods of noils, &c. are well softened and afterwards easily removed by means of this treatment.—H. S.

Wool, Scouring and Degreasing; Improvements in. G. Malard, Paris, France. Eng. Pat. 23,882, Dec. 13, 1895.

THE material is placed upon a travelling belt which passes above a series of tanks containing the cleansing liquid. This liquid is pumped up into sprinklers arranged above the belt, and falls from these on to the wool to be treated, and then the liquid returns by means of an automatic arrangement to its own or to the next tank. The wool is first treated with the liquid containing most of the grease, and finally with that containing the least, or with pure water or other suitable liquid.—H. S.

Wool, the Treatment of; [Cleansing], Improvements in and relating to Process of and Apparatus for. J. C. Anderson, Chicago, U.S.A. Eng. Pat. 2213, Jan. 30, 1896.

A PROCESS for cleansing wool by means of volatile solvents. The wool is placed in steam-jacketed vessels, where it is moistened with water, and heated by admitting steam to the jacket space. The steam generated in the vessel serves to soften and loosen the fatty matters and also to vaporise certain volatile constituents, which are led away and condensed.

In the treatment with hydrocarbons which follows, the essential feature is that the solvent, instead of repeatedly passing through the wool and thus becoming more and more highly charged with fatty matter, is subjected to evaporation and condensation after each passage through the wool, whereby the wool is several times treated with pure solvent.—R. B. B.

Linoleum, Kamptulicon, and other Floor Coverings, Improvements in or relating to the Manufacture of. K. Kléc, Lancaster. Eng. Pat. 18,937, Oct. 9, 1895.

THE object of this invention is the manufacture of linoleum, the design of which, instead of being printed on the surface,

passes through the whole thickness, and therefore cannot be worn off. For this purpose a number of differently coloured sheets of linoleum are prepared, the colouring matters being mixed with the material during manufacture. These sheets are cemented together according to a design, and form a block or cube. From these blocks slices are cut which are again cemented into other blocks, showing in cross section the pattern required. Finally, cross sections of these are taken and used, either directly or mounted on suitable fabrics, as floor coverings.—R. B. B.

Peat Fibres, Chemically Prepared; a New and Improved Process for the Manufacture of. C. Geige, Düsseldorf, Germany. Eng. Pat. 20,501, Oct. 30, 1895.

THE patentee states that chemically prepared pure peat fibres are obtained by placing the cut peat in a weak alkaline bath, continuously agitated for several hours. After having been dried, the fibres are disintegrated by suitable opening machines, and then they are placed for several days in a warm bath containing yeast and dilute sulphuric acid, in order to decompose the starch and vegetable albumin present. After this treatment, the fibres are washed and subjected in closed vessels under pressure to the action of hot ether, benzene, petroleum spirit, or other fat solvents. After another washing, the peat fibres are boiled with dilute acids or alkalis, the suitable strength being usually 1 to 3 per cent. Finally, the material is again thoroughly washed, and, if desired, bleached in the usual manner.—H. S.

Waterproof, Textile, and other Fabrics, Ornamental and other Designs upon, Improvements in the Production of. L. Mistovski, Heywood, Lancashire. Eng. Pat. 21,511, Nov. 13, 1895.

See under XIII, C., page 364.

Fabrics, Waterproofing; Improvements in Materials or Compounds for. A. J. Boulton, London. From L. P. Converse, Chicago. Eng. Pat. 2201, Jan. 30, 1896.

See under XIII, B., page 364.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Piece-Goods, Woollen; the Bleaching of. A. Lohmann. Färber. Zeit. 7, 35—37 and 49—50.

THE author gives a full description of the well-known processes of bleaching piece-goods in sulphur chambers, and also of liquid bleaching with sulphurous acid and with hydrogen peroxide. He recommends as the most perfect bleach, after treatment in the sulphur chamber, to wash with warm water, rinse in dilute ammonia, then pass into very dilute hydrogen peroxide, in order to remove sulphurous acid, and finally to tint with some blue or violet dyestuff, to obtain the desired tone of reddish- or bluish-white. This is better than applying the dyestuff before bleaching.

In bleaching with hydrogen peroxide, the bath is used in a faintly alkaline state, but when kept for further use it is rendered more stable by making it slightly acid, and then adding an excess of ammonia before use.—R. B. B.

Alizarin, Soluble, and its Application in Turkey-Red Dyeing. H. Schaeffer. Bull. Soc. Ind. Mulhouse, 1896, 81—85.

THE so-called "soluble alizarin" consists of sodium boron-alizarate, and by its use there can be produced on cotton, pink and red shades of equal fastness to light and other agencies to those produced by the ordinary Turkey-red process, and less liable to rub off. Schmid has described (Chem. Zeit. 19, 776—778; this Journal, 1895, 653) a process in which the alizarin is applied before mordanting, but he states that the method is only suitable for pinks. However, with this order of operations the boron-alizarate will yield full and bright reds. Soluble alizarin is produced by dissolving one part of alizarin and two parts of borax in boiling water and evaporating the solution to dryness. The residue is ground to powder, and is well suited for exportation, being un-

affected by extremes of temperature. A solution of soluble alizarin in distilled water forms a very delicate test for the presence of lime in water, giving a flocculent precipitate with the merest trace of a calcium salt.

Method of Dyeing.—The goods are prepared with oil in the usual manner, and dried; then padded in the alizarin solution, to which a little Turkey-red oil has been added, squeezed, and passed through the mordant bath. They are left piled for 15–20 minutes, and then well washed to remove uncombined mordant. The padding with alizarin, mordanting, and washing operations are repeated as often as is necessary to obtain the desired shade. After the last mordanting the goods are not washed, but are padded in a solution of acetate of tin at $\frac{1}{2}$ B., then dried, steamed, washed, and finally soaped, with the addition of a little silicate of soda.

The mordant consists of acetates of aluminium, calcium, and tin, with acetic acid, or may be prepared from aluminium and magnesium sulphates, sodium carbonate, stannous chloride, and calcium acetate.—R. B. B.

Indigo Vat, The Stannous Chloride; and its Application instead of the Hydrosulphite Vat. C. Dreher. *Färbet. Zeit.* 7, 145–147.

THE hydrosulphite vat possesses the advantage over other indigo vats, of much greater penetration of thick or closely packed materials. This doubtless results from the fact that in this vat alone is the reducing agent present in a soluble form. It is therefore sought to discover some process having this advantage, without the great disadvantage of the unstable nature of the hydrosulphite. The reducing agent must be in alkaline solution but not too strongly alkaline, or the resulting shades are weak and dull and animal fibres are injured. This defect of too great alkalinity is shown by the proposed alkaline glucose vat.

Useful results are obtained by using an alkaline solution of a stannous salt, e.g., a solution of stannous chloride in caustic soda. The vat is thus prepared:—

Steep 500 grms. of ground indigo in four times the amount of hot water, and grind together into a paste. Then make the following solutions (1), 250 grms. of glucose in 2 litres boiling water, (2) 500 grms. of caustic soda in 5 litres warm water, (3) 500 grms. of stannous chloride in 1.5 litres warm water. Add solution (3) to solution (2) with constant stirring. The resulting liquid must be quite clear. 750 grms. of indigo paste are well mixed with solution (1), the mixture slowly heated to 60° C., and this temperature maintained while the alkaline tin solution is gradually stirred in. A clear golden yellow liquid results. This, diluted with 20 litres of water, is the required vat, in which the goods are dyed as usual. After the necessary number of dips, the goods are washed in water containing a little hydrochloric acid, then washed with water and dried. The resulting dyes are very bright and quite even, and penetration is complete. The fastness is considerably improved by subsequent steaming for a short time without pressure.—R. B. B.

Aniline Black (Grawitz's) with Sulphocyanides. Henry Schmid. *Chem. Zeit.* 1896, 20, 51–52. (See also this Journal 1882, 361.)

A criticism of Grawitz's process (*Eng. Pat.* 2614, 1895; this Journal, 1895, 569). Author states that with the formula given (1 mol. aniline salt, $\frac{2}{3}$ mols. sodium chlorate, and 1 mol. ammonium sulphocyanide) at most a very indifferent grey is obtainable, by whatever method of steaming. In the presence of vanadium, the sulphocyanide may not exceed $\frac{2}{3}$ mols., or 20–25 grms. per litre of dye. Better results are obtainable if manganese chloride be substituted for the vanadium, and with 1 mol. of aniline hydrochloride, $\frac{2}{3}$ mols. NaClO_3 , $\frac{2}{3}$ mols. NH_4CNS , and $\frac{1}{4}$ mols. $\text{MnCl}_2 + 4 \text{ aq.}$, in the proportion of 100 grms. of aniline salt to the litre, the black by steaming is satisfactory as regards its quality, but offers no advantages over the ferrocyanide black. The new black of Grawitz is said to be inferior to and dearer than Prud'homme's black, to turn green, and it is moreover alleged that the fibre is tendered. Another objection is, that the dye-liquor rapidly decomposes. For oxidation black, the sulphocyanide process offers no special advantages, Witz having pointed out as early as 1881 (this Journal

1882, 361) that ammonium sulphocyanide retards the development of the black, the effect being already noticeable with 10 grms. to the litre of dye, and above 30 grms., the development becomes difficult.—I. S.

Tissue Printing, Recent Progress in. Oesterr. Wollen- und Leinen-Ind., 1896, 15, 9.

Silk Tissues.—The colour-mixtures employed, are in general similar to those which are used in printing woollen fabrics, but certain shades, especially dark browns, are not easy to obtain on silk.

Reserve-patterns are still printed with melted fat and wax mixtures, but the grounds are now chiefly dyed with the basic colouring matters.

For discharge-printing, the tissues are dyed with acid azo-dyestuffs, the discharges being obtained with zinc dust or stannous salts.

Mixed Silk and Cotton Tissues.—Large quantities of these are printed. The colours applied, with few exceptions, are the same as those employed in calico printing, basic dyestuffs being principally used for bright colours.

Reserve-effects are produced on black grounds by padding the mixed fabrics with an aniline black mixture, drying at a low temperature, printing, and developing the black in the ordinary manner.

Discharges are effected with stannous salts or zinc dust on grounds dyed with the cotton-substantive azo-colouring matters.

Cotton Tissues. Bleaching.—For scouring for printing purposes, the apparatus of Thies and Herzig and of F. Gebauer is finding increased employment.

Several large concerns are experimenting with electrolytic bleaching processes.

Azo-colouring Matters formed on the Fibre.—A bluish shade of red is obtained from diazo-*p*-nitrobenzene and "naphthol R" (*Eng. Pat.* 16,987, of 1894; this Journal, 1895, 803), a mixture of β -naphthol with 2'-2'- β -naphthol-sulphonie acid.

Several derivatives of *p*-nitraniline, sent into commerce under the names of nitrosamine red (*Eng. Pat.* 20,605 of 1893; this Journal, 1894, 1189), azophor red (*Eng. Pat.* 21,227, of 1894; this Journal, 1895, 962), and paranitro red (*Eng. Pat.* 18,429 of 1894; this Journal, 1895, 800; 1896, 27), possess the advantage, it is stated, of giving diazo-salt solutions, which are more stable than those ordinarily prepared from *p*-nitraniline. It is discovered, however, that the diazo-solutions directly obtained from *p*-nitraniline may be kept for a moderate length of time in the absence of sodium acetate, a salt which is usually added to them. It is advisable, therefore, not to add this salt until immediately before the solutions are required for use.

The blue azo-colour from dianisidine is not in extensive use, owing partly to the inability of the colour to completely resist the action of weak acids (e.g., those of the perspiration), but primarily to the difficulty of obtaining even shades of it.

Benzidine is considerably used, along with *o*-nitraniline and dianisidine, for various shades of brown, puce, &c.

The "azo-blacks," for printing on calico prepared with sodium β -naphtholate, have not met with much success, partly no doubt owing to the fact that logwood-black mixtures, acidified with acetic acid, may be used for the purpose. In the black and scarlet style, aniline black is printed along with a thickened solution of sodium β -naphtholate, and after the black has been developed, the fabric is padded on its printed surface with a solution of a diazo-*p*-nitrobenzene salt.

For resisting the formation of the naphthol-azo colours, potassium bisulphite is in many cases found to be a satisfactory agent. The red from *p*-nitraniline is not perfectly resisted by it, when oil compounds are employed in the β -naphthol preparation-solution for the cloth, but in their absence a pure white is obtained. The shade of red, however, is rather dull and yellow.

White and colour reserves, under *p*-nitraniline red and α -naphthylamine chloride, are largely produced.

No means have as yet been discovered for completely resisting the azo-colours from benzidine. The reserve-effects on grounds coloured with these, are consequently, confined to colour-patterns.

It is important that the apparatus used in the development of the azo-colours on cotton shall be so constructed that the immersion of the tissue in the diazo-salt solution (contained in the trough of a mangle, for example) is of very brief duration, the combination proceeding and becoming completed as the tissue afterwards passes in the air over a system of rollers, prior to being washed and soaped.

Basic Colouring Matters.—Instead of printing the discharge-mixtures after mordanting with tannic acid, this is now deferred until the tannic acid has been combined with antimony oxide, better results being thus obtained. The cloth, after rinsing, is dyed various colours: navy blue, green, red, &c.

This process, however, seems likely to be superseded by a method of discharging after padding or dyeing with the colouring matters in question, which consists in applying an oxidising mixture of sodium chlorate and potassium ferrieyanide (such as is used for discharging indigo) and steaming; pigments, with albumin, being added for colour-discharges.

Aniline Black.—A new method of obtaining reserves under this colour is to print a mixture of zinc oxide and sodium acetate or potassium thiocyanate, for white, with basic or cotton-substantive colouring matters, or pigments and albumin for colours, and to pad with an aniline black mixture, and steam-age, &c., as usual.

The padding-mangle employed is provided with three bowls, two for squeezing and one for supplying the colour-mixture to the lower of the two squeezing-bowls. The cloth passes between the squeezing-bowls and then over steam-heated drying-cylinders.

Cotton-Substantive Dyestuffs find important and increasing application in dyeing cotton fabrics for printing discharges upon, and in tinting grounds, being principally applied for the latter object in the starch-paste used in the process of finishing.

Indigo.—Kalle's salt (Eng. Pat. 4287 of 1893; this Journal, 1893, 988; and 1894, 145) and the more recently discovered "indophor" (Eng. Pat. 9291 of 1894; this Journal, 1895, 477), are not much used. Very fast blues, similar in shade to those obtained from indigo, but more readily and economically produced than these, are obtained from various colouring matters now available, of which brilliant alizarin-cyanine may be cited as an instance.—E. B.

Printing, Direct, of Basic Dyestuffs on a Ground dyed with Substantive Colouring Matters. E. Grossmann. *Färber Zeit.* 7, 131—132.

The valuable property of the direct cotton dyestuffs of acting as mordants for basic colouring matters may be made use of in printing, by printing a solution of a basic dyestuff thickened with starch and gum tragacanth on cotton dyed with a "direct" dyestuff. After printing, the goods are steamed and then soaped at 40° C. The process is much simpler than the discharge method, no stannous chloride or tannin being required, nor is the treatment with tartar emetic necessary. Tartar emetic affects injuriously many direct dyes, e.g., Chrysamine and Chicago Blue. The effects produced differ from the discharge effects with the same dyestuffs, since the pattern does not show the colour of the printed dyestuff, but a mixture of this and the ground colour. For instance, with Chrysophenine G and Malachite Green a bright yellowish-green results, with Congo Orange R and Methylene Blue 2 B, a black, and so on. The fastness of the colour compares favourably with that of discharge colours.—R. B. B.

Colours, Alkaline Discharge, on Turkey Red. B. Maslowsky. *Färber Zeit.* 7, 33—35.

TURKEY-RED calico, either plain or printed with fast colours, is in great demand in Russia. Formerly the printed fabrics were produced by hand printing with bleaching powder discharge colours, but, since the introduction of roller printing, alkaline discharge colours have been employed. Turkey red is dyed in two shades, the yellower for all-red fabrics or those printed in black, the bluer shade for white and coloured discharge printing. For the latter is used an

Alizarin containing 70—73 per cent. of Flavopurpurin, 20—22 per cent. of Alizarin, and 7—8 per cent. of Anthrapurpurin.

Printing with Black.—A strong Vanadium aniline black is employed; after printing, the goods are subjected to oxidation, passed through a weak soda and chalk bath with or without the addition of $\text{Na}_2\text{Cr}_2\text{O}_7$, washed, and dried.

White Discharge.—A thickening is prepared consisting of caustic soda and gum Seuegal. Stannous chloride is very gradually added whilst maintaining a low temperature. On the addition of sodium silicate and glycerin the discharge is ready for printing.

Yellow Discharge.—This may consist of the thickening described, with the addition of lead chloride, glycerin, and silicate of soda, or of plumbate and silicate of soda.

Indigo Blue Discharge.—Contains, besides the above white discharge, glucose and indigo, with a further quantity of caustic soda. Before printing, the pieces are prepared with glucose and dried on a cylinder.

Green Discharge.—A mixture of Indigo with the plumbate of soda yellow discharge.

In all cases after printing, the pieces are steamed for 1—2 minutes, then immediately fixed and washed. Fixing consists in treatment in four successive baths. The first and second contain silicate of soda, the first being twice the strength of the second. The remaining baths contain water only. The first three are kept boiling, the last is cold.

The yellow requires a further treatment with potassium bichromate and hydrochloric acid to develop the colour. Finally all are dried in the air, finished with gum Seuegal and Turkey red oil, and again dried.—R. B. B.

PATENTS.

Cloth and like Materials, Transferring from One Machine or Place to Another, in Bleaching, Dyeing, Finishing, and other Works, A New or Improved Apparatus for. J. Smith, Heywood. Eng. Pat. 7403, April 11, 1895.

AN apparatus for conveying cloth continuously from one machine to another during the process of finishing, &c.

It consists of two endless travelling aprons. One of these receives the cloth from one of the machines, the other is arranged above the first and is shorter. The cloth is transferred to the latter and then withdrawn in the open state by the second machine.

The cloth while upon the longer apron may be submitted to certain treatment, for example, dyeing, to effect which the apron is caused to pass through a dyebath.—E. B.

Rhea, Ramie, China Grass, and other Vegetable Fibres, and Undyed Fabrics Made from Vegetable Fibres, Improvements in the Mode of Bleaching. R. W. E. MacIvor and J. Chester, London. Eng. Pat. 10,424, May 27, 1895.

THE bark and resin or gum are first removed from the fibres, which are then thoroughly washed in hot water. Bleaching is accomplished by immersing the fibres, for a period not exceeding two hours, in a dilute solution of potassium or sodium permanganate, and then, for half an hour longer, in the same bath after the alkaline permanganate left in it has been decomposed by the addition of the requisite amount of hydrogen dioxide. Any manganese hydroxides retained by the fibres are removed by rinsing in dilute sodium bisulphite solution, and the fibres are thoroughly washed and dried.

The order of the principal operations as given above may be reversed, the hydrogen dioxide being first applied and then the alkaline permanganate.—E. B.

Bleaching Agents, Improvements in Electrolytic Decompositions, and especially in the Electrolytic Production of, and their Uses, and in Electrodes and Apparatus therefor. [Anode and Heating Bleaching Vat.] H. Blackman, New York, U.S.A. Eng. Pat. 11,016, June 4, 1895.

THE disadvantages attending the use of the weak solution of hypochlorite yielded by the electrolysis of brine, are overcome by heating the bleaching vat to a temperature of from 130° to 160° F. After passing through the bleaching vat, the solution is cooled and returned to the electrolytic cell, where it is re-electrolysed, and again passed into

the bleaching vat. The improved anodes are formed of conductive metallic oxides, preferably magnetite or ilmenite, which may be sawn into shape or fused with black slag and cast into the required form. The above process may be used in conjunction with the centrifugal electrolytic cell described in Eng. Pat. 19,170, 1892 (this Journal, 699, 1893).—G. H. R.

Yarn, Dyeing and Drying; Improved Process for. T. F. Hassler, Augsburg, Germany. Eng. Pat. 20,153, Oct. 25, 1895.

The yarn is wound on perforated, aluminium tubes closed at one end with valves, and terminated at the other with hollow, screw-threaded pins. The latter serve to attach the yarn tubes to a system of pipes contained in a frame. To dye the yarn the frame is lowered into a dye vat, and the liquors are drawn through the yarn by means of a pump. The drying is similarly effected by drawing hot air through the yarn, the frames, to this end, being placed in a heated chamber and attached to a fan.—E. B.

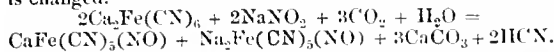
ERRATUM.

This Journal, 1896, 272, col. 1, line 17 from top. For "Cochineal" read "Cochineal."

VII.—ACIDS, ALKALIS, AND SALTS.

Nitroprussides, A New Method of Production. C. Marie and R. Marquis. Comptes rend. 1896, 122, 473.

Nitrous acid, set free by carbonic acid, reduces potassium ferriocyanide to ferrocyanide, and produces a small quantity of nitroprusside; acting on potassium ferriocyanide it produces nitroprusside, but the presence of alkaline carbonate prevents the completion of the reaction. If calcium ferriocyanide be employed, however, the whole of the ferriocyanide is changed.



This equation was verified by determinations of the calcium carbonate and hydrocyanic acid formed.—A. C. W.

Importation of Ammonia into United States. Board of Trade Journal, May 1896, 586.

A COMMUNICATION, dated April 16 last, has been received at the Foreign Office from Mr. A. G. Vansittart, Her Majesty's Consul at Chicago, stating that a considerable amount of ammonia is being imported by the packing houses established in Kansas City and throughout the west for freezing and cooling purposes.

It appears the demand exceeds the American supply. As these houses must keep a large stock in hand, one important firm in Kansas City has contracted for a whole year's import of ammonia to come from Berlin.

PATENTS.

Chlorides and other Salts, Improvements connected with their Electrolysis, and the Evaporation of Solutions. [Fuel Economy.] H. Tee, Liverpool. Eng. Pat. 6565A, March 30, 1895.

THE fuel is employed to raise steam for a high pressure engine which drives the dynamo. After use in the engine the steam which is still considerably above the atmospheric pressure, is conducted into covered salt pans, where it is condensed. The steam from the covered brine pans, which is at or near the atmospheric pressure, may be used in the low pressure part of the engine, or in a vacuum engine, from which it passes into a condenser, preferably formed of open brine pans. The same fuel is therefore used both for the electrolysis of sodium chloride, and for the production of common salt from brine.—G. H. R.

Chlorides and other Salts, Improvements connected with their Electrolysis, and the Evaporation of Brine and other Solutions. [Fuel Economy.] H. Tee, Liverpool. Eng. Pat. 6565, March 30, 1895.

ACCORDING to this invention the steam used in the engine employed for driving the dynamo for electrolytic purposes, is produced by evaporating brine in a covered vessel. If the steam be at or near the atmospheric pressure, the engine

will be a low pressure one. After use in the engine the steam is passed into pipes or chambers connected with open salt pans and condensed there, thus making the salt pans act as a condenser to the engine. The coal is therefore first used to generate steam and produce salt. The steam is utilised in the engine, and in condensing evaporates brine.—G. H. R.

Brine, Treating in the Manufacture of Salt, An Improved Method of and Apparatus for. J. Todd, Andreas, Isle of Man. Eng. Pat. 8342, April 27, 1895.

THE invention relates to economising the heat in the fire-gases as they leave the flues under an ordinary horizontal salt pan. A vertical boiler, egg-ended at the top, is set against the end of the salt pan farthest from the fireplace, through which one or more tubes (three are shown) pass, communicating with the furnace flue. The boiler is completely closed, and the tubes conveying the fire-gases issue through a plate in the top, into the chimney flue. This boiler is filled with brine through a valved pipe, its lower part being provided with a discharge valve for removing sediment; a tapped pipe from the boiler immediately over the salt pan permits discharge of the heated brine into the latter. It is stated that "owing to the peculiar construction of the boiler and to the fact that it is closed air-tight, the brine in it can be heated up above the temperature necessary to form crystals in an open pan, so that when the brine flows into the open salt pan the crystals will at once form."

—E. S.

Soluble Bodies, Envelope or Covering for Use in Preserving; An Improved. A. Le Chatelier, Paris, France. Eng. Pat. 7192, April 8, 1895.

See under I, page 341.

Alkaline Nitrates, the Decomposition of, Improvements in and in Apparatus for. H. K. Baynes and The Chemical and Electrolytic Syndicate, Limited, London. Eng. Pat. 7273, April 9, 1895.

A MIXTURE of an alkaline nitrate with about 2 parts of ferric oxide is delivered gradually into a slowly revolving, slightly inclined retort, by means of a hopper and archimedian screw. The retort, except as to its ends, is heated by a furnace, and is provided with longitudinal ribs internally, to keep the particles of the charge in motion; and their adherence to the sides is prevented by the blows of hammers on the sides of the retort effected automatically by "wipers," acting on the hammers fixed externally, and controlled by springs. Air, or steam and air, is passed into the retort at its lower end (where also is the outlet for the mixture as it is worked off), and the nitrous fumes have exit, either through the hollow archimedian screw or through a specially-provided passage, into suitable apparatus for transformation into nitric acid. The fixed product of the process, an alkaline ferrite, is lixiviated, to obtain caustic alkali and ferric oxide for re-use.—E. S.

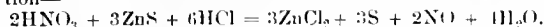
Nitric Acid and the Recovery of By-products, Treating Nitrates for the Production of, Improvements in. R. Main, Stevenston, and W. Donald, Saltcoats, Ayrshire. Eng. Pat. 23,819, Dec. 12, 1895.

A MIXTURE of sodium nitrate and manganic oxide is heated in a muffle furnace, and the nitrogen oxides evolved are taken to an oxidising tower, charged with nitric acid and water. The nitric acid recovered may be distilled with sulphuric acid to obtain strong nitric acid, and the dilute sulphuric acid remaining may be concentrated, the vapour from it being returned to the tower. The furnace product, consisting of soda and manganous oxide, is treated with water, steam, and a current of air, to obtain caustic soda and to regenerate manganic oxide for re-use.—E. S.

Zinc, Chloride of, and other Metal Chlorides, Improvements in the Manufacture of, applicable also to the Manufacture of Acetate or Sulphate of Zinc. C. Hoefner, Giessen, Germany. Eng. Pat. 7560, April 13, 1895.

To obtain zinc chloride, blende is treated with nitric acid, either mixed with hydrochloric acid, or with sodium chloride and sulphuric acid, under conditions to set free the sulphur

without oxidising it, and so as to liberate nitric oxide (easy to regenerate as nitric acid) as is represented by the equation—



Sodium sulphate, if present in the solution, may be separated by freezing. If the solution, after purification, be used to obtain chlorine and zinc by electrolysis, the residual solution is again used in the treatment of zinc ores. Zinc sulphate is obtained from blende by treatment with nitric and sulphuric acids. Ferric chloride may be obtained from sulphide ores by the first described process, and its solution be utilised as a solvent of zinc from roasted zinc ores.

Equations are also given, representing the processes for obtaining nickel sulphate, cupric chloride, and lead acetate from the respective sulphides.—E. S.

Cyanides, Improvements in the Manufacture of. H. W. Crowther, West Bromwich, E. C. Rossiter, and G. S. Albright, Birmingham. Eng. Pat. 8669, May 1, 1895.

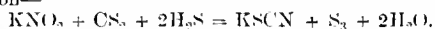
THE inventors have found that the process and apparatus for drying potassium or sodium sulphocyanide described in Eng. Pat. 8305, 1894 (this Journal, 1895, 656) are adaptable for transforming such sulphocyanides into cyanides by heating them with zinc or lead.—E. S.

Nitrogen, Fixation of, and the Production of Cyanides, Improvements in the. T. Twynam, Egham, Surrey. Eng. Pat. 9332, May 11, 1895.

LUMES of coke saturated with potassium or sodium carbonate are exposed in a basic-lined chamber or shaft to a current of the waste gases passing off from a Bessemer converter, between the commencement of the carbon period and the drop of the flame; though, in basic steel making, the gases may pass until about the middle of the afterblow. The cyanide formed may be washed out of the coke; or it may be made to yield ammonia by passing air and steam after the hot furnace gases.—E. S.

Sulphocyanides, Manufacture of from Nitrites, Bisulphide of Carbon, and Sulphuretted Hydrogen. O. Imray, London. From Goerlich and Wichmann, Hamburg, Germany. Eng. Pat. 11,287, June 8, 1895.

A NITRITE, potassium nitrite for instance, carbon bisulphide, and hydrogen sulphide are heated together in a closed vessel provided with an agitator and pressure gauge, to about 120° C. to obtain potassium sulphocyanide, sulphur being separated. The proportions used are indicated by the equation—



The nitrite is added in aqueous solution into which the H_2S has been passed; or the latter may be forced into the digester.—E. S.

Cyanogen Compounds, Improvements in the Manufacture or Production of. A. von Rad and J. Rosenfels, Pforse-Augsburg, Bavaria. Eng. Pat. 1022, Jan. 15, 1896.

BARIUM or calcium carbide, heated to redness in a current of nitrogen, yields a cyanide. It is preferred, however, to employ a mixture of the carbide with a dry alkaline carbonate in equivalent proportion. The following equations show the reactions believed to take place:—

1. $\text{CaC}_2 + \text{K}_2\text{CO}_3 = \text{K}_2\text{C}_2 + \text{CaO} + \text{CO}_2$, and
2. $\text{K}_2\text{C}_2 + \text{N}_2 = 2\text{K}(\text{NC})$.

If ammonia gas, instead of nitrogen, be passed over the mixture at a red heat the cyanide is formed as before, and hydrogen is set free.

In the manufacture of potassium ferrocyanide from potassium carbonate and nitrogenous animal matters, barium or calcium carbide is incorporated with the mixture instead of carbon, with, it is stated, great advantage.—E. S.

Chloride of Lead, for Use in Electrical Storage Batteries, and for other Purposes, Improvements in the Preparation of. A. R. Davis, Manchester. Eng. Pat. 8914, May 4, 1895.

LEAD oxide is treated in a steam-jacketed vessel (preferably made of enamelled iron) with dilute hydrochloric acid,

and when the hot solution is saturated, it is run into a series of coolers, in which about three-fourths of the lead chloride crystallises out. The solution overflows into a well, from which, when cold, it is raised to an elevated steam-jacketed vessel, to be strengthened by addition of more acid, and, when hot, is run into the first-named vessel, provided with an agitator, in which the liquor is again saturated with lead oxide, the process being thus made continuous. As the volume of liquid continually increases, portions of the cooled mother-liquor are periodically withdrawn, to be precipitated by lime or soda, the lead oxide thrown down being utilised in the dissolving vessel. Acetic or nitric acid may be added to the hydrochloric acid used.—E. S.

Chlorine and Alkalies or Alkaline Earths, Treating Chlorides for the Production of, and the Recovery of By-Products, Improvements in. R. Main, Stevenston, and W. Donald, Saltcoats, Ayrshire. Eng. Pat. 10,713, May 30, 1895.

A MIXTURE of sodium chloride with manganic oxide is heated with nitric acid, slightly diluted, and the chlorine evolved is collected. The remaining mixture of nitrates with free nitric acid, is evaporated and roasted, and the nitrogen oxides that come off are oxidised to nitric acid by suitable means. The residue is heated with water, and air is blown in to peroxidise the manganese oxides, from which the caustic soda solution is separated, and may be dried up as such or converted into carbonate. Potassium, barium, calcium, magnesium, or other chloride may be substituted for sodium chloride in the process; but if, as in the case of magnesium chloride, the hydrate be not soluble, the residue left after expelling nitrogen oxides is exposed in shallow trays to the action of heated air, to regenerate the manganic oxide. The product may be digested with ammonium chloride, and then with nitric acid, to obtain chlorine.—E. S.

Decomposing Sulphuretted Hydrogen, and Obtaining Ammonia, Compounds of Ammonia, Oxy-sulphides, Sulphides, and Sulphur, Process for. O. Imray, London. From Goerlich and Wichmann, Hamburg, Germany. Eng. Pat. 10,931, June 1, 1895.

HYDROGEN sulphide is passed through a solution of a nitrite, as sodium nitrite for instance, when one or other of the following reactions ensue, according to the proportion of the gas:—

1. $\text{NaNO}_2 + 3\text{H}_2\text{S} = \text{NaOH} + \text{NH}_3 + \text{S}_3 + \text{H}_2\text{O}.$
2. $\text{NaNO}_2 + 5\text{H}_2\text{S} = \text{NaSH} + \text{NH}_4\text{SH} + \text{S}_3 + 2\text{H}_2\text{O}.$

Part of the sulphur dissolves in the alkaline solution, producing an oxy-sulphide.

A mixture of carbon bisulphide and ammonia, heated with a nitrite in a closed vessel, is decomposed with separation of sulphur. Gases or liquids containing hydrogen sulphide may be freed from it by treatment with a nitrite.—E. S.

Acetic Acid, An Improved Process of Obtaining from Pyroigneous Salts. W. P. Thompson, London. From Dr. C. von der Linde, Crefeld, Germany. Eng. Pat. 3987, Feb. 21, 1896.

THE crude pyrolignite (sodium pyrolignite for instance) is thoroughly decomposed by sulphuric or hydrochloric acid, and the acetic acid released is distilled *in vacuo*, in order that it may be obtained free from any tar-spirit or oils contained in the pyrolignite.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

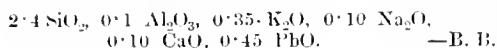
Glass, the Function of Alumina in the Composition of. L. Appert. Bull. de la Soc. d'Encouragement, 1896, 1, [3] 415—416

RESEARCHES on the composition of ancient glass have led the author to certain practical conclusions respecting the influence of alumina when used in the manufacture of glass. It appears that the introduction of alumina impedes, if it does not prevent, the tendency of glass to become devitrified by frequent changes of temperature and besides its

presence admits of the substitution, in equivalent proportions, of lime for soda or potash, the glass thus modified being more solid, more elastic, and less alterable. Alumina substituted for silica in glass in not greater proportion than 7 to 8 per cent. slightly increases its fusibility, its malleability not being sensibly diminished. One inconvenience, however, attends the introduction of alumina into colourless glass; namely, that it tends to give colour owing to its action on any iron oxide present; hence the materials used should be selected of as great purity as possible. The alumina is best introduced as a pure clay, or as felspar. The author sums up by stating that the use of alumina in bottle glass, admits of the introduction of a good proportion of earthy bases; and that its presence is advantageous even in the choicer varieties of glass.—E. S.

Hungarian Stone Ware. Sprechsaal, 1896, 28, 2.

HUNGARIAN makers lacking a plastic clay suitable for the preparation of feldspathic ware made in the English manner have had recourse to the use of as much as 50 per cent. of lime. Stoneware made from such a mixture and burnt at a temperature corresponding with the fusing point of Seger's cones 07—08, is very sensitive to slight differences of temperature in burning, becoming yellow when slightly overburnt, and taking the glaze badly when under-burnt. Ordinary German stoneware glazes and glazes containing boric acid, are unsuitable for this class of goods. Some improvement in the ware may be effected by the addition of kaolin, and, as a glaze, a mixture is used containing 36 parts by weight of litharge, 25 of sand, 18 of felspar, seven of carbonate of potash, seven of salt, and seven of broken glass. This mixture is fused and finely ground, with the addition of a few per cents. of litharge; the composition of the glaze corresponds to the formula—



IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Wood, Strength of, Wet and Dry. J. Marebott, Mitt. k.k. Techn. Gewerbe-Museums (Vienna), 1896, 82—89.

THE author has determined certain mechanical constants of two species of beech, Weissbuche (*Carpinus betulus* L.) and Schwarzbuche (*Ostrya carpinifolia* Scot.) in a moderately dry and in an approximately saturated condition and has arrived at the following conclusions.—(1.) The compressive strength of the wet wood is about 55—60 per cent. smaller than that of the dry and the resistance to bending stress is about 10 per cent. smaller. (2.) The modulus of elasticity of the wood is somewhat increased by saturation with water. (3.) In bending tests, the elastic limit and the ultimate strength are nearly coincident in the case of the saturated wood, there being no intermediate condition of flow. (4.) The work done in the bending test of the saturated wood is about 60 per cent. smaller than in that of the dry.—B. B.

Sand Cement. B. H. Wallin. Thonind Zeit. 1896, 20, 18.

SO-CALLED sand cement consists of Portland cement intimately ground with sand. Three grades are put on the market containing respectively 1 part of cement to 3, 8, and 12 parts of sand. The author has made experiments on the tensile and compressive strength of cement mortars made by mixing these sand-cements with further quantities of sand, the proportions being adjusted to give ultimately 1 part of cement to 25 of sand. The mixture prepared in this manner from the 1:3 sand cement had a tensile strength at 28 days of 7.23 kilos. per sq. centimetre and a compressive strength at the same date of 38.2 kilos. The sand cements having larger proportions of sand, when made into cement mortar so that the final mixture contained the same proportion of cement and sand as that made from the richest sand cement, gave lower results. Any increase in the proportion beyond 25:1 yielded mixtures considerably weaker than those already mentioned.—B. B.

Portland Cement, Hardening of, in Sea Water. R. Bech. Thonind. Zeit. 1896, 20, 32.

THE author has carried out a series of experiments in which test pieces of cement were placed in cages and exposed to sea water constantly renewed by natural flow. One set of tests was made with the cage sunk 1 metre below the level of the water, while in the other it was at the surface of the water, and was exposed or covered according to natural fluctuations. Briquettes of 1 part of cement to 1 part of sand thus exposed gave irregular results, which were on the whole lower than those obtained in fresh water. Briquettes kept on the surface of the water gave results similar to those of the immersed briquettes during the first year, but fell somewhat behind in the second year, a result probably due to mechanical attrition. The usual action of the magnesium salts in the sea water upon the lime compounds of the cement was also observed.—B. B.

PATENTS.

Slag Cements, Improvements in the Manufacture of. S. Jørgensen, Copenhagen, Denmark. Eng. Pat. 9210, May 9, 1895.

ORDINARY slag cement, consisting of a mixture of slag and slaked lime, has its setting time diminished and its strength improved, by admixture with it of a material obtained by slightly igniting a portion of the same mixture. The incorporation of the two materials should be intimate and is preferably effected in "tube mills."—B. B.

Cement Testing. C. Berger. Mitt. k. k. Tech. Gewerbe Museums (Vienna), 1896, 57—81.

See under XXIII., page 380.

Cement, Hot Tests for. L. Erdmenger. Thonind. Zeit. 1896, 20, 2.

See under XXIII., page 380.

Gypsum Pulverised, and other Finely Divided Materials, Apparatus for Drying or Dehydrating, Improvements in and Connected with. H. Kropff, Dusseldorf, Germany. Eng. Pat. 6868, April 3, 1895.

THE apparatus consists of a vertical cylindrical case containing horizontal shelves, provided with stirrers driven by means of radial arms from a vertical shaft co-axial with the cylinder. The material to be dried is fed into a hopper at the upper end of the apparatus, and is passed systematically from shelf to shelf, being heated during this process by steam, circulating also in a systematic manner from the lower to the upper part of the cylinder. Water vapour and dust are drawn off from the top of the cylinder and are caught in a separate drum. The material dried by passage down the cylinder is ejected through openings in the bottom of the casing.—B. B.

Kilns or Furnaces Applicable for Burning Lime and other Materials; Improvements in. H. Simmonds, Colne, and J. Delaney, Horton. Eng. Pat. 7425, April 11, 1895.

THE kiln patented is designed to burn limestone or similar material with gaseous fuel with or without a supplementary supply of solid fuel. It consists of a vertical shaft, the upper part of which contains the material to be burnt while the lower serves as a cooling chamber. An arch divides the two portions, but does not completely cut off access from the upper to the lower. Gas from a producer set at the side of the kiln, enters under this arch and burns there, the flame heating the materials stacked above the arch. The secondary air-supply of the producer is heated by passage through sinuous flues set in the lower part or cooling chamber. An inlet in the side of the kiln opposite the flue admitting the producer gas, allows of the introduction of a subsidiary supply of solid fuel at a point immediately below the bridge. The charging of the kiln is effected through an automatic tipping door at the top.

—B. B.

Cement or Plaster Compounds, Improvements in the Manufacture of. F. W. Golby, London. Eng. Pat. 21,293, November 9, 1895. From F. Schmeisser, Leipzig, Germany.

THE composition patented, consists of about 50 kilos. of plaster and 5 kilos. of cocoanut fibre; sand may be added. The material may be moulded and used for making or repairing floors, roofs and similar portions of a structure.—B. B.

Moisture, Nitre or Acids in or Upon Walls or other like Surfaces, A New or Improved Composition for Preventing the Formation or Accumulation of, said Composition being Capable of being made into Artificial Stones or Bricks for Building Purposes. F. Ludewig, Düsseldorf, Germany. Eng. Pat. 23,981, December 14, 1895.

A COMPOSITION designed for the purposes mentioned in the heading, is made by mixing such substances as powdered charcoal, cement, lime, kieselguhr and peat. Various proportions may be used.—B. B.

X.—METALLURGY.

Pig Iron, Containing very little Phosphorus, Production of. N. Tholander. Oesterr. Zeits. Berg. u. Hüttenw. 1896, 54, 20.

CHARCOAL iron, on account of the very small proportion of phosphorus contained in it, commands a high price, and is largely exported from Sweden. In the production of "grey" charcoal-iron, practically the whole of the phosphorus contained in the ore, limestone, and charcoal employed, passes into the metal; and very little can be done towards its elimination. The main point lies in the choice of suitable and rich ore, as free as possible from phosphorus, and requiring a minimum of fuel and limestone for its reduction. The amount of phosphorus derived from the fuel varies somewhat, but averages (when 50 per cent. of fuel is used) 0.015 per cent. calculated on the iron. In any case the bark of trees is richest in phosphorus; it might be advisable, therefore, to use only such charcoal as has been stored for some time in a dry situation, carefully sifted, and prepared from wood denuded of its bark.—H. T. P.

Lead Slags, as flowing from Furnace, Temperature of. M. W. Iles. School of Mines Quarterly, 17, 20—25.

THE method of taking the temperature, was to place a steel bar of from one to two pounds weight in the flowing slag, and when hot to withdraw it, plunge it and any adherent slag into a weighed quantity of water, and note the rise in temperature. It was noticed that the larger the amount of slag adhering to the steel, the lower was the result, which seemed to indicate that the figure taken for the specific heat of the slag was too high. Furthermore a lower result was obtained, when the steel bar was heavier, thus, a piece of steel weighing 1.07 lb. gave a resulting temperature of 2,170° F., whereas another piece weighing 1.875 lb. indicated 1,641° F., or a difference of 529°. This is at present inexplicable. The averages of the temperatures obtained with two separate furnaces were 1,878° and 1,642° F.

—A. W.

Gases from Lead Furnaces, Temperature of. M. W. Iles. School of Mines Quarterly, 17, 19—20.

TESTS of the temperature of exit gases from two blast furnaces smelting silver, lead, and gold ores, working as far as possible under exactly the same conditions and both possessing the same amount of accretions of sulphides of zinc and lead upon the side walls, showed an average temperature for 28 days of 214° F. The temperature of the gases increased as the wall accretions increased. A standard dial pyrometer and a Siemens copper ball pyrometer were used so as to check one another and the averages of the results obtained with each were nearly identical.—A. W.

Pig Iron, Sulphur in, Drown's Method of Determining. G. Auchy. J. Amer. Chem. Soc. 18, [4], 405.

See under XXIII., page 381.

Platinum, The Assay of. E. H. Miller. School of Mines Quarterly, 17, 26.

See under XXIII., page 379.

PATENTS.

Pulverised Ore and Other Substances, Improved Apparatus for Roasting. Paul Naef, Argentine, Kansas, U.S.A. Eng. Pat. 2736, Feb. 7, 1895.

A ROTATING inclined iron cylinder lined with firebrick or other refractory material, is connected at the upper end with a fixed chimney, and closed at the lower end by a plate, through the centre of which a tube passes into the interior, and is surrounded by a larger tube, closed at the top, but having apertures at the lower end, so that the air passes along the inner tube and back through the outer tube on its way to the inside of the cylinder. The cylinder is divided longitudinally into chambers by iron partitions, having apertures to allow the ore to pass from one chamber to another, as the cylinder revolves. Neither the tubes, nor the partitions extend into the upper part of the cylinder, which, however, is furnished with longitudinal ridges. The feeding hopper is at the upper end, whilst the discharge is effected through apertures in the bottom plate, fitted with spring valves, which in course of the revolution are released by fixed cams, and thus the apertures are temporarily opened.—D. A. L.

Reverberatory Furnaces used for Metallurgical Purposes, Improvements applicable to. John Spencer, Conthridge, Lanarkshire. Eng. Pat. 8848, May 4, 1895.

A FUEL chamber forms part of the same structure as the reverberatory furnace, the communication between them being below an adjustable hanging bridge, and brick chequer work is arranged in the communicating passage. Coal is charged into the fuel chamber up to or above the bottom of the hanging bridge, and air for combustion is introduced under pressure into a perforated box at the lower part of the fuel chamber, opposite the bridge, and having to pass through the fuel. Air may also be introduced from the top of the structure into the communicating passage to complete the combustion of the gases. By preference the air is pre-heated by the waste gases from the reverberatory or otherwise.—D. A. L.

Iron and Steel, Manufacture of, Improvements in, by which Sulphur is eliminated. Henry Clement S. Dyer, Elswick Works, Newcastle-on-Tyne. Eng. Pat. 9081, May 7, 1895.

THE presence of manganese being ensured, the ordinary process of making iron and steel is interrupted, by allowing the molten pig iron to cool to a temperature, at which sulphur combines more readily with manganese than with iron. At the blast furnace this takes place before running on to the pig bed, and in the Bessemer process, before charging into the converter, whilst in the open hearth it is effected by turning off the gas, and may be accelerated by adding cold metal. In any case time enough must be given for the combination and removal of the sulphur, and to this end arrangements to retain the metal at the required temperature are mentioned.—D. A. L.

Iron, Case-Hardening; Improved thin Liquid Substance for. William Phillips Thompson, Liverpool. From Hans Schaaf, Charlottenburg, Germany. Eng. Pat. 9610, May 15, 1895.

THE mixture consists of the following substances and is preferably prepared in the following manner, though the proportions may be varied. 200 grms. of potassium ferrocyanide and 40 grms. of powdered chalk are stirred together, whilst a mixture of 100 grms. of water-glass and 75 to 100 grms. of water is gradually added; more water-glass is next stirred in until the mixture has become gelatinous; it is then rendered permanently thin by the addition of ammonia. Articles are brushed over well with the mixture, warmed, re-brushed, and finally heated in a coal or charcoal furnace.

—D. A. L.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Persulphuric Acid, the Formation of. K. Elbs and O. Schönherr. *Zeits. f. Elektrochem.* 2, 245—252.

FAIRLY strong solutions of persulphuric acid have been prepared, as suggested in a former communication (this Journal, 1895, 583 and 1896, 277). A cylinder 14 cm. high and 7 cm. diameter, containing a porous cell which nearly filled it, had a stopper through which were sealed the electrodes (a large slit hollow cylinder in the porous cell as cathode, and a wire of about 2.5 sq. cm. surface, bent in a ring round the middle of the cell, as anode), and which was also provided with a gas delivery tube. The cell, nearly filled, contained 110 c.c. of sulphuric acid of 400 grms. H_2SO_4 per litre, and the outer space 70 c.c. of acid of 500 grms. H_2SO_4 per litre. The anode was red-heated just before beginning, the whole plunged in broken ice, and a current varying from 3 to 2 ampères passed for 13 hours, a copper voltameter being continually in circuit, and a water voltameter connected so as to be brought into circuit at will. The yield of persulphuric acid (58 c.c., containing 129 grms. H_2SO_4 and 510 grms. $\text{H}_2\text{S}_2\text{O}_8$ per litre), amounted to 29.6 per cent. of that corresponding to the electricity which had passed. 40 c.c. of the anode fluid, precipitated by barium carbonate and filtered, gave a fluid free from hydrogen peroxide, barium, or sulphuric acid, containing 519 grms. $\text{H}_2\text{S}_2\text{O}_8$ per litre.

Portions of different concentrations kept and analysed from time to time, showed that pure solutions are fairly stable, but that as the amount of free sulphuric acid present increases, so does rapidly the rate of decomposition of persulphuric acid. As might have been expected, dilute solutions, even when sulphuric acid is present, are more stable than strong solutions. Rise of temperature quickens the rate of decomposition, but the last portions of persulphuric acid are very stable, even when boiled in acid solution with oxalic acid.

The presence of such sulphates, as those of ammonium, nickel, potassium, or aluminium, exerts great influence in increasing the yield of persulphuric acid formed by electrolysis in a given time. Other sulphates are found to act similarly, though to different extents. Some average figures are given in another table. The much greater influence of potassium than of sodium sulphate is remarkable. Aluminium sulphate is very active even in very small amounts.

The condition of the electrodes affects the yield. They should be freshly heated to redness before each experiment. The authors have not been able to discover the precise way in which this heating acts, but it seems that a smooth electrode is better than a rough one, for platinising the anode reduced its activity, whilst on again heating the platinised anode to redness, and especially on red-heating after dissolving off the deposited platinum by aqua regia, its activity was restored. The anode should be arranged horizontally, that the persulphuric acid formed may not remain in contact with it and be itself electrolysed.

Ammonium sulphate is the most suitable salt to use, as it is more soluble than the potassium or the aluminium salt; more especially too, as the aluminium persulphate when formed cannot be crystallised. The normal sulphate is used, in saturated solution, and on filtering from the separated persulphate, the solution should be neutralised with ammonium carbonate before saturating again with ammonium sulphate.

Schoop has stated that lead persulphate is precipitated on adding lead acetate to ammonium persulphate, and draws therefrom support for Darrieus' hypothesis of the chemical actions in storage cells. This is erroneous, as pure ammonium persulphate gives no precipitate with lead acetate; Schoop's precipitate was simply lead sulphate. The authors have before shown that Darrieus' hypothesis, as far as it is based on the behaviour of persulphuric acid, is untenable.—J. T. D.

Persulphuric Acid, Formation of, in Storage Cells. Paul Schoop. *Zeits. f. Elektrochem.* 2, 272—275.

ELBS and SCHÖNHERR (this Journal, 1896, 277), state that: 1. No persulphuric acid is formed when sulphuric acid of

such strength as is used in storage cells is electrolysed with such current densities as occur there; 2. Persulphuric acid in dilute sulphuric acid solution has no oxidising action on lead oxide, and hence cannot be operative in storage cells; 3. The precipitate which the author obtained by acting on lead acetate with potassium persulphate was simply lead sulphate, and contained no lead persulphate.

To overthrow Darrieus' hypothesis it would, in the author's opinion, be necessary to show, not only that persulphuric acid does not remain in quantity after the action in the cell has stopped, but that it is not continuously formed and decomposed during the action, leaving only traces at the end.—J. T. D.

Bleaching Agents, Improvements in Electrolytic Decompositions, and especially in the Electrolytic Production of, and their Uses, and in Electrodes and Apparatus therefor. [Anode and Heating-Bleaching Vat.] H. Blackman, New York, U.S.A. Eng. Pat. 11,016, June 4, 1895.

See under VI., page 355.

Manganese Carbide. H. Moissan. *Comptes rend.* 1896, 122, 421.

See under 11., page 343.

Analysis, Electro-Chemical Methods, which can be Usefully Applied. B. Neumann. *Zeits. f. Elektrochem.* 2, 231, 252, and 269.

See under XXIII., page 378.

PATENTS.

Secondary Batteries, Electrode Plates or, Process for the Production of. C. Lucknow, Deutz, near Cologne, Germany. Eng. Pat. 5205, March 12, 1895.

THE inventor follows the methods of Planté in forming his electrodes by electrolysis. He prefers "strongly diluted" electrolytes for obtaining a maximum degree of oxidation, his "treatment being distinguished by the application of strongly diluted, slightly acid, neutral or weak alkaline solutions of fixed percentages" ["The most suitable fixed percentages of salt amount, according to the kinds of salt, to from 1 to 3 per cent. of the anhydrous salts; and the quantity of the free acids or caustic alkali must not exceed 1.5 per cent. of the solution. The use of such strongly diluted electrolytes forms solely the characteristic feature of the invention"]. As salts employed as electrolytes, are used:

"a. The salts of all the light metals (*i.e.*, of those metals whose oxides are heavier than the elements themselves) and of ammonium, during the decomposition of which by the electric current no products of decomposition appear at the + pole, which have a retarding effect on the oxidation of the metallic lead."

"b. The double salts or salt mixtures of the light metals and of ammonium with each other and having the above-named qualities."

"c. The salts of the heavy metals (*i.e.*, those metals, the oxides of which are lighter than the elements themselves), their double salts or salt mixtures with each other, or with the light metals and the ammonium, the above-named qualities being taken for granted, and in which a separation of the metal at the - pole either does not take place at all or may be prevented by a slight quantity of free acid."

—J. C. R.

Chlorides and other Salts, Improvements connected with their Electrolysis and the Evaporation of Solutions [Fuel Economy]. H. Tee, Liverpool. Eng. Pat. 6565A also 6566, March 30, 1895.

See under VII., page 356.

Electric Batteries, Improvements in or connected with [Carbon Positive]. C. P. Shrewsbury, F. L. Marshall, J. Cooper, London, and J. L. Dobell, Modbury. Eng. Pat. 8306, April 26, 1895.

THE improvement consists in enclosing the carbon electrode in a porous cell which is suspended from the lid or cover of the battery, the cell being large enough to allow of the free circulation of the fused nitrate. It is claimed that

this arrangement facilitates the combination of the oxygen of the fused salt with the carbon electrode, and that the carbon dioxide produced readily escapes at the top of the cell in a pure state. The negative element is formed of iron or other suitable material.—G. H. R.

Electric Batteries, Improvements in or connected with [Carbon Positive]. C. P. Shrewsbury, F. L. Marshall, J. Cooper, London, and J. L. Dobell, Modbury. Eng. Pat. 8876, May 4, 1895.

THE object of this invention is to simplify and improve the construction of the battery described in a previous patent (Eng. Pat. 12,483, June 27, 1894; this Journal, 1895, 974). The battery consists of an oblong rectangular trough, of iron, divided by transverse plates of the same material, which extend to a height below the level of the fused nitrate. These divisions are in electrical connection with the iron trough, and form with it the negative electrode. The positive electrodes are carbon plates, which are enclosed in porous jars which pass through the lid of the battery, and are suspended from it by flanges formed on them. A rim surrounds each opening in the cover, and fixed upon, and in electrical contact with the upper end of each carbon plate, is a corresponding cover which fits upon the rim surrounding the slot. Surrounding the entire group of the carbon plates and their covers is another rim, thus forming round each opening a channel which is filled with a suitable alloy of low melting point. This alloy is kept fused by the heat of the cell, and maintains electrical connection between the positive plates while sealing the cover. An inclined circulation pipe connects the opposite ends of the cell, and the fused nitrate enters this pipe at the lower end, and passes through it to the upper end, which is provided with a perforated arm contained in a recess in the side of the cell. At the opposite end of the cell is a vaporising chamber, which is wholly or partially immersed in the fused nitrate which maintains it at the required temperature. A reservoir containing nitric acid is placed above the vaporiser, and connected with it by a pipe and suitable valve, so that the supply of acid can be regulated. A pipe provided with a back pressure valve connects the vaporiser with an injector placed near the lower opening of the circulation pipe, so that the acid fumes produced in the vaporiser are injected into the spent nitrate and regenerated.—G. H. R.

Electric Batteries, Secondary, Electrodes for, A New or Improved Method of Manufacturing. H. Leitner, Niederschönhausen, near Berlin, Germany. Eng. Pat. 780, Jan. 11, 1896.

ELECTRODES are manufactured by intimately mixing oxide of lead (95) with retort-carbon (5) and glycerin (25 parts). The pulpy mixture (which becomes hot) is moulded to the desired shape and sets to a more brittle mass. It is reduced electro-chemically to porous lead, which is pressed and bent into flat, curved, or cylindrical shape.—J. C. R.

Voltaic Batteries [Secondary], Improvements in. D. G. Fitzgerald and W. C. Bersey, London. Eng. Pat. 1054, Jan. 15, 1896.

THE object is to construct a "dry" (electrolyte) or absorbent battery of low resistance. The absorbent mixtures preferred are compounded as follows:—

	Parts by Weight.
I. Sulphate of zinc (commercial).....	30
Yellow prussiate of potash.....	26
Granulated pumice or Tripoli stone.....	100
11. Sulphate of iron (commercial)	22
Yellow prussiate of potash.....	20
Pumice or Tripoli stone (granulated).....	100

The absorbent material or mixture of materials is packed in the cell around the plates and saturated with sulphuric acid.

"The sulphuric acid thus added, is of a strength such that the resulting liquid electrolyte will correspond to acid of a density of about 1·300, at which strength of the acid persulphuric acid is not generated."—J. C. R.

Organic Compounds, Improvements in the Reduction of. C. Kellaer, Vienna, Austria. Eng. Pat. 3090, Feb. 11, 1896.

THE inventor claims a process for the reduction of organic compounds (in neutral, alkaline, or acid solution) by intimate contact with an amalgam of an alkaline metal that has been produced by electrolysis in a chamber separate from the reducing chamber. "The reduction process is not limited in its application to a determined class of substances, but can be applied in all cases of reduction where nascent hydrogen can be advantageously used as a reducing agent. Thus the process can be employed for the reduction of nitrobenzene, nitrotoluene, and in general of the nitro derivatives of aromatic hydrocarbons or of the carbon sulpho-acids, and also for the direct production of azo compounds and hydrazo compounds, by reduction of the corresponding nitro substances in alkaline solution. Similarly the reduction of compounds, such as "sugar acid," belonging to the group of carbon hydrates, can be effected in acid solution by means of the process."—J. C. R.

(B).—ELECTRO-METALLURGY.

Silver, Möbius's Electrolytic Method for Refining. G. Faunce. Oesterr. Zeits. für Berg. und Hüttenw. 1896, 44, 30.

THE process described, is in successful operation at the works of the Pennsylvania Lead Company and elsewhere.

The silver to be refined is first treated by ordinary well-known metallurgical processes to reduce the quantity of other metals present (lead, copper, bismuth, &c.) to at most 2 per cent. It is then cast in sheets measuring 45 × 25 × 1·3 cm. and weighing 13—15 kilos. each. These serve as anodes. The cathodes are formed of thin, rolled sheets of pure silver, 33 × 55 × 2 cm. in size. The electrolyte is a solution of the nitrates of copper and silver, to which 0·5—1 per cent. of nitric acid is added to prevent the deposition of the copper. Four cathodes and three anodes are placed in each cell at distances apart severally of 43 mm.

The anodes are enclosed in muslin bags for the purpose of intercepting the undissolved matters which fall from them as the action proceeds. These consist of gold, bismuth, the principal portion of the lead (in the form of dioxide), and a little silver and copper.

A sheet of woollen cloth stretched on a frame near the bottom of each cell, catches the silver as it is removed from the cathodes by a mechanically-moved wooden scraper.

The intensity of the current employed is 18 amperes per square foot of cathode surface.

The silver is collected from each cell at intervals of two days, the gold once a week. The silver is washed with water and then melted in graphite retorts capable of holding 560 kilos. each, and is thus obtained of a fineness of 999—999·5.

The residue of gold, &c., after being melted, granulated, and treated with acid, gives gold of a fineness of 996—998.

To the above process, care must be taken that the amount of copper in the electrolyte does not exceed 4—5 per cent., as otherwise the silver is not obtained in a pure state.

—E. B.

Magnesium, Electrolytic Preparation of. F. Oettel. Zeits. Elektrotechn. 1895, 2, 394.

IN the electrolytic preparation of magnesium the difficulty hitherto has been due to the fact that the metal is not obtained in compact masses but in small spheres which cannot readily be made to unite. This is, no doubt, due to a thin coat of magnesia on the surface of the metal, which is attributed partly to an impurity of magnesium sulphate in the carboallite used as raw material and partly to the presence of aqueous vapour. It is therefore necessary to remove the impurities and to protect the melt from contact with aqueous vapour. A trace of magnesia still present after purification can be rendered harmless by the addition of fluorspar.

The author also describes an apparatus for the preparation of magnesium on a small scale in the laboratory.

—A. K. M.

Galena containing Zinc, The Working of. W. Borchers. Zeits. f. Elektrochem. 2, 277—278.

For some time chemists have sought a method of treating the galenas of Colorado and New South Wales, which contain silver and zinc. The mechanical preparation of the ores has been improved, and the loss of metal in this way lessened, but hitherto no way of utilising the zinc has been devised.

In 1893 the author pointed out that any successful method must proceed, after appropriate mechanical treatment, somewhat on the following lines:—1. Roasting in the air at a low temperature. 2. Completion of the conversion of the zinc into sulphate by treating the mass with sulphuric acid, or sulphur dioxide and air. 3. Lixivation, to extract the zinc sulphate. 4. Working up the solution for zinc sulphate, or by electrolysis for metallic zinc. 5. Smelting the residue for crude lead. 6. Desilverisation. Precisely this process has been worked out by the Broken Hill Company. Siemens Brothers and Co. have undertaken to deposit the zinc from the sulphate solution at a cost of 72s. per ton, making the cost, with the royalty, 92s. per ton. Another way of dealing with the zinc solution is to precipitate it by magnesia.—J. T. D.

Antimony, Electrolytic; A New Commercial Product. Zeits. Elektrochem. 1896, 2, 524—525.

ELECTRO-DEPOSITED antimony is now beginning to appear in the market in very brittle grey plates, 2 mm. in thickness, with the striated or modular surface at the back, which is characteristic of metals so obtained, but on the other side it is smooth, lustrous, and, in places, silver white. The fracture is white and crystalline, and the depositing bath is a solution of a sulphantimonite. Analyses of the deposit before and after fusion, are as follows:—

	Unfused.	Fused to Regulus
	Per Cent.	Per Cent.
Iron	0.008	0.0046
Lead and copper	Trace	0.004
Sodium	0.014	..
Arsenic .....	..	..
Sulphur	0.288	0.001
Antimony	99.690	99.984

—W. G. M.

Metals, Electro-Deposition of; by Alternating Currents. B. Rösing. Zeits. f. Elektrochem. 2, [25], 550—552.

It is known that metals can be deposited from solutions by alternating currents, but no practical application has been made of this, because the amount of metal deposited is small in comparison with the energy expended. This disadvantage can be partly removed by using highly asymmetrical alternating currents. Such currents can be obtained by sending a continuous current through a commutator provided with adjustable brushes, so that the current which issues shall flow in one direction for a definite time *f*, and in the opposite direction for a much shorter time *d*. The author's experiments are comparative. One-half of a constant current is sent directly through an electrolytic cell (the comparison cell); the other half is sent through the above commutator and a similar cell (the experimental cell). The metals deposited are copper and zinc. The ratios of *f*:*d* vary from 90:10 up to 95:5, and the ratios between the amounts deposited in the experimental and comparison cells vary from 75.6:100 to 88.8:100. The results show that the metallic deposits produced by such alternating currents are denser than those produced by continuous currents. But they are not sufficiently extensive to show how high the ratio of *f*:*d* can be chosen, nor do they indicate what is the most suitable frequency of alternation.—D. E. J.

PATENTS.

Sulphide Ores containing Zinc in Association with other Metal or Metals; Improvements in the Treatment of, for the Separation and Obtainment of Metals contained

therein. T. Parker, Tettenhall, Staffordshire. Eng. Pat. 24,861, Dec. 21, 1894.

Roasted ore is treated with dilute sulphuric acid, and the solution is caused to circulate through electrolytic cells, until by deposition of most of the zinc and re-formation of sulphuric acid, the acid strength of the solution is restored; it is then used for treating a fresh quantity of roasted ore, and so on. Fresh sulphuric acid is added occasionally to make good any loss. The negative electrode is zinc or other suitable substance, the positive lead; but when hydrochloric acid is used instead of sulphuric, a carbon or other chlorine-resisting positive is used, and the electrodes are separated by a diaphragm, whilst the residual solution is not used again. A suitable diaphragm is figured and described, having vertical wooden bars, connected at the ends by cross bars and packed between with porous material (glass wool).—D. A. L.

Electro-Deposition of Iron on Copper or other Metallic Surfaces, Improvements relating to the. A. Horns, Hanley, Stafford. Eng. Pat. 4660, March 5, 1895.

THESE improvements relate to the facing of copper plates with iron. The plates are dipped in a solution of potash at 80° F., scoured with a mixture of soda lime and powdered pumice stone, and washed in water. The "striking" bath is made up of 7 oz. of ammonio-sulphate of iron to 1 gall. of water, the anode being of Swedish or other "pure" iron. A potential difference of above 5 volts is employed on this bath. The plates are removed, again scoured, and treated in a bath of ferrous sulphate, 6 oz., ammonium chloride, 3 oz., to 1 gall. of water, worked at a temperature of 120° F., with a potential difference of 1 volt. Old plates to be re-coated are stripped in sulphuric acid solution, 1 of acid to 10 of water, kept at a temperature of 80° F. A dilute solution of potassium cyanide is used for cleaning copper plates from stains, so as to be ready to receive an iron deposit.—J. C. R.

Analysis, Electro-Chemical Method; which can be usefully applied. B. Neumann. Zeits. f. Elektrochem. 2, 231—235; 252—262; 269—272.

See under XXIII., page 378.

XII.—FATS, OILS, AND SOAP.

Cocoa-Butter, Iodine Number and Refractive Index of. A. Strohl. Zeits. anal. Chem. 1896, 35, 166.

SAMPLES prepared from all known trade varieties of Cacao gave iodine numbers varying from 32.8 to 41.7. The same variety may give different numbers according to the year, place of origin, or ripeness of the fruit. The refractive indices, determined at 40°, fell between 1.4565 and 1.4578. A low iodine number is generally accompanied by a low refractive index and *vice versa*.—A. C. W.

Cerotic and Melissic Acids existing Free in Beeswax, Properties of. T. Marie. Bull. Soc. Chim. 1896, 15, 510.

THE results of analyses of cerotic acid and its esters agree with the formulae $C_{25}H_{50}O_2$ or $C_{26}H_{52}O_2$ for the acid. Cerotic acid is easily soluble in methyl alcohol and in ether, melissic acid only slightly. Methyl cerotate crystallises in nearly microscopic needles melting at 62.5° C. (Nalzgier gives 60°). Methyl melissate has the same appearance and melts at 74.5° C. Pure cerotic acid in 1 per cent. boiling alcoholic solution gives no precipitate with magnesium acetate; the salt separates on cooling to 50°, but if the cerotic acid contain melissic acid, there is an immediate precipitate.

—A. C. W.

Fatty Acids, The Oxidation of. T. Marie. Bull. Soc. Chim. 1896, 15, 508.

COMMERCIAL stearic acid was oxidised by alkaline permanganate. From the mixture of acids produced, an acid was isolated by taking advantage of the great solubility of its barium salt. This acid, boiled at 181°—185°, and had the odour of normal valeric acid. The barium salt is stable

and does not smell of ordinary valeric acid; hence, contrary to general statement, normal and not iso-valeric acid is produced on the oxidation of stearic acid.—A. C. W.

Rosin and Rosin Oil; Detection of Oils and Varnishes. F. Ulzer. Mitt. k. k. Tech. Gewerbe Museum (Vienna), 1896, 91—92.

See under XXIII., page 382.

Mineral Oils, Fatty Oils in; Detection of. G. Halphen. Ann. Chim. Anal. Appliq. 1896, 1, 29.

See under XXIII., page 382.

Lubricating Oil, Soap in; Detection of. F. Jean. Ann. Chim. Anal. Appliq. 1896, 1, 31.

See under XXIII., page 382.

Oils, Determination of the Heat of Bromination in. H. W. Wiley. J. Amer. Chem. Soc. 18, [1], 378.

See under XXIII., page 384.

PATENTS.

Vegetable Oils, A New or Improved Process for the Treatment and Refining of, During or Subsequent to their Expression from Nuts, Beans, Seeds, and the like. G. Mitchell, London. Eng. Pat. 9153, May 8, 1895.

THE feature of this invention is in the maintenance of a vacuum in the vessels in which the oil is purified, by which the moisture can be extracted at a low temperature.

—J. J. K.

Oleaginous Materials, A New or Improved Testing Machine for. G. Mitchell, London. Eng. Pat. 16,371, Sept. 4, 1895.

See under XXIII., page 377.

Soap, A New or Improved. J. Stockhausen, Crefeld, Germany. Eng. Pat. 2896, Feb. 8, 1896.

CASTOR or other oil is sulphated, the excess of sulphuric acid being removed by means of sodium chloride; then 60 kilos. of caustic soda lye, 36° B., are added to 100 kilos. of sulphonated oil and the mixture is constantly stirred. An acid soap is obtained in a gelatinous state, which may be further neutralised with alkali if necessary. It is said to possess certain advantages when used in dyeing operations and the preparation of textile fabrics, being perfectly soluble in water and giving a clear solution.—J. J. K.

Soaps, Improvements in the Manufacture of Soft and other. W. Hanley, Gorton. Eng. Pat. 3312, Feb. 13, 1896.

POTASSIUM chloride in the proportion of 1 per cent. is substituted for the potassium carbonate used, and is said to produce a better soap.—J. J. K.

XXIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

Antimony Vermilion, Formation of. J. H. Long. J. Amer. Chem. Soc. 18, [4], 342—347.

THE antimony vermilion prepared in the usual manner by boiling a solution of tartrate or chloride of antimony with sodium or calcium thiosulphate, is impure from the presence of oxychloride. By employing tartar emetic and sodium thiosulphate a pure vermilion was obtained, which analytical results indicated to be Sb_2S_3 .

Attempts made to produce the characteristic red pigment by methods (such as the action of sulphides or sulphur dioxide) other than those comprising the action of thiosulphates on neutral or acid antimony compounds, failed, although the product obtained may be antimony sulphide, the formation of the vermilion being apparently preceded by that of an intermediate yellow product, which suggests that Sb_2O_3 is at first formed from the tartar emetic and then acted on by the free thiosulphuric acid. This view was confirmed by the behaviour of pure antimony trioxide when exposed to the action of solutions of thiosulphate, no

vermilion being formed until the mixture is acidified with hydrogen chloride. That the reaction does not commence by the formation of antimony chloride is shown by the failure to precipitate anything but sulphur when the acid is shaken up with the oxide and the thiosulphate added to the filtrate, whereas if the acid and thiosulphate be first mixed and the oxide subsequently added, even after opalescence has set in, the vermilion begins to come down almost immediately.

In working with the pure trioxide, however, it is not found possible to convert the whole into vermilion, even after exposure for two months, and the amount converted diminishes as the percentage of thiosulphuric acid increases, which is probably due to the greater tendency of the stronger solutions to decompose, with evolution of sulphur dioxide, which in turn subsequently delays the action of the remaining thiosulphuric acid—a fact experimentally demonstrated by the author.

From oxychloride of antimony and thiosulphate the vermilion can be readily prepared, without the presence of any other acid than that resulting from the decomposition of the oxychloride in water.—C. S.

Zinc White, Cause of Yellow Colour of. F. Fuchs and F. Schiff. Oesterr. Zeits. Berg. u. Huttenw. 1896, 44, 29.

CERTAIN samples of zinc oxide, in spite of every endeavour to maintain the manufacturing conditions constant, have a yellow tint which detracts from their commercial value. This discoloration is commonly attributed to the presence of iron. Investigation made with a large quantity of the material proved the absence of iron, but led to the detection of 0.003 per cent. of cadmium sulphide. Seeing that zinc invariably contains cadmium, the fortuitous presence of sulphur would cause the presence of the strongly coloured sulphide. Similarly, small quantities of cadmium oxide or oxide of iron have no sensible influence on the colour. In order to restore the pure white of the zinc oxide it suffices to convert the cadmium sulphide into cadmium oxide by several hours' roasting in air, but a more radical remedy naturally consists in the choice of pure zinc for the production of the pigment.—B. B.

PATENTS.

Inking Rollers, Letterpress Printers', An Improved Composition for. W. Murray and J. Speirs, Glasgow. Eng. Pat. 22,449, Nov. 25, 1895.

See under I., page 341.

Compositions or Compounds for Removing Paint, Improvements in. W. P. Thompson, Liverpool. From C. S. Bailey, St. Augustine, Florida, U.S.A. Eng. Pat. 4249, Feb. 25, 1896.

THIS composition consists of calcium sulphide, 10 parts; oxide, 40; barium oxide, 16; arsenious acid, 10; and soda ash, 24 parts. The whole is mixed with water, starch or other thickening material being added to prevent sediment.

—F. H. L.

(B.)—RESINS, VARNISHES.

Preliminary Report on Two Burmese Turpentine. H. E. Armstrong. Imp. Inst. Scient. and Tech. Research Department Journal, May 1896, 182.

THE crude turpentine from *Pinus Khasya* was a grey, thick, pasty mass, containing a quantity of small pieces of wood. That from *Pinus Merkusii* was more fluid and cleaner in appearance.

About $\frac{1}{100}$ ths of its weight of oil was separated from the *Pinus Khasya* turpentine by distilling with steam, and nearly $\frac{1}{100}$ ths from the *Pinus Merkusii* turpentine. On a previous occasion nearly 17 per cent. of oil was obtained from a sample of the first-named turpentine.

The original turpentine and the distilled oil, in each case, have a very slight but agreeable odour, even less pronounced than that of French turpentine. The two oils are very similar in this respect.

The oil from *Pinus Khasya* appears to be identical with that which the author received from the Colonial and Indian

Exhibition, and examined several years ago, but which he was then led to believe came from the same tree.

The examination of oils of this description with a view to determine their precise composition is a matter of great difficulty. The oil from *Pinus Khasya* is strictly comparable with French oil of turpentine.

The oil from *Pinus Merkusi* is very similar to that from *Pinus Khasya*.

Like French oil of turpentine, both these oils distil within a very narrow range of temperature, near to 155° C., but the oil from *Pinus Khasya* appears to contain a somewhat larger proportion of a constituent of higher boiling point.

The two oils are very nearly alike in relative density viz.:—

	<i>P. Khasya</i>	<i>P. Merkusi</i>
at 20° C.	0.8627	0.8610

They both turn the ray of polarised light to the right, the so-called specific rotatory power being—

<i>P. Khasya</i>	<i>P. Merkusi</i>
+ 36'' 28	+ 31'' 45

The rotatory power of French turpentine is practically always about 36''. The *Pinus Khasya* oil now examined, agrees with that previously obtained from British Burma.

Practically, French oil of turpentine and that from *Pinus Khasya* exactly correspond in properties.

Both these Burmese oils are of the highest quality, and the author believes they would serve every purpose for which oil of turpentine (French or American) is used. They even compare favourably with the French oil, which is the highest quality in the market.

The resin left on distilling off the oil would also, the author believes, be available for all purposes for which ordinary resin is used.

There is no reason, he thinks, why India should not obtain whatever turpentine is required from native sources, if the industry can be developed, and the cost of carriage be not too great.

Rosin and Rosin Oil: Detection of, in Oils and Varnishes. F. Ulzer. Mitt. k.k. Tech. Gewerbe Museen (Vienna). 1896, 91—92.

See under XXIII., page 382.

PATENTS.

Varnish [Amber and Copal], Improvements in the Manufacture of. H. Flemming, Cologne. Eng. Pat. 8915, May 4, 1895.

In order to avoid the necessity for melting amber and copal before making them into varnishes, according to this patent the solvent properties of the chlorhydrins of glycerin, especially the di- and the tri-chlorhydrin, are made use of. One part of dry powdered gum kauri is moistened with an equal weight of the said solvent, and after a time two parts of alcohol are introduced, the mixture being warmed till solution is effected. 10 to 15 per cent. of linseed oil is finally added to complete the material. It forms a quick-drying varnish, which may be applied to wood without previous "filling"; and it will bear pumice stone, or polishing with linseed oil.—F. H. L.

Linoleum, Kamptulicon, and other Floor Coverings, Improvements in or relating to the Manufacture of. K. Klie, Lancaster. Eng. Pat. 18,937, Oct. 9, 1895.

See under V., page 353.

Fabrics, Waterproofing, Improvements in Materials or Compounds for. A. J. Boulton, London. From L. P. Converse, Chicago. Eng. Pat. 2201, Jan. 30, 1896.

Three parts of linseed oil are boiled for five or six hours, cooled, mixed with one part of blood, and the whole heated at 100° C. Three-quarters of a part of vaselin or of a similar substance is well worked into the mixture, and pigments such as lamp-black or zinc white may also be added either to obtain a particular colour or to thicken the product. The blood is best used raw and fresh, and it is claimed to be "a quick and good drier, while affording to the fabric . . . peculiarly superior flexibility and softness."—F. H. L.

(C.)—INDIA-RUBBER, &c.

Gutta-Percha, Analysis of. J. Montpellier. Ann. Chim. Anal. Appliq. 1896, 1, 1.

See under XXIII., page 385.

PATENTS.

Gutta-Percha or its Compounds, Treating for the Manufacture of Golf Balls and other Goods, Improvements in. J. H. R. Paterson, Edinburgh. Eng. Pat. 10,715, May 30, 1895.

THE object of this patent is to refine gutta-percha in such a manner that it shall be white throughout, and therefore the better suited for the purposes indicated. The crude material is treated with petroleum spirit (sp. gr. 0.7) at 40°—55° C. Water, somewhat less in volume than the solvent, is added, and the whole agitated violently, and allowed to settle. The clear solution is drawn off, the aqueous residue washed with more spirit, and the insoluble portion thrown away. The whole of the gutta solution is then bleached with sulphurous or hypochlorous acid, well washed again in water, and finally the substance is precipitated by cooling the liquid below 18° C. During this cooling process pigments may be introduced if desired. The gutta paste is placed in a centrifugal machine, washed with fresh light petroleum to free it from resin, dried in a current of air, and finally kneaded under rolls or by other means.—F. H. L.

Waterproof Textile and other Fabrics, Ornamental and other Designs upon, Improvements in the Production of. L. Mistov-ski, Heywood, Lancashire. Eng. Pat. 21,511, Nov. 13, 1895.

GLASS, reduced to an impalpable powder and thoroughly sifted, is applied to the waterproofed fabric, either uniformly all over or in the form of a particular design. This produces a "soft, silky, and luminous effect." If further ornamentation, such as the application of colours, &c., be adopted, a second coat of glass may be employed to obtain a "shot" effect, before the final vulcanisation. Eng. Pat. 1297, 1895 (this Journal, 1895, 748) is referred to.

—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin Estimation, Remarks on the Vienna Method of. J. Schneider. Časopis českého lékařnictva, 1896, 15, 4.

See under XXIII., page 385.

PATENTS.

Leather, Artificial, Manufacture of. O. Thiele and J. Stocker, Stargard, Pomerania, Germany. Eng. Pat. 8960, May 6, 1895.

THE mode of manufacture is as follows:—(1) 5 parts of bone glue are dissolved in linseed oil heated to 100° C., or in tannin solution, or glycerin and paraffin. (2) 5 parts of caoutchouc and 10 parts of colophony or other resin are dissolved in 100 parts of sulphide of carbon and 6 parts of spirits. The solution of these materials occupies from 12 to 24 hours. The two solutions are mixed, with continuous stirring, in a glazed closed vessel. (3) 50 parts of ivory nuts, cocoa or para nuts, are ground, boiled in glue solution, and then dried. (4) 50 parts of cotton fibre, or wool or other fibre, are finely divided by suitable machinery. The materials referred to under (3) and (4) are combined with those referred to under (1) and (2) by working them together for a sufficient length of time in a rag engine, and during this process 5 parts of carbonate of lime, and such colouring matters as may be required, are incorporated with the mass. In order to produce a good white colour, 5 parts of camphor must be dissolved in process (1) or (2), it being then possible to effect a thorough bleaching. A silky lustre is imparted to the material by adding to the product of operations (1) to (4) a little acetic acid and boiling for five minutes.

When the working of the mixture in the rag engine has been continued sufficiently long, the product is spread out and dried in the air for 1 or 2 hours. The dried mass is

rolled to the desired thickness and then passed through a mixture of concentrated nitric and sulphuric acids in order to remove the fibrous particles visible on the surface and to impart to the whole a homogeneous, horn-like appearance. Washing and drying follow, and the mass is introduced into a solution of camphor in ether; it is then again rolled, the rollers being heated to about 50° C. The proportions above given can be varied within certain limits. A recipe for the substitution of bone glue for caoutchouc is given.—A. G. B.

Inking Rollers, Letterpress Printers', An Improved Composition for. W. Murray and J. Speirs, Glasgow. Eng. Pat. 22,449, Nov. 25, 1895.

See under 1., page 341.

XV.—MANURES, Etc.

Sulphate of Ammonia as a Fertiliser. U.S. Consular Reports, April 1896, 547.

ACCORDING to a report from Consul Seymour, of Palermo dated January 23, 1896, experiments made in that consular district with sulphate of ammonia as a fertiliser for the citrus and the vine have proved very satisfactory, the results being a good healthy growth imparted to the plant, uniting with the increase of fruitage an improvement in quality. The best results are obtained by mixing the sulphate of ammonia with the natural fertilisers.

Fertilisers, Commercial; Phosphoric Acid in, Various Modifications of the Pemberton Method of Determination. E. G. Veitch. J. Amer. Chem. Soc. 13, [4], 389.

See under XXIII., page 381.

Alumina in Phosphates, Determination of. H. Lasne. Bull. Soc. Chim. 1896, 118, 146, and 237.

See under XXIII., page 381.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Advance in, for the Last Quarter of 1895. Dingler's Polytech. J. 1896, 299, 118 and 166.

J. MÜLLER (Die deutsch. Zuckerind. 1895, 20, 1713) has found that the sugar prepared from beetroots infected with dry-rot has a grey colour. Inasmuch as the juice from such roots contains alkaline sulphides and salts of iron, a double sulphide of potassium and iron is formed, the sodium analogue of which is well known in the soda industry as an objectionable compound possessing considerable tinctorial properties. According to Lunge's investigations, this sulpho compound, even when present in some parts per million, produces a pale to dark green or brown coloration according to the concentration. Now a combination of the dark green with the natural yellow colour of the raw sugar will give rise to a grey-coloured product. If dilute acetic acid be poured over grey sugars, the sulpho salt is decomposed, and the yellow colour of the raw sugar reappears. The sulpho salt is soluble in the alkaline sugar liquor, and is partially precipitated, but never completely, during the saturation process, a portion remaining in solution even when the reaction of the liquor is neutral. The sulpho salt may perhaps be formed by the decomposition of albuminoids, or it may owe its origin to the presence of sulphuretted hydrogen in the carbon dioxide employed for saturation. The juice from normal beet always has an alkaline reaction, and sulphuretted hydrogen cannot be detected in it. Notwithstanding the fact that the juice is warmed to 80° C., the albuminoids can only partially separate, for they were found in the scum which forms over the boiling mash. If slaked or unslaked lime be added to raw juice raised to 80° C. according to the time and the quantity of lime employed, the filtrate gives a distinct brown coloration with basic lead acetate, which indicates the presence of alkaline sulphides. Conditions of working which hinder the precipitation of the albuminoids before the addition of lime, such as alkaline raw juice, inefficient preliminary heaters, the adoption of too low a temperature during diffusion, an undue addition of lime, or inappropriate defeccation with

caustic lime, tend to produce a grey coloration of the raw sugar. The sulpho salt may be decomposed by passing a compressed current of air through the warm liquor at the first saturation. If carbon dioxide gas of about 20—29 per cent. be made use of, which contains about 6—10 per cent. of oxygen, it is probable that the decomposition of the sulpho salt is attained.

Maxwell (Sugar Cane, 1895, 27, 575) has investigated the efficacy of certain chemical substances employed in defeccating raw juice, namely, sulphurous acid, acid phosphate of lime, and lime. When gaseous sulphurous acid is passed into the juice, the density is raised to 0.3° Bx., with moderate decolorisation and coagulation. The inversion is slight in the cold, very appreciable at 60°, and considerable in the case of hot thick liquor through which the gas has been passed until good decolorisation is attained. Acidity due to calcium acid phosphate has about the same inverting power as that due to sulphurous acid, and accordingly appears to invert sugar more readily than phosphoric acid. Sulphurous is more efficacious as an antiseptic than other acids. Both agents precipitate the albuminoids present in the juice, but sulphurous acid only does so when a considerable quantity has been absorbed. Gums or pectins are not precipitated by either of these agents, although lime at a high temperature effects their precipitation, as also that of the greater portion of the albuminoids. In consequence of the inversion caused by acidic defeccating agents, the juice should only be treated with them in the cold, and must be neutralised before heating with lime. Good working results are attained if the juice, after being rendered alkaline with lime, is neutralised with acid phosphate and heated. It is, however, advisable to make use of sufficient phosphate to produce an acid reaction, otherwise much lime will remain in the juice, in combination with organic acids, and the acidity produced by the organic acids set free by the small excess of phosphate causes but slight inversion.

The bleaching effect of sulphurous acid takes place only in acid solution; after the neutralisation the juices which have been treated with phosphates are usually better in colour because it causes the precipitation of pigments. Sulphurous acid has, however, a strong bleaching effect upon caramel-like products.—J. L. B.

Sugars, Molecular Modifications of, The Cause of Multi-rotation. C. Tanret. Bull. Soc. Chim. 1896, 15, 349—351.

It is shown that certain sugars can exist in two or more isomeric forms, each possessing a rotatory power peculiar to itself, and that bi-rotation and other changes in the rotatory power observed under varying experimental conditions (alterations in the concentration of solutions, influence of heat, alcohol) are due to the preponderance—in any particular case—of one of these modifications.

When a sugar is dissolved in water, the β - (or ordinary stable) modification is formed. The transformation is complete, however, only in dilute solutions. Beyond certain limits of concentration, the conversion of the solid (α -) sugar into the β -variety is only partially effected, and in consequence the rotatory power is increased. This is particularly the case with dextrose and galactose. The rotation of a concentrated solution, falls, not immediately, but gradually to the normal value, when diluted with water. The specific rotation of a sugar in alcoholic solution may be greater or less than in aqueous solution. In the former case this is due either to its incomplete transformation into the β -modification, or to the formation of a third variety possessing increased optical activity. Similarly, a diminution in the rotatory power is owing to the production of a third (γ -) species of the sugar. In the case of galactose the γ -modification has been isolated in the crystalline state. In general, the influence of heat on sugar solutions resembles that of alcohol; both diminish the specific rotation of lactose, galactose, and arabinose, and increase that of xylose. On the other hand, the rotation of dextrose, although diminished by alcohol, is only sensibly influenced in very strong solutions at an elevated temperature, by heat.

—H. T. P.

Beetroot in Germany. Chamber of Commerce Journal, April 1896, 58.

From the results of the campaign of 1895-96, the difference in the production of beetroot in Germany as compared with that of France appears to be a very drastic one. The *Freisinnige Zeitung* reports on the subject of statistics for January as follows:—

	Germany.	France.
Factories in operation	397	255
Area planted with beetroot..... Hk.	374,174	200,000
Crop of beetroot harvested..... T.	11,672,000	5,411,000
Sugar produced.....	1,610,000	670,000
Production of sugar per head... Qs.	13'03	33'18
Production of beetroot per head ..	311'94	270'42
Sugar obtained from beetroot .. "	13'25	12'00
Beetroot worked up per factory .. Qs.	294'00	152'420
Receipts from the production of .. M.	0'900	0'770
sugar per head (28 M. per 100 kilos.).		
Quantity of beetroot required to .. Qs.	7'25	8'08
produce 1 q. of sugar.		

According to these figures the production of beetroot and sugar per head, also the yield of the beetroot, is therefore considerably larger in Germany than in France, and our contemporary remarks that they speak very powerfully against an increase in the premium.

PATENTS.

Starch from Raw or Crude Starch, Process for obtaining Pure. W. von Siemens, Berlin, and O. N. Witt, Berlin. Eng. Pat. 24,455, Dec. 20, 1895.

By "raw or crude starch" the inventors mean the starchy product obtained from cereals, &c. by levigation in the usual manner. The object of this invention is to prepare from this a pure starch which will be colourless, and have the cellulose membrane of the starch grain so acted upon as to readily yield to any chemical treatment; a starch thus prepared is readily converted into sugar by mineral acids without a vestige of bad odour and yields a perfectly smooth paste when treated with boiling water or potash, &c. This pure starch is prepared as follows:—The crude starch is stirred up with water, and a saturated solution of potassium permanganate is added until the pink colour of the latter persists in the liquid. The manganese peroxide formed by the decomposition of the permanganate is deposited in a state of extreme division on the starch, which thereby assumes a brown colour. The starch is then well washed and treated with a dilute solution of hydrochloric acid, varying, according to the nature of the starch, from 0.5 per cent. As soon as a sample of the starch when treated with alkali gives a perfectly clear solution, the starch is filtered off and freed from excess of manganese peroxide by sulphurous acid or dilute bisulphite, washed, and dried.

—A. L. S.

Sugar-refining, Improvements in. M. Zahn, Artern, Thuringia, Germany. Eng. Pat. 3565, March 21, 1896.

In place of using ordinary steam for washing sugar in the centrifugals, the inventor proposes to use superheated steam; by so doing he states that much loss of sugar is avoided. Also he introduces into the last portion of the steam the required amount of "blue" mixed with a small quantity of water or syrup, and thus the bleaching of the sugar is conveniently effected.—A. L. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

Fermentations caused by Friedländer's Pneumococcus.

L. Grünbert. Bull. Soc. Chim. 1896, 87-96.

THE results obtained in the fermentation referred to are summed up as follows:—1. The products of the fermentation are, ethyl alcohol, acetic acid, levo-rotatory lactic acid, and succinic acid. 2. Whilst, however, glucose, galactose, arabinose, mannite, and glycerin give levo-rotatory lactic acid and no succinic acid, saccharose, lactose, and maltose give both, whilst dulcitol, dextrin, and potatoes produce only

succinic acid without a trace of lactic acid. 3. The acetic acid produced, is always obtained pure and free from both formic and propionic acids. 4. Ethyl alcohol is formed in smaller quantities than the other products, in some cases being absent, as in the fermentations of potatoes and arabinose, and only present in traces in the fermentations of glucose, saccharose, or maltose. In dextrin fermentations it is mixed with a small quantity of higher alcohols. 5. Most striking is the behaviour of the two isomerides mannite and dulcitol, the former giving levo-rotatory lactic acid, whilst the latter yields only succinic acid, furnishing a rare example of a ferment giving different products according to the nature of the sugar decomposed.—T. A. L.

Schizosaccharomyces Pombe, The Dextrin-fermenting Yeast, and its Practical Employment. F. Rothenbach. Zeits. für Spiritusind. 1896, 19, 58, 59, 71, 87, 88, 104, 105, 111, 112, 119, 120.

This yeast was first described by Saare, who obtained it from an African beer (Zeits. für Branerei, 1890). See also this Journal, 1896, 127.

It is considered to ferment dextrin, as it will attenuate malt worts lower than Frobberg yeast, the latter being considered able to ferment all the sugars present. However, to place the matter beyond doubt, a solution of dextrin was prepared which gave no coloration with iodine and no osazone with phenylhydrazine, a little asparagin and mineral nutritive matter were added, and the solution seeded with this yeast. About one-half of the dextrin was fermented.

At temperatures of 55°—65° F. Pombe yeast ferments slowly and acts like a low-fermentation yeast; at temperatures of 85°—95° F., fermentation proceeds very rapidly and as with high-fermentation yeasts. Pombe yeast produces a much larger amount of acidity than other yeasts, nearly or quite 10 times as much; it has a destructive action on bacteria; when sown in a malt wort which had been strongly infected with various bacteria, it fermented as usual, and during the fermentation the bacteria were found to be destroyed; this latter property has probably some connection with its acid-producing power.

Comparative experiments were made on the attenuative power of Pombe yeast and a distillery yeast of high attenuative power; a wort was prepared such as would occur in a distillery, containing free diastase; the former yeast was always found to attenuate the wort the most; and when mixtures of the two yeasts were employed the attenuation was always considerably lower, a result which may perhaps be caused by the enzyme of Pombe yeast hydrolysing the dextrin to sugar, which is then fermented by the other yeast.

In a wort prepared from potatoes, Pombe yeast does not increase satisfactorily; this difficulty was, however, overcome by the addition of a small quantity of ammonium phosphate. Some fermentations were made on the large scale in distilleries, pitching with Pombe yeast instead of that usually employed; they were not at all satisfactory, the difficulties being chiefly caused by too slow reproduction and fermentation.—A. L. S.

Malt and Beer Worts, Nitrogenous Constituents of.

E. Erich. Der Bierbräuer, 1895, 10, 146.

THE conclusions are:—

1. The analytical separation of albuminoids, peptones, and amides cannot as yet be satisfactorily effected. By Stutzer's method (copper hydrate and phosphotungstic acid) more peptones but less amides and albuminoids are found than by the lead acetate tannin process. In the latter, the filtrate from the albumin precipitate should be completely freed from lead before the separation of the peptones is attempted.

2. During the germination of barley, the albuminoids are peptonised to an extent proportionate to the degree of growth—at least within the limits obtaining in practical malting. At the same time, those constituents that produce turbidity (glutens) correspondingly disappear.

3. A further peptonisation of the albuminoids takes place when malt is mashed, the temperature most favourable to the action being about 50° C. A slight tendency to gluten

turbidity may be overcome by prolonged mashing at the above temperature.

4. In respect to nutritive power as yeast-food, peptones and amides are about on a level, and both greatly excel the albuminoids.—H. T. P.

Lupulin, Chemical Constituents of. H. Seyffert and R. v. Antropoff. Zeits. f. d. ges. Brauwesen, 1896, 19, 1—5.

The results arrived at are summarised as follows:—
1. Bungener's acid (Hopfenbittersäure) is identical with the β -acid obtained from the petroleum ether or ethereal extract, after precipitation of the α -body with lead acetate.
2. The α - and β -acids, on treatment of their ethereal solutions with potash, suffer no decomposition beyond the formation of a slight amount of resin.
3. Lerner's acid (Bittersäure) cannot be identical with the α -acid.
4. Besides the two known α - and β -acids, no third crystalline substance of similar nature could be detected. The yellow crystalline substance found in the γ -resin appears to possess the character of a weak acid, but to belong to a quite different class of compounds.
5. The hop resins are mixtures of substances in different stages of decomposition; Hayduck's modifications appear to be present in the decomposition products.
6. The quantitative determination of the α - and β -substances can be best effected by extraction of the hops with ether, evaporating the extract, and exhausting the residue with petroleum ether.—A. K. M.

Wines, Sweet; Investigation and Valuation of. M. Barth. Forschungsber. Lebensmittel, Hyg., forens. Chem., Pharmakogn. 1896, 3, 20.

TOKAY wines partake of the character of concentrated wines made from somewhat over-ripe grapes without addition of sugar or alcohol. Szamorodni wine contains in 100 c.c. at least 3 grms. of sugar-free extract, 0.2 gm. ash, and 0.04 gm. phosphoric acid. The glycerin content is proportionally high, and never falls below the observed limit for the better German wines. The sugar consists chiefly (70 per cent. or more) of levulose. In sweet Tokay of the first quality the sugar-free extract amounts, even in the poorer specimens, to 3.5 grms. per 100 c.c., and with a sugar content of 8 per cent. and upwards it is at least 4 grms. per 100 c.c. The ash in the same brand is not lower than 0.25 gm. per 100 c.c., nor is the phosphoric acid lower than 0.06 gm. per 100 c.c.; the proportion of glycerin to alcohol is very high. The common Hungarian sweet wines also have a sugar-free extract of 3 grms., an ash of 0.24 gm., and a phosphoric acid content of 0.04 gm. per 100 c.c.; the glycerin is somewhat lower than it is in German wines, and levulose is the predominant sugar. The so-called Greek dry wines are not concentrated wines; they contain 2.4 grms. of sugar-free extract, 0.2 gm. of ash, and 0.017 gm. of phosphoric acid per 100 c.c.; if they contain added alcohol, this is not more than 2 per cent.; levulose forms the larger portion of the little still unfermented sugar. Greek sweet wines contain at least 3 grms. of sugar-free extract, 0.24 gm. of ash, and 0.03 gm. of phosphoric acid per 100 c.c. The glycerin content of these wines is lower than that of Tokay wines, since added alcohol is present, although at least 6 grms. of alcohol per 100 c.c. are derived from fermentation of the must; levulose is the preponderating sugar and its proportion to the dextrose varies from 55:45 to 66:34. The sulphuric acid should not exceed 0.092 gm., nor the chlorine 0.03 gm. per 100 c.c.

The methods adopted for the examination of the above wines were those commonly in use.—A. G. B.

Wine, Occurrence of Copper in. H. Karsten. Zeits. österr. Apoth. Ver. 1896, 34, 84.

In Switzerland, attacks resembling those of dysentery, following the consumption of a certain wine, were traced by the author to the use of copper sulphate as a means of protecting the grape vines from the ravages of disease fungi. Copper sulphate solution is employed in the form

of a spray, and appears to be in some way retained by the unripe grapes. A polished knife blade dipped into the wine in question for 12 hours became covered with a distinct film of metallic copper.—H. T. P.

Alcohol Vinegar, Insufficiency of the Methods employed for the Detection of. H. Quantin. Monit. Scient. 1896, March, 10, 171—176.

SINCE it is impossible to trace "wine vinegars" chemically to their natural source, it is necessary to make a further study of the properties of such vinegars for the purpose of identification. In the meantime it is proposed to make compulsory the introduction into the alcohol used in manufactures of some substance readily detected, and at the same time unobjectionable from a hygienic point of view. Phenolphthalein would be very suitable, and in quantities of 5—6 mgrm. per litre is quite harmless. By this addition the object in view would be precisely attained.—N. H. J. M.

PATENTS.

Yeast, Improvements in and relating to the Production of. H. H. Lake, London. From J. Effront, Brussels, Belgium. Eng. Pat. 4598, March 4, 1895.

YEAST is cultivated in a wort prepared from maize, rice, or other cereals, to which has been added a small amount of hydrofluoric acid, salicylic acid, or other antiseptic. The crop of yeast is then sown in a similar wort containing a greater amount of antiseptic, and the crop obtained in one containing a still greater amount, and so on until the amount of antiseptic is as great as possible. The yeast is then separated by filtering the whole of the fermented wort through a filter press, and the pressed yeast dried by exposure to the air or in a suitable vacuum apparatus, but not at a higher temperature than 40° or 50° C. Yeast thus prepared is said to retain its vitality for a length of time.

The claim is for a process of preparing a special yeast called "dregs yeast," the characteristic feature being the recovery of the yeast from a fermented wort, by retaining it with the said dregs by filtration and desiccation. The yeast obtained is, it is said, of particular physiological character, and of an absolute unchangeability.—A. L. S.

Grain, Pneumatic Malting of; Improvements in or relating to the. A. Kinder, London, and H. Baird, Glasgow. Eng. Pat. 6661, April 1, 1895.

IN the working of a pneumatic malting drum, difficulty has been found in passing the air uniformly through the whole mass of the grain, as the thickness of grain between the inlet and outlet channel is much less in that portion of the drum which happens to be uppermost at any one time. In order to obviate this the inventors propose to shut off the air current from that portion of the drum. This is effected by two radial vanes pivotally mounted within the central air conduit; these vanes extend from end to end of the conduit. Each end of the space occupied by the vanes is suitably blocked, so that the space between them forms a closed chamber from which the air currents are excluded.

During the latter stages of malting, instead of passing fresh air through the grain, the inventors circulate the air over and over again; by so doing they claim that the withering is more efficient. The air is suitably attempted between each passage.—A. L. S.

Brewers' Refuse, Grains, and the Whe, Improvements in or relating to Apparatus for Drying. E. Makin, Manchester. Eng. Pat. 9835, May 18, 1895.

THIS relates to improvements of Eng. Pat. 18,833 of 1891 (this Journal, 1892, 932). The substances to be dried are introduced into the hot-air current as it enters the rotating drying drum. The dried material is carried forward by the air current and passes out with it. The interior of the drum is fitted with baffle plates in order to prevent a too rapid passage of the materials through it.—A. L. S.

Liquids, Fermented and Distilled, Improvements in Processes of Manufacturing. A. Myers, Philadelphia, U.S.A. Eng. Pat. 2587, Feb. 1, 1896.

In the preparation of a wort for distillers it is customary, when using raw grain, to employ a small quantity of malt, in order to supply the diastase necessary to convert the starch into sugar. The inventor states that the hull or bran of the grain, which is separated in the milling process, contains diastase, and may be substituted for the malt commonly used.

The bran is soaked in five to six times its weight of water at a temperature of 75° F. for from 18—36 hours. The mixture is added to the well-boiled mash when it has cooled to 155° F. in the proportion of 6—12 lb. of bran to each bushel of malt. The process is then carried on as usual.—A. L. S.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Bakeries, Petroleum Residues Used in. Dunbar. D. Med. Wochenschr. 1896, 22, 33.

MINERAL oil is said to be used for smearing bread and other articles which are baked, in order to prevent adjacent loaves from sticking together. Fatty oil has hitherto been used, but at the present time a petroleum residue is employed, known to commerce as bakers' oil (Brötöl). Illness has been traced to this practice in Hamburg, for it appears that the oil is not dissipated in the baking, but penetrates to a depth of some millimetres into the crust and causes digestive disturbances.—B. B.

Gelatin in Meat Extracts and Commercial Peptones, Estimation of. A. Stutzer. Zeits. anal. Chem. 34, 568.

See under page XXIII., page 386.

Butter, Method for Determining the Purity of, by Means of the Density. R. Brüllé. Comptes rend. 1896, 122, 325.

See under XXIII., page 385.

Butter-Fat and its Substitutes; Examination of. H. Bremer. Forschungsber. Lebensmitt. Hyg. forens. Chem. Pharmacoegn. 1895, 2, 124.

See under XXIII., page 385.

Cheese, Extraction of Fat from, for Examination. O. Henzold. Milch Zeit. 24, 729.

See under XXIII., page 386.

PATENTS.

Margarines and Natural Butters, Improvements in the Manufacture of, and Apparatus therefor. A. Dubuisson, Brussels, Belgium. Eng. Pat. 4489, March 2, 1895.

The inventor claims a process by which all microbes and germs are destroyed, so that the article may be kept for more than two years.

The apparatus consists of a water-bath communicating with a vat heated by steam up to at least 110°. The fat traverses a suitable coil placed in this vat, and after passing through a siphon it goes through another coil of pipes into a refrigerator, where it is cooled down to 30°—15°, and is then allowed to flow to a churn from which the air is excluded. The tubes through which the melted fat passes are best made of tin.—L. de K.

Coffee, A New Process for Torrefying. A. Eckardt, Dortmund, Germany. Eng. Pat. 5776, March 19, 1895.

THE roasting of coffee, coffee extract, or coffee substitute is effected with additions of $\frac{1}{2}$ —2 per cent. of tannic acid, 1—50 per cent. of sugar, and $\frac{1}{2}$ — $\frac{1}{2}$ —3 per cent. of vegetable fat. A pure and uniform product of superior taste is claimed.—L. de K.

Food Material, Improved Means for Preserving, and in Apparatus for the Purpose. A. Sowerbutts, New Southgate. Eng. Pat. 9160, May 8, 1895.

AN air-tight case filled with carbon dioxide, nitrogen, or with other inert gas, with mechanical arrangements for introducing the articles to be preserved.—L. de K.

Food Extracts, Powdered or Granulated; Improvements in or relating to. W. P. Thompson, London. From The New Process Food Co., Milwaukee, U.S.A. Eng. Pat. 3130, Feb. 11, 1896.

ONE part by weight of malt and three parts of fresh meat are macerated together at 120° F. until the proteids of the meat have been converted into peptones and rendered soluble and digestible, which generally takes from three to four hours. The liquid is strained and mixed with 1 per cent. of salt, and then evaporated *in vacuo* at 100°—110° F. The dry mass is granulated.—L. de K.

(B).—SANITATION; WATER PURIFICATION.

Matches in Belgium, Manufacture of. J. Soc Arts, 44, 1896, 526.

A RECENT number of the Bulletin of the Labour Bureau of France states that the following new regulations are in force in Belgium relative to the manufacture of matches. It is not to be considered sufficient in the future that the dipping plates of white phosphorus matches should be covered with hoods connected with a strong draught chimney; a suction tube connected with mechanical ventilation must be established on the level of the dipping plates and vessels which contain the paste. Respecting the composition of the pastes, they must not contain more than 80 per cent. of white phosphorus without reckoning water; the least infringement of this regulation will not be tolerated, as it is satisfactorily proved that an excellent match paste can be manufactured of this consistency. The dryers, except the tunnels in which workmen must remain, must in future be aired by mechanical ventilators. Permanent committees exist which are to fix the amount of air. The working tables upon which the white phosphorus matches are filled must likewise be ventilated so that the phosphorus vapours may be immediately drawn off to the lower part of the workshop and expelled. The ventilation must be such that, combined with the other causes of removal of the air in the workshops, the expulsion of the air per hour and per workman in each room where white phosphorus matches are handled, shall be at least 2,119 cb. ft. The removal of the air in the rooms where Swedish matches are handled must be 1,060 cb. ft. per hour and per workman, and further, each workman must always dispose of at least 353 cb. ft. of air. There must be in each factory a room where vessels containing water and soap for the use of the workmen shall be placed. The strictest control will be exercised in this respect. Workmen will be subject to a preliminary medical examination and afterwards to a monthly visit, the results of which are to be duly inscribed in a record book. They shall not be allowed to work from the time when they may have been attacked by phosphorus necrosis, or from the period when they appear to be threatened with an attack of this disease.

Paraffin and Mineral Oil Manufacture, The Gases and Effluents from. Chem. Zeit. 29, 1896, 2251—2253.

IN granting concessions to new enterprises, the authorities take into consideration the health of all persons dwelling within the immediate vicinity of such undertakings, and they further protect the agricultural interests in regard to possible injury to vegetation through the escape of gases, and the contamination of the soil by chemical effluents or deposits of flue dust from chimneys.

In considering from a hygienic point of view the methods by which brown coal (lignite) is decomposed, the question relating to the injurious effect of the flue dust on vegetation forms an important factor. In constructing works in which such effect is to be avoided, great stress must be laid on the erection of high chimneys provided with suitable pits for the removal of the flue dust. Maercker, who has investigated this point on behalf of a number of agriculturists, refers

to the general destruction to plant life brought about by the emission of fine dust, and although his remarks are well founded as regards delicate plants, it must be admitted that in the neighbourhood of works in which the destructive distillation of lignite is carried on, and from the chimneys of which fine dust is thrown out in large quantities, corn, potatoes, beetroot, clover, maize, and the like thrive in a remarkable manner. In fact, the luxurious growth of some plants, such as clover, is attributed to the fertilising effect of certain salts contained in the fine dust.

Brown coal is decomposed in vertical cylinders, the resulting gases being in part condensed to lignite tar, whilst the combustible gases are used as fuel for heating the cylinders. The percentage composition of the gases varies considerably with the temperature employed and the mode of firing. By maintaining a temperature of 150° to 160° in the cylinders, the highest yield of tar is obtained and the smallest proportion of non-combustible gas. According to Grotowsky the decomposition of brown coal commences at 112° , carbonic anhydride being liberated, with the formation of a small proportion of hydrocarbons. With a rise of temperature the quantity of the former is rapidly decreased, being to some extent replaced by carbonic oxide, whilst the amount of hydrocarbons is increased. At a red heat the elementary constituents of the coal are resolved into the so-called permanent gaseous hydrocarbons, especially illuminating gases. In addition to gaseous impurities the atmosphere of lignite-carbonising works is frequently contaminated with particles of coke dust, the inhalation of which gives rise to pulmonary complications and injury to the mucous membranes. The effluents, on the other hand, if free from tar and particles of coke, exercise a beneficial influence on vegetation.

The conclusions drawn indicate the fact that the gases derived from the destructive distillation of brown coal are detrimental to animal and vegetable life, unless they are diluted with a sufficient quantity of pure air, in which case it is estimated that at the most only 25 to 30 metres of the adjacent land would be exposed to the influence of the escaping gases. Beyond this distance it would be impossible to discern any prejudicial result.—D. B.

PATENTS.

Town Refuse, Improvements in Apparatus for Burning.

E. E. Glaskin, Harrow-on-the-Hill, Middlesex. Eng. Pat. 6175, March 25, 1895.

THE described apparatus consists of a crucible or combustion chamber supported within, and above the floor of, an annular brick setting, dome-shaped at the top, in such a manner that the products of combustion pass downwards, between the sides and bottom of the crucible and the setting, thus keeping the crucible hot. The crucible is supplied with a hot-air blast through tuyères, and has a loose cone-shaped bottom capable of vertical movement. A fire having been lighted and the crucible made thoroughly hot, the refuse is continuously fed in through a vertical shoot, mixed with fresh fuel if necessary. Part of the mineral matter fuses and escapes round the bottom of the crucible into the chamber below, the dust carried away by the blast settles in the same chamber, and the hot gases are led away through the flue of a boiler or are utilised in any other way.—L. A.

Water Purifying or Softening Apparatus, Improvements in. S. H. and P. E. Hodgkin, London. Eng. Pat. 7545, April 13, 1895.

THE improvements consist in arrangements (1) for intimately mixing the hard water and the reagent solution, and (2) for drawing off the reagent from a store tank under a constant head.—L. A.

Textile Materials and Fabrics, Improvements in the Treatment of. S. Simon and R. Dux, Manchester. Eng. Pat. 8858, May 4, 1895.

TEXTILE yarns and fabrics of any kind are impregnated with antifetorile substances, such as quinine and its salts, acetanilide, atipyrine, &c., the patentees being of opinion that the wearer of fabrics so impregnated will benefit by the action of these substances.—H. S.

Softening Water, Improvements in Apparatus for. C. E. Gittins, London. Eng. Pat. 9829, May 18, 1895.

THE patentee constructs the vessels containing the water to be softened and the reagents to be employed, of the same depth, whilst the respective areas are such as to correspond with the relative proportions in which it is desired to mix the water and reagents. Adjustable siphons are also employed for regulating the supply of the solutions or liquids, which are delivered into a lower cistern.—O. H.

Sewage and other Foul Waters, Improvements in, and in the Production of Compositions adapted to be used in the Treatment of. C. A. Burghardt, Manchester. Eng. Pat. 10,891, June 1, 1895.

A COMPOSITION or cake containing ferric and aluminium sulphates is made by taking an iron ore or any other substance consisting largely of hydratized ferric oxide, also lauxite or any other suitable material containing alumina, boiling the finely-ground substances with sulphuric acid until the iron and aluminium are converted into sulphates, and then evaporating the liquid until on cooling it will set into a cake. Or the ferric sulphate alone may be dissolved in water, a solution of aluminium sulphate added, and the mixed solution evaporated until it will set in a cake. The relative proportions of ferric oxide and alumina in the cake are controlled by analysis of the raw materials, and are varied according to requirements. (See also this Journal, 1894, 832.)—L. A.

(C).—DISINFECTANTS.

Argentine Republic: Sheep Scab and Sheep Dips.

N. S. Consular Reports, April 1895, 519.

See under Trade Report, page 588.

PATENTS.

Disinfecting Apparatus, Improvements in. W. Defries, London. Communicated by G. Herscher and Co., Paris. Eng. Pat. 8223, April 25, 1895.

THE improvements consist (1) in controlling the pressure in a steam disinfecter by causing the steam to blow through a seal of water, disinfectant solution, or other fluid, the depth of which regulates the temperature in the disinfecter; (2) in a disinfection stove in which the air for drying is heated by passage through tubes which pass through the steam space of the boiler; and (3) in an apparatus embodying the above improvements.—L. A.

Insecticides, Improvements in. I. S. and J. T. McDougall, London. Eng. Pat. 9535, May 14, 1895.

TO obviate the necessity of water for diluting a liquid insecticide in order to apply it as a wash, the liquid is incorporated with a suitable absorbent, and, by gently drying the mixture, a powder is produced which can be dusted over the plants. Examples of such mixtures are: (A.) Extract of tobacco, 10 lb.; precipitated sulphate of lime, 90 lb. (B.) Extract of tobacco, 5 lb.; extract of hellebore, 3 lb.; lac sulphur, 10 lb.; dry soap, 2 lb.; kieselguhr, 80 lb. (C.) Arseniate of potash or soda (solution), 2 lb.; extract of quassia, 8 lb.; vegetable fibre (finely powdered), 90 lb.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Sulphite Wood Pulp Process, Sulphur, Consumption of, in the. H. Brünger. Papier Zeit. 1896, 21, [9], 260.

THE table given by the author shows the consumption of sulphur during the months of 1895, at the sulphite pulp mills of J. Halbmayer and Co., Josefsbütte, Bohemia, the absolute dry fibre being taken at 88 per cent. of the pulp.

In round numbers, it was found that 10 kilos. of sulphur were required for 100 kilos. of air-dried pulp (88 per cent.). The sulphur is taken as 100 per cent., and the system adopted consists in absorbing the sulphur dioxide by milk of lime.—S. P. E.

Sulphite Wood Pulp Process; Sulphur, Consumption of, in the. A. Frank. *Papier Zeit.* 1896, **21**, [12], 354-355.

In the preceding abstract, H. Brüngger publishes the monthly consumption of sulphur per 100 kilos. of pulp (88 per cent.) for the year 1895. Although these figures are valuable, and the results of actual practice, the circumstances and conditions of working at this mill must be taken into consideration before any comparison or conclusions can be deduced from them. It is a well-known fact that less sulphite liquor is required by those processes in which indirect steam is employed, as to the Mitscherlich system and Salomon-Brüngger system, as adopted at Josefshütte, than in the so-called Ritter-Kellner process, where steam passes into the liquor direct.

In the latter process a large quantity of steam is condensed, thereby diluting the liquor considerably and necessitating the occasional blowing off to waste of a quantity of unused liquor to give space for the introduction of fresh steam for heating the contents. It is also well known that a weaker liquor may be used for digesting the wood, if it be not required to remove the whole of the incrusting matter from the fibres. Such partially reduced pulp is most suitable for some purposes in which a strong fibre is necessary, but it requires more bleaching powder to whiten it than perfectly reduced fibre does.

The results given by Brüngger do not tell the amount formed of SO_2 and SO_3 respectively. In the author's own plant, in connection with a method for testing the product is provided (see Hofmann's Handbook, p. 1518), he can guarantee 95 per cent. of the sulphur in the form of SO_2 , and in well-conducted mills 98 per cent. is obtained. Without the knowledge of the quantity of SO_2 formed, the results are of little value. Brüngger's report of the consumption of sulphur for 1894 (see *Papier Zeit.* 1895, **2**, 33) shows that in July of that year, when the air was very moist, and the formation of SO_3 likely to be at its maximum, the consumption per 100 kilos. of pulp was only 8.75 kilos., whilst the highest consumption of sulphur was in February (11.3 kilos.). In the year 1895, the highest consumption was in the three summer months (June, July, and August), as might be expected. The author says that by carefully working and recovering the gases, it is easy to produce 100 kilos. of sulphite pulp per 10-11 kilos. of sulphur, even in processes where direct steam is employed.—S. P. E.

Wood Pulp, Moist; Storing of. F. Wolesky. *Papier Zeit.* 1896, **21**, [18], 563.

THE deterioration of moist wood pulp when stored, is largely due to the impurity of the water employed in grinding the wood.

Manufacturers employing clear, pure well or spring water for grinding, are able to produce a wood pulp capable of being stored for a considerable time without deterioration. If the water employed be taken from streams or ponds, which frequently contain a large number of micro-organisms and other decomposable matter, the pulp is very liable to become mildewed, or spotted with fungoid growths. Water containing any effluents from, or located in the vicinity of, breweries, sugar refineries, distilleries, or even sulphite pulp mills, is also liable to contain germs capable of developing an appearance of mildew in pulp. Impure waters such as the above should certainly be treated by some cheap purifying or sterilising agent. The durability of wood pulp may be increased by saturating it with various salt solutions in the process of manufacture, such as common salt, Epsom salt, or sulphate of alumina, which have no injurious effect upon the machinery, nor deteriorate the pulp for paper-making purposes.

These salts may be employed in solutions of $\frac{1}{20}$ th per cent., or more or less in proportion to the impurity of the water. A $\frac{1}{40}$ th per cent. solution of bisulphite of soda may with advantage be employed to improve the colour of the pulp. The store rooms should be large and airy, with a cement floor having a good fall, and plenty of water for cleansing purposes.—S. P. E.

Papers, Sulphite; Gunning of. *Papier Zeit.* 1896, **21**, [27], 861.

Users of sulphite papers complain that the hard and glossy nature of these papers is such that ordinary gum will not readily adhere to the surface. In reply to a correspondent who asks for a suitable gum, or a remedy, the above journal states that envelopes and wrapping papers composed of sulphite fibres owe their value to their beautiful glossy surface. When used for envelopes it is sometimes difficult to get the gum to adhere. The glossy surface refuses to take the gum solution. If resin size has been employed, the free resin fills the pores of the paper surface, and it naturally resists an aqueous solution of gum. This may be overcome by brushing the surface with a weak alkaline solution of soda. A solution of soda, however, destroys the size and also many colouring matters, and may therefore be unsuitable. The difficulty may in some cases be overcome by adding a little spirit to the gum. It is stated that gum arabic may be successfully employed.

—S. P. E.

Strawboards, Turning Yellow of the White Paper Coating. *Papier Zeit.* 1896, **21**, [26], 829.

IN reply to a question relating to the removal of lime from boiled straw pulp by washing, and to the cause of the white paper turning yellow when pasted on the strawboards, a correspondent in the above journal says that at his mill, about 150,000 kilos. of strawboards are coated with paper weekly. The operation is carried out on the machine, and the straw pulp is not washed, nor is this operation necessary if the pulp be properly boiled. The paper covering the boards does not turn yellow. In pasting them by hand it frequently happens that too much of the dilute paste is employed, the water of which saturates the surface of the board, and then penetrates through the paper, which upon drying develops a yellow coloration.—S. P. E.

Filter-Paper, Testing of. *Papier Zeit.* 1896, **21**, [7], 195.

A GOOD filtering paper suitable for chemical laboratory work should stand the following tests:—1. Distilled water after passing through the paper should not leave a residue upon evaporation. 2. Ammonium sulphide should not turn the paper brown. 3. A 10 per cent. solution of hydrochloric acid should not be coloured yellow after passing through the paper. 4. After passing dilute acids through the paper, and then saturating them with alkali, no milkiness should appear. 5. After passing dilute alkalis through the paper and then neutralising them with acids, no milkiness should result.

No. 1 test proves the absence of soluble salts, 2 and 3 of iron, 4 of salts of barium, calcium, and strontium, and 5 of greasy matters.—S. P. E.

Parchment Paper turning Yellow. *Papier Zeit.* 1896, **21**, [2], 34.

THE cause of parchment paper turning yellow is frequently due to the presence of lead, which becomes acted upon by sulphuretted hydrogen in the air. The presence of lead in the parchment is due to the fact that the sulphuric acid employed in its production, had been stored in lead vessels. A large number of samples of parchment paper showed the presence of iron, probably derived from the drying cylinders through the action of the trace of acid left in the paper.—S. P. E.

Animal Sizing [Paper]. Clayton Bandle. *The Paper Maker*, Vol. **11**, No. 3, 153-157.

IN order to determine the comparative values of different classes of gelatin upon waterleaf paper, solutions were made of such strength that a gallon of each solution contained an equal value of gelatin. Waterleaf paper was soaked in each solution, and after the removal of the excess of solution the sheets were dried, and the amount of gelatin retained by the paper was calculated from the increase in weight. The results are summarised in a table. The author concludes therefrom: (1) That there is great regularity in the amount retained in each series.

(2) That the amount retained by each series is proportionate to the concentration of the solution. (3.) That the finer grade gelatins are cheaper in the end.

In making a comparison of the "gelatinising power" of different gelatins with their sizing effect, the author comes to the conclusion that the sizing effect of a gelatin is in proportion to its "gelatinising power."

In another table are given the results of a trial in which sheets of paper are sized with diminishing quantities of gelatin, in order to determine the minimum amount thereof necessary to produce a "hard-sized" paper. The paper was found to be hard-sized when it contained 4.5 per cent. of gelatin, but below this amount it could not be said to be hard-sized. The relative merits of "single-sheet sizing" and "web sizing" are discussed. By the former process a hard-sized paper can be obtained with much less gelatin than is necessary in the latter. The imperfection of the latter process is largely due to the rapidity of the drying and the high temperature of the air. The success in sizing, in the author's opinion, largely depends upon allowing the sizing solution with which the paper is permeated, to solidify to a jelly first of all, and then to dry at a temperature below the melting point of the jelly. When these precautions are not observed the films which seal the interstices become dispersed, and the paper often becomes soft-sized.

An easy method for calculating the amount of gelatin absorbed by the paper whilst passing through the sizing trough, is given for the use of manufacturers.

About 40 determinations of the amount of gelatin in the web of paper as it passed over the dryers, were made. The conditions were so complex that it was difficult to arrive at any definite conclusions. No connection could be traced between the thickness of the paper and the amount of gelatin absorbed. The amount retained was found to vary very much with the composition of the paper. It was found on an average that hard-sized papers absorbed their own weight of the gelatin solution. It is fair to assume that for each ton of the above paper 220 gallons of water have to be evaporated during the drying of the sized paper, and that 235 gallons of the sizing solution have to be supplied to the sizing trough.—C. B.

Canadian Wood-Pulp Industry. Board of Trade Journal, May 1896, 601.

THE *Canadian Gazette* states that the Dominion Government has now under consideration a proposal which has often been urged upon Canada for an export duty of 2 dols. per cord upon pulp wood, so as to discourage the export of the raw material from Canada, and encourage its manufacture into pulp in Canadian mills. At present the United States tax on imported pulp is 10 per cent., while pulp wood is free. A Canadian export duty would, it is claimed, induce the United States to remove their duty; this the Canadian Association think would give them control of the trade. At present Canada exports about 500,000 cords of pulp wood yearly, so that the proposed export duty would, it was said, yield a revenue of 1,000,000 dols. annually. The exporters of pulp wood, of course, object to such an impost. As it is, they have their hands full, they say, to compete with the pulp-wood sellers of Virginia and Maine.

On the face of it, Canada is wise to encourage her own manufacturers. Her exports of the raw material, *i.e.*, pulp wood, practically all of which goes to the United States, have been as follows:—

	Dols.
1890.....	108,998
1891.....	219,458
1892.....	386,092
1893.....	392,262
1894.....	468,359

These figures show a constantly increased export of raw material. The pulp wood exported in 1894 would be capable of producing mechanical pulp to the value of 400,000*l.* sterling, or about five times the value of the pulp wood now exported. If converted into chemical pulp the export value would be no less than 700,000*l.* sterling.

As it is, Canada is doing an increasing export trade in pulp as well as in the wood. The exports of pulp stand thus:—

	Dols.
1890.....	168,180
1891.....	280,619
1892.....	355,303
1893.....	455,893
1894.....	547,217
1895.....	590,874

These figures show also a steady annual increase.

The British demand for wood pulp is largely on the increase. The imports for 1895, for example, were of the value of 1,574,400*l.* (297,098 tons), an increase of 150,000*l.* over 1894.

There is a further stage to which Canadian mills should carry this wood-pulp business, namely, to the stage of paper manufacture. The United Kingdom imported last year unprinted paper to the value of 2,046,106*l.*, and strawboards, millboards, and wood-pulp boards to the value of 548,254*l.* The exports of paper from the United States were last year of the value of about 500,000*l.* sterling. Canada, with her forest resources and unlimited water power, should certainly take her place in the business. At present Great Britain looks chiefly to Germany, Holland, Sweden, and Belgium for her imported unprinted paper.

Esparto Fibre in Tunis. Chamber of Commerce Journal, April 1896, 69.

THE *Handel's Museum*, in an interesting article on esparto fibre, in which it is stated that there are two sorts of this fibre—"rusia," long and firm, and "mahbula," so called from its thread-like character. "Rusia" embraces nine different qualities, one of which, "hemmeima," possesses a long and tolerably thick stalk, used in cigar-making, art-plaiting, and paper-making. The sort known as "lass" is a very fine plant, which, at Marseilles, where it is used for making "seourins" (*i.e.*, mats which in oil factories serve as a basis for the presses), is preferred to all other kinds. The chief markets for esparto in Tunis are Sfax, Gabes, and Skira. For export, it is made up in bundles of about 150 kilos. The Tunis fibre, if in its raw state, pays an export duty of frs. 1.27 c. per 100 kilos., whilst the Tripolis fibre is perfectly free from duty.

PATENTS.

Paper suitable for Writing Purposes, Improvement in or relating to. F. E. Ullstein, Leipzig, Saxony. Eng. Pat. 5657, March 18, 1895.

UNFINISHED but sized paper of a kind suitable for writing paper is converted into imitation leather by means of special embossing rollers, which operate so as to produce on the surface of the paper lines or indentations similar to those found on leather. The material may be varnished with a lacquer similar to that commonly used in the manufacture of artificial leather, such as linseed oil and vegetable wax.—A. G. B.

Peat, The Treatment of; Improvements relating to, and to Apparatus therefor. H. H. Lake, London. Froux M. M. Rotten, Berlin, Germany. Eng. Pat. 6615, March 30, 1895.

A PROCESS for the separation of peat substance into fibres, other vegetable matter, and mud. The peat, suspended in water, enters at the front of a box with transverse partitions of less height than its outer walls, and, passing out at the rear wall of the box, is strained through a sieve of fine mesh. The mud and water passing through are separated in settling tanks; the fibres remain on the sieve, and can be used for paper making; and other vegetable matter is deposited in the partitioned box.—R. B. B.

Paper Pulp [Hypochlorous Acid and Chlorine], Process for Bleaching. F. Stehle, Coeslin, Germany. Eng. Pat. 10,716, May 30, 1895.

FIBROUS pulp, straw pulp, and "more particularly, certain rag sorts," are first partially bleached by means of calcium hypochlorite and chlorine. The pulp is next pressed until

the amount of moisture present in it is reduced to about 50 per cent., when it is placed in a gas-tight vessel and treated with chlorine gas. It is afterwards washed and otherwise treated in the customary manner.—E. B.

Cellulose suitable as a Raw Material for Paper and for other Purposes, Improvements in the Manufacture or Preparation of. A. Dufek and A. Merrel, Prague, Bohemia. Eng. Pat. 24,272, Dec. 18, 1895.

CELLULOSE and paper are manufactured from the roots of the weed *Agropyrum repens*. More than one-third of these roots consists of strong and pliable fibres suitable for this purpose. The cleansed roots are cut into pieces about 1½ ins. long, and are boiled in suitable alkaline liquids under a pressure of, preferably, about 6 atmospheres.—R. B. B.

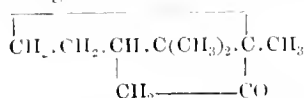
Woody and Similar Fibrous Substances, in Suspension; Straining. A Process for, and Apparatus therefor. J. A. F. Wallberg, Karlstad, and J. D. Ullgren, Katrineholm, Sweden. Eng. Pat. 2655, Feb. 5, 1896.

A PROCESS for straining wood pulp, &c., which consists in conducting the fibres, suspended in water or other liquid, through a fixed tube or drum composed partially or wholly of sieve plates, and communicating to the liquid, by means of an elastic rod within the tube, an undulating and vibratory motion, so that it is alternately sucked away from and driven against the sieve plates.—R. B. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Camphor, Partial Synthesis of. J. Bredt and M. de Rosenberg. Bull. Soc. Chim. 1896, 135—142.

ACCORDING to Wislicenus, when calcium adipate is distilled it yields oxypentamethylene, and on the hypothesis that camphor is made up of two pentamethylene nuclei according to the following formula—



the authors have treated in the same way homocamphoric acid, since this may be considered to have a constitution in the camphor series analogous to that of adipic acid. Homocamphoric acid, obtained by saponifying camphor cyanide, is converted into its calcium salt, $\text{C}_{11}\text{H}_{16}\text{O}_4\text{Ca} \cdot 7\text{H}_2\text{O}$. The salt loses its water of crystallisation at about 140° C., and when distilled in a current of carbonic acid, a syrupy distillate is obtained, which, after drying on a porous plate, forms a greyish-white mass. It is purified by steam distillation, but still contains traces of a yellowish oil, from which it can be freed by pressing between porous plates. The substance then melts at 175° C., and shows all the properties of natural camphor. The yield calculated on the calcium salt is about 70 per cent. of the theoretical.

—T. A. L.

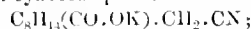
Charas: the Resin of Indian Hemp. T. B. Wood, N. Spivey, and T. H. Easterfield. Proc. Chem. Soc. 1896, [163], 76.

THE authors have examined "charas," the exuded resin of *Cannabis indica*, with a view to the isolation of the active principle. The method adopted consists in the fractional distillation of the ethereal extract prepared from the crude substance. By this means four compounds were isolated:—(1.) A terpene, b.p. 170°—180°. (2.) A sesquiterpene, b.p. 258°—259°, identical with that previously obtained by Valenta from Persone's "cannabene," the green oil obtained when the hemp plant is distilled with water. (3.) A paraffin, probably $\text{C}_{29}\text{H}_{60}$, m.p. 63·5°—64°. (4.) A red oil, formula $\text{C}_{15}\text{H}_{22}\text{O}_2$, semi-solid below 60°, and boiling constantly at 265° at 20 mm. pressure; this compound is present to the extent of 33 per cent. in the sample of charas examined. In doses of 0·05 grm. it produces intoxication, followed by sleep. The substance has also been isolated by the authors from a number of pharmaceutical preparations made from the plant. The resin as prepared by

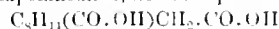
T. and H. Smith in 1847 contains no less than 80 per cent. of the oil. There can be no doubt that the characteristic action of Indian hemp is due to the presence of the compound.

Camphor, Conversion of Dextro-Camphoric Acid into; Partial Synthesis of Camphor. A. Haller. Comptes rend. 1896, 122, 446.

IN a previous paper (Comptes rend. 1896, 122, 293) is described the reduction of camphoric anhydride to campholid, a lactone analogous to phthalid. Campholid, when heated in a sealed tube with a molecular proportion of pure potassium cyanide at 230°—240° for six hours, is converted into the potassium salt of cyanocampholic acid—



from this, by saponification, homocamphoric acid—



is obtained, the lead salt of which, on gentle heating, decomposes into camphor and lead carbonate. Thus the synthesis of camphor is reduced to that of camphoric acid. The cyanocampholic acid produced by these processes is identical in melting point and rotatory power with that prepared from cyanocamphor by the action of alcoholic potash; the homocamphoric acid is identical with that prepared by direct saponification of cyanocamphor.

—A. C. W.

Formaldehyde, Production of Pure Gaseous. A. Brochet. Comptes rend. 1896, 122, 201—203.

PASSING a mixture of air and methyl alcohol vapour over heated platinum, as a method of preparation, is attended by several disadvantages. Some 5—10 per cent. only of the alcohol burnt is converted into formaldehyde, the remainder undergoing more or less complete combustion to carbon dioxide and water, the latter imparting excessive humidity to the atmosphere. What is more serious, it is found that there is invariably a quantity of carbon monoxide formed (from 3—5 per cent. of the alcohol used). All these difficulties are avoided, according to the author, by preparing the gaseous formaldehyde by passing a current of warm air over solid trioxymethylene, broken up into small fragments; the supply of gaseous formaldehyde in a pure condition thus obtained is easily regulated, and may be applied in sterilising objects which cannot withstand high temperatures. A further advantage is that the unpleasant and clinging odour which is produced by the slow combustion of methyl alcohol is entirely absent, the smell of the formaldehyde disappearing rapidly.—T. E.

Cinchonidine and Homocinchonidine: their Microchemical Distinction. H. Behrens. Zeits. anal. Chem. 1896, 35, 133.

CINCHONINE, cinchonidine, and homocinchonidine are precipitated from a solution of their hydrochlorides by sodium carbonate in the order given; they are distinguished by the different size and shape of their crystals. Cinchonidine and homocinchonidine obtained by sublimation, their chloroplatinates and hydro-iodides, all differ in crystalline form, and the latter base, as also its compounds, always occurs in much larger crystals. Thus homocinchonidine cannot be impure cinchonidine.

By sublimation no quinine or quinidine could be found in cinchonidine, and attempts to prepare the small crystals by fractional precipitation of solutions of mixtures of the large crystals with quinine, quinidine, and cinchonine were without result.

There appear to be two distinct modifications of cinchonidine, of which the large crystalline variety is the more abundant in the preparations examined. The change of one modification into the other, according to the method of Hesse (Ann. Chem. Pharm. 258, 140), could not be accomplished.—A. C. W.

Formopyrine, A New Compound of Antipyrine and Formaldehyde. E. Marcourt. Bull. Soc. Chim. 1896, 15, 520.

AN aqueous solution of antipyrine mixed with a molecular proportion of 40 per cent. of formaldehyde gives, after some

days, a precipitate consisting of a simple addition product, $C_{11}H_{15}ON_2 \cdot CH_3O$, melting at 142° . Heated to a higher temperature, it decomposes, giving the smell of pyrrol. Formopyrine is insoluble in cold water, slightly soluble in boiling, soluble in chloroform, acetic acid, and alcohol. Dilute and strong acids dissolve it, forming stable salts of an intensely bitter and acid taste (except the insoluble oxalate) decomposed by alkalis with precipitation of the base. The reactions of formopyrine are with slight exceptions those of antipyrine.—A. C. W.

"Pyranthin," A New Febrifuge. A. Piatti. Chem. Zeit. 1896, 20, 54—55.

"PYRANTIN" is the name given to the new febrifuge *p*-ethoxyphenylsuccinimide, $(CH_3CO)_2 \cdot N \cdot C_6H_4 \cdot OC_2H_5$, which may be prepared by fusing the hydrochloride of *p*-amidophenetol or phenacetin with succinic acid, and extracting the melt with alcohol. The yield is nearly theoretical. Pyranthin crystallises in colourless prismatic needles, melting at 155° , and insoluble in ether. One part dissolves in 1,317 parts of water at 17° , and in 83.6 parts at 100° . The following are the characteristic reactions of pyranthin:—(1.) By hydrochloric acid or fused hydrogen-potassium sulphate it is split up into succinic acid and *p*-phenetidine, which latter can be identified by means of the ferric chloride test. (2.) If 0.05 gm. of pyranthin be dissolved in 2—3 c.c. of hot concentrated HCl, diluted with water, and one drop of a 3 per cent. solution of chromic acid be added, the liquid turns to a ruby-red. (3.) If fused with potash, and to the aqueous solution of the melt be added some calcium hypochlorite, a red coloration gradually appears.—I. S.

Opoponax. A. Baur. Arch. de Pharm. 233, 209.

ONE of the brands on the market, which has the appearance of a brownish resin, contains: moisture 4.5, woody fibre 70, essence 6.5, and resin 19 per cent. The author has separated three resinous substances from it, which he has termed pana-resene- α ($C_{25}H_{34}O_4$), pana-resene- β ($C_{23}H_{30}O_4$), and pana-resinotannol ($C_{33}H_{40}O_4$). When crude opoponax is distilled with superheated steam an essential oil passes over, whilst the resinous residue contains the above substance, together with a decomposition product, chironol. This substance, which is an alcohol having the formula $C_{28}H_{44}O$, crystallises in fine needles, melting at 176° C., and giving an acetyl derivative melting at 196° C., and, on oxidation with permanganate, an acid, $C_{28}H_{44}O_4$, melting at 108° C. The essential oil consists principally of a mixture of terpenes boiling at 105° — 120° C., of terpenylic ethers, and also of a compound, $C_{30}H_{46}O$, which boils at about 250° — 255° C., and reacts violently with benzoyl chloride. Crude opoponax contains, in addition, an astringent substance and a gum soluble in water. According to the author, Mecca balsam contains a volatile oil distilling at 140° — 170° C., and a resinous substance partially soluble in soda, insoluble in ammonia. It contains alcohols, but not ethers of the resinotannol group. In conclusion, a histological description of plants yielding opoponax balsam is given.—T. A. L.

Sagapenum. Hohenadel. Arch. de Pharm. 233, 259.

SAGAPENUM balsam has the following composition:—Resin soluble in ether, 56.8; essential oil, 5.8; water, 3.5; gum, 23.3; woody fibre, 10.6 per cent. The essential oil can be separated by distillation in a current of steam, and the resin, which is soluble in ether, chloroform, alkalis, and sulphuric acid, and can be sublimed, melts when pure at 74° — 76° C. It does not contain any aldehydic compounds. In order to saponify it, it is necessary to heat it for a very considerable time with dilute sulphuric acid (1 : 3), when it is converted into umbelliferone and sagaresinotannol, $C_{29}H_{40}O_5$. The latter compound on heating with nitric acid (sp. gr. 1.27) on the water-bath yields styphnic acid. The essential oil of sagapenum is yellowish and has a disagreeable odour. Its specific gravity is 0.905, and it contains 9.7 per cent. of sulphur. On fractionation, an ether of valeric acid (hornyl valerate?) can be separated, together with a blue mal-odorous liquid, which has a characteristic absorption

spectrum. Analogous essences, valerian, asafetida, galbanum, &c., on distillation, give similar blue liquids, probably formed in the operation.—T. A. L.

Rhodinol from Oil of Pelargonium and Otto of Roses. P. Barbier and L. Bouveault. Comptes rend. 122, 529—531.

IN a previous communication (Comptes rend. 117, 1092) the identity of the principal constituent of oil of pelargonium with rhodinol from otto of roses was suggested, and this the authors now propose to confirm by a comparison of the chemical properties of the two substances. Rhodinol is, however, certainly different from limonol (geraniol), although this view has been contradicted quite recently by Erdmann and Huth (J. Prakt. Chem.; this Journal, 1895, 292). The confusion has arisen from the fact that oil of pelargonium contains both limonol and rhodinol. The latter can be separated from the mixture by means of its benzoyl compound, and the authors propose that the name rhodinol, which formerly was applied to the mixture, shall now designate the alcohol of the formula $C_{10}H_{18}O$ free from limonol. The alcohol, whether obtained from oil of pelargonium or from otto of roses, has a rose-like smell, boils at 110° C. under a pressure of 10 mm.; its specific gravity is 0.8731 at 0° C.; and $n_D^{20} = -2^\circ 11'$. In a subsequent paper the authors propose to show that the chemical properties of the two alcohols confirm their identity. The proportion of rhodinol in the two oils amounts at most to 20 per cent. (See also this Journal, 1894, 1085).—T. A. L.

Rhodinal, and its Transformation into Menthone. P. Barbier and L. Bouveault. Comptes rend. 1896, 12, 737.

PURE rhodinol, submitted to regulated oxidation by the chrome-sulphuric acid mixture, and the product boiled with water, the distillate being repeatedly fractionated *in vacuo*, gives a liquid boiling at 93° — 95° under 10 mm. pressure. Rhodinal thus obtained has the odour of peppermint; its composition is $C_{10}H_{18}O$; it does not combine with sodium bisulphite, but gives easily an oily oxime, boiling at 130° — 135° under 10 mm., from which the rhodinal is regenerated by dilute sulphuric acid. With the semi-carbazide it gives a crystallised product, separable by solvents into two isomeric carbazones. The first and most abundant is very soluble in ether, and melts at 115° . It dissolves in cold, strong hydrochloric acid, and is precipitated by water without change. Rhodinal is an aldehyde of rhodinol, and the semi-carbazones of the aldehydes are only decomposed by treatment with hot dilute acids, whilst those of the acetones are decomposed in the cold acid. The second semi-carbazone is insoluble in ether, and is an oil smelling of peppermint. It is identified as the semi-carbazone of menthone. Thus, the original liquid obtained by oxidising rhodinol is a mixture of rhodinal and menthone.

Previously, the authors had separated two bodies from essence of pelargonium, to which they assigned the formula $C_{10}H_{18}O$ and $C_{10}H_{16}O$ respectively; but they now recognise that these bodies were isomeric, and identical with those here described.

If the oxime of the mixture of rhodinal and menthone be treated with acetic anhydride, the product is purely, and in theoretical proportion, an acetate of the oxime of the menthone; and the menthone, regenerated by boiling with dilute sulphuric acid, gives only the semi-carbazide melting at 186° — 187° . The isomerism takes place at the moment of treatment by the acetic anhydride, for the oxime, treated by dilute sulphuric acid, regenerates the mixture of rhodinal and menthone.

This isomerism is of great interest, not only in itself, but also because it removes all doubt from the constitution of rhodinol.—E. S.

Citronellal and Rhodinal. P. Barbier and L. Bouveault. Comptes rend. 1896, 122, 795—796.

CITRONELLAL is obtained from citronella oil (from Messrs. Roure, Bertrand, and Son, of Grasse) by distillation under a pressure of 10 mm. of mercury. A colourless liquid boiling at 92° , under 10 mm. pressure, is obtained, the formula of which is $C_{10}H_{18}O$. Its semi-carbazone is characteristic, crystallising in plates which are very readily soluble in all

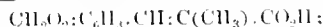
solvents with the exception of petroleum ether, and which melt at 82°. The aldehyde is converted into citronellal acid by passing through the stages of oxime and nitrile. The acid yields a paratoluide which boils without decomposition at 230° under a pressure of 10 mm., is easily soluble in organic solvents with the exception of petroleum ether, and melts at 95°. The paratoluide of the isomeric rhodinic acid melts at 89.5°. On oxidation, citronellal yields acetone and *β*-methyl adipic acid.—T. E.

Anise, Russian Oil of. G. Bouchardat and Tardy.
Comptes rend. 1896, 122, 198—201.

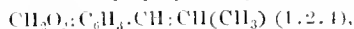
The oil is cooled to 5° and the liquid part drained off from the solid anethol which forms the major part of it; a repetition of this process at -15° removes a further quantity of anethol and anise-camphor or fenchone. The liquid obtained at +5° is dextro-rotatory whilst that obtained at -15° rotates the plane of polarisation to the left, showing that the oil contains several substances acting in different ways on polarised light. The liquid combines partially with sodium bisulphite, the compound after purification and decomposition yielding an oil which is separated by fractional distillation into fractions boiling from 245°—248°, and from 260°—265° respectively. The first consists of anise aldehyde, $C_9H_8O_2$. It is inactive, smells of dry hay or hawthorn, and has the density 1.141 at 0°. The second has the density 1.095 at 0°, is also inactive, and resembles the first in its odour; dilute potassium permanganate solution oxidises it to anise and acetic acids, it is therefore probably a ketone of the formula $C_{10}H_{10}O_2$. 22 kilos. of the anise oil yielded 80 grms. of the aldehyde and 20 grms. of the ketone, which are probably products of the oxidation of the anethol and estragol contained in the oil.—T. E.

Isosafrol, Synthesis of. C. Mouren. Comptes rend. 1896, 122, 792—795.

ISOSAFROL is synthesised by heating methylene homocaffeic acid—



it is thus proved to be propenyl-methylene-catechol—



the only formula available for its isomer, safrol, being therefore—



—T. E.

Formalin, The Detection of. O. Hehner. Analyst 21, 94.
See under XXIII., page 382.

Formalin, Further Notes on the Detection of.
H. D. Richmond and L. K. Boscley. Analyst 21, 92.
See under XXIII., page 382.

Quinine, Note on the Titration of. A. H. Allen.
Analyst 21, 85.
See under XXIII., page 386.

Cinchona Extract, Examination of. L. Hulsebosch.
Ber. Pharm. Ges. 1895, 5, 286.
See under XXIII., page 386.

Caffeine, Action of Wagner's Reagent, A new Method of Estimation. M. Gomberg. J. Amer. Chem. Soc. 18, [4], 331.
See under XXIII., page 384.

PATENTS.

Acetone, Improvements in Processes of and Apparatus for Making Pure. O. Porseh, New York, U.S.A. Eng. Pat. 5255, March 12, 1895.

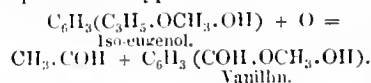
This invention is designed for producing pure acetone suitable for the manufacture of smokeless powder, for which purpose it must meet the following requirements:—(1.) It must be perfectly clear and limpid. (2.) It must be miscible with water in every proportion, and the mixture should not show a cloudiness even after long standing. (3.) It must be perfectly neutral. (4.) It must indicate at

15° on a thermo-alcoholometer of Schultze (Berlin) at least 99.5 per cent. (5.) It must not contain more than 0.1 per cent. of aldehyde, and its iodometric test should not show less than 98.5 per cent. of C_3H_6O . (6.) On distillation at least 98.8 per cent. should pass over at 58°. The process consists in subjecting acetates in the presence of calcium hydrate in excess at a uniform temperature to destructive distillation and to the action of superheated steam. By this means, an alkaline residue is obtained, which is perfectly free from acetic acid, so that the yield of acetone approaches almost the limit of the theoretical yield, and thereby 25 per cent. of pure acetone boiling at 58° may be regularly obtained from commercial calcium acetate. The acetone vapours are condensed into crude liquid acetone, which is mixed with about ten times its weight of water, and allowed to stand for 24 hours in a cool place. Any tar oils collecting on the surface of the aqueous solution are removed by a decanting process, and the clear mixture of acetone and water is subsequently drawn off from the sediment which has collected at the bottom of the containing vessel. The clear liquid containing the acetone is now submitted to fractional distillation in a dephlegmator for the obtainment of the acetone.

The apparatus comprises a jacketed mixing vessel or retort, the jacket being filled with molten lead, which is kept in this condition by the heat of a suitable furnace surrounding the mixing vessel. Thus superheating of the charge in the retort is obviated, and any variations of temperature during the liberation of the acetone prevented, a product being obtained, which is free from aldehyde and ketones. By the introduction of superheated steam into the retort after about 12 per cent. of the acetone has gone over, the generation of the remaining portions is accelerated, whilst the formation of mechanical impurities, and the passing over of any portion of the charge in the form of powder is prevented. The connecting tubes between the retort and the dust collecting vessel, and between the latter and the condenser can be readily cleaned after each operation by a series of steam pipes, whereby the choking of the tubes and the consequent liability to explosion is prevented. On subjecting the aqueous acetone to fractional distillation, the first and last runnings are collected separately, whilst the intermediate distillate containing from 90 to 96 per cent. of acetone is treated separately so as to permit the removal even of the small percentage of water still contained therein. This is effected in a copper still, provided with a rectifying column. The distillation is so regulated that not more than 150 litres pass over per hour, but even of this distillate, the first 50 litres and the last 50 litres should be set aside as probably containing traces of aldehyde. When the iodometric test shows that the quantity of acetone which has been set aside, being a certain quantity running over at the beginning, and also at the end of one distillation mixed with the same quantity obtained by a second distillation,—contains more than 0.1 per cent. of aldehyde, such acetone is passed in the form of gas through red-hot tubes and then condensed again, so that the ketones boiling at a higher temperature than the acetone are split up.—D. B.

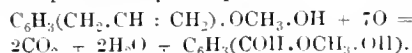
Perfumes, Improvements in the Manufacture of. M. Otto and A. Verley, Paris. Eng. Pat. 6596, March 30, 1895.

The claim is for the use of ozone in oxidising the groups of atoms:— $CH : CH, CH_3$ and $CH : CH : CH_2$ into COH . By means of this process iso-safrol, iso-eugenol, and anethol, all containing the group of atoms $CH : CH : CH_3$, may be oxidised to heliotropin, vanillin, and aubepin respectively. The gaseous ozone is allowed to act on the substances (preferably warmed) without using any solvent, thus facilitating the isolation of the products. The following equation represents the typical reaction which occurs:—



Substances which contain the group of atoms $CH_2 : CH : CH_2$, such as eugenol, safrol, and estragol, also yield aldehydes, those named giving vanillin, heliotropin,

and anebpin respectively; the reaction in the case of eugenol is represented by the equation:—



—T. E.

Perfumes, Improvements in the Manufacture of. M. Ekenberg, and Lars Montén, Stockholm. Eng. Pat. 15,592, April 1, 1895. (Under International Convention.)

THE claim is for a process for imparting a greater intensity of odour to perfumes by saturating them with some substance which is wholly or partly gaseous below 30°C ., and which is inodorous or possesses only a faint odour. Further claims are that the pressure developed by the volatile substances within the bottles may be conveniently employed for forcing the perfume out of them and spreading it. The volatile substances may also be used as solvents for the perfume, thus ensuring its perfect vaporisation.—T. E.

Musk, Artificial; Improvements in its Manufacture. H. H. Lake. From the Fabriques de Produits Chimique de Thann et de Mulhouse. Eng. Pat. 10,946, June 1, 1895.

THE manufacture of artificial musk by the nitration of symmetrical (1.3.5) halogen butyl toluenes is claimed. Symmetrical bromobutyl toluene, for example, is prepared by the gradual addition of 1 part of AlCl_3 to 4 parts of meta-bromotoluene and 4 parts of butyl chloride, without application of heat. The reaction being at an end, the mass is poured into water and the crude oil submitted to fractional distillation. The (1.3.5) bromobutyl-toluene boiling between 230° and 250° (or after further purification between 243° and 246°) is then slowly brought into a well cooled mixture of fuming nitric and sulphuric acids, which is finally heated on the water-bath until a sample solidifies at once on pouring into water. The tri-nitro derivative thus obtained forms, after crystallisation from alcohol, yellowish-white needles melting at 129° and possessing a strong odour of musk.—T. E.

ERRATUM.

This Journal, 1896, page 49, col. 2, top line:—For "greater" read "less."

XXI.—PHOTOGRAPHY.

PATENT.

Photographic Printing Paper and the like; Improvements in and connected with. F. Hrdliczka-Csizsar, Vienna. Eng. Pat. 9438, May 13, 1895.

THE inventor describes the manufacture of a sensitive paper with which, he asserts, it is "possible to obtain good prints with high lights . . . even from the duller negatives, which cannot be reproduced by the processes at present resorted to." It appears to consist essentially in the addition of a small quantity of a chromate (neutral or acid), or of a "compound of ferric cyanates" in dilute alcoholic solution to an ordinary citro-chloride emulsion of silver in "celloidin" or gelatin.—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives, Safety. Winkhaus. Trans. North of Eng. Inst. Min. and Mech. Eng. 1896, 45, 141—154.

THE results of the Prussian Fire-damp Commission experiments in 1885 (see also this Journal, 1892, 179) led to the conclusion that high explosives, if fired with a sufficiently strong detonator, explode without igniting either coal-dust or pit-gas (see this Journal, 1889, 415). Lohmann in 1887 found, on the contrary, that with larger charges, all the high explosives were unsafe (see also this Journal, 1889, 419). Safety powders are now made either by reducing the explosion temperature of the substance, by mixing it with a heat absorbent, such as damp sawdust, soda crystals, magnesium sulphate, ammonium carbonate, &c. (as in "Wetter-dynamit"), or by using explosives which have *per se* a low detonation temperature. In the latter group are explosives of the securite class, containing ammonium

nitrate mixed with nitro derivatives of aromatic hydrocarbons, or with non-nitrated carbonaceous substances; to this order belong most of the explosives described in a table which is given.

Lohmann defines as safety explosives all such as prove on experiment to be considerably safer than ordinary dynamite, and have not, in practical mining, produced the ignition of fire-damp; and, in any case, they are deemed sufficiently safe if an unstemmed shot, fired from the steel cannon with 8·82 ozs. of the powder, is found incapable of igniting the coal-dust (from the König pit) in suspension in the experimental gallery at Neunkirchen. But the writer urges that these galleries should be used only for the comparison of explosives, for there is a great difference between a shot fired from a steel cannon and one fired from a bore-hole in a non-conducting material like coal, which, moreover, readily yields a highly inflammable dust; and explosives which have passed Lohmann's test have failed in practice (see also this Journal, 1890, 214). In a table are incorporated the results of the author's experiments with the various explosives employed in Westphalia. Increasing charges were fired until ignition of the suspended coal-dust in the gallery ensued. With three exceptions (noted) no ignition was observed with a charge of 17·64 oz. The shots were fired, unstemmed, from a steel mortar with a 2·16 in. bore, set at an oblique angle in the floor of the gallery.

It is found that, with very safe powders, the paraffined cartridge cases (used when deliquescent ingredients are present) are not dangerous, but when the detonation temperature is high, a plain case is preferable, at least for unstemmed shots. The combination of relative safety with a high shattering power is a characteristic of the new ammonium nitrate powders. Another table given, shows that the safety of these powders diminishes as the percentage of the carbon-bearing constituent is increased; and any degree of safety may be secured by proportioning the ingredients correctly within the practical limits of blasting efficiency and transmissibility of the explosion from one cartridge to another. In the table the results with various mixtures of dinitro-benzene and ammonium nitrate are recorded.

Owing to the hygroscopic character of ammonium nitrate, powders containing this substance occasionally fail to detonate. The addition of 2·5 per cent. of potassium bichromate to Dahmenite has vastly increased its safety without affecting its shattering power; this is due to the readiness with which the bichromate decomposes at a dull red heat, whereby the detonating capacity and rapidity of ignition are increased, whilst heat is absorbed. The addition of 4 per cent. of potassium permanganate to roburite allows the nitrobenzene to be reduced to 7 per cent., and thus great safety is ensured, whilst the blasting efficiency (per unit of nitrobenzene) is not reduced.—W. G. M.

Explosives (Flameless) Committee, Report of the. North of Eng. Inst. Min. and Mech. Eng., Parts I. and III., 1894 and 1896.

THE third and last part of the report of the Committee appointed in 1888 is now published, and the experiments, which are fully described in 136 pages, have led to the following conclusions:—(1) The high explosives tested (amonite, ardeer powder, bellite, carbonite, roburite, securite, and westfalite) on detonation produce evident flame. (2) They are liable to ignite inflammable mixtures of air with fire-damp or coal-dust, or of the three together, and are not absolutely safe when used in presence of such mixtures; but (3) they are less liable than blasting powder to produce such ignition. (4) The ignition of mixtures of air and coal-dust, with or without fire-damp, can be obtained with a much smaller proportion of coal-dust than was previously deemed necessary. (5) The risk of explosion in a mine is lessened, but not abolished, by the use of high explosives in place of blasting-powder; and therefore (6) examinations of the working places, and precautions similar to those in force in mines where blasting-powder is used, must be rigidly observed where a high explosive is employed. (7) In view of the changes from time to time made in the proportions and constituents of

high explosives, it is desirable that the name of the explosive should be printed on the wrapper of each cartridge, and that the date of manufacture, and the proportion of the ingredients used in the manufacture of the explosive should be printed on the case of each packet of cartridges. (8) As these explosives alter in character if improperly kept, every care should be taken in the storage to ensure their being maintained in good condition.—W. G. M.

Smokeless Powder and Manufacture of Same, An Improved.
E. Ungania, Imola, Bologna, Italy. Eng. Pat. 12,325, June 25, 1895.

THE powder is designated "Fulgor" and its chief constituent is nitrated hydrocellulose. The following compositions by weight are given:—Fulgor "A," for military purposes, 100 parts of "hendeka-hydronitrocellulose," 2 of paraffin, 30 of hexa-nitromannite, 0.05 of aniline black; Fulgor "B," sporting powder, 100 parts of "hendeka-hydronitrocellulose," 0.05 of potassium ferrocyanide; Fulgor "C," sporting powder of moderate strength, 80 parts of hepta-hydronitrocellulose, 20 of hexa-hydronitrocellulose, 15 of potassium chlorate, 8 of barium nitrate, 1.50 of paraffin, and 0.05 of potassium ferrocyanide.

To produce "hendeka-hydronitrocellulose" 1 part of hydrocellulose is treated with 20 parts of an acid mixture containing 5 parts of nitric acid (1.52 sp. gr.) and 15 parts of Nordhausen sulphuric acid. The hepta-hydronitrocellulose is made with the following proportions: 1 part of hydrocellulose, 4 parts of nitric acid (42 B.) and 12 parts of sulphuric acid (66° B.). In all the above the proportions are by weight.

The nitro-mannite must not be made by the Stecker process, but by treating very finely divided mannite with a mixture of fuming nitric and sulphuric acids. This, it is stated, will give a nitro-mannite unalterable by heat or light. Powders "A" and "B" are gelatinised by means of acetic ether, and "C" by means of acetone and "benzine."—R. B. P.

Explosives [Nitroglycerin] for Blasting Purposes and for Use as Ammunition, Method of Manufacturing.
R. Weigel, Domitz-on-the-Elbe, Germany. Eng. Pat. 23,242, Dec. 4, 1895.

THIS invention relates to explosives containing nitroglycerin, and has for its object the diminution of the danger attending their manufacture and use. This is stated to be effected by the addition of "erosote and other alkylated, i.e., methylated, ethylated, &c. derivatives of the benzene and phenol class" which lower the freezing point of nitroglycerin, and render the finished explosive "absolutely flameless" capable of being stored in a damp atmosphere, "uninflamable," and insensitive to shock. The following composition is given as a type:—27 per cent. of nitroglycerin, 1 per cent. of collodion cotton, 4.5 per cent. of erosote, 5.5 per cent. of bicarbonate of soda, 53 per cent. of nitrate of soda, 9 per cent. of rye-flour.—R. B. P.

Explosives, Production of, from Reduced and Nitrated Cellulose Bodies. W. Theodorovic, Vienna, Austria. Eng. Pat. 949, Jan. 11, 1896.

THE inventor proposes a mixture of nitrated cellulose, the cellulose, previous to nitration, being first reduced to a pulverulent state by boiling with dilute hydrochloric acid, and "nitrate salts or carbonaceous material," the mixture then being gelatinised by means of amyl acetate and acetone, the gelatinising agent being subsequently removed by treatment with dilute methyl or ethyl alcohol.—W. M.

Explosives, Manufacture of, An Improved Process and Apparatus for. H. H. Lake, Middlesex. From Fried. Krupp, Grusonwerk, Magdeburg. Eng. Pat. 2575, Feb. 4, 1896.

THIS specification describes an apparatus for, and "method of manufacturing tubular or other threads or cords of explosive material from a pasty or plastic mass previously rolled in the form of a band; the said process or method consisting in placing the coil of plastic material in a chamber, and compressing the same throughout its convolutions by forcing a mandril into the central or inner convolution,

thereby displacing the air confined between the convolutions and forcing the material through a die in the form of a thread or cord; or when a hollow tube of the explosive is to be formed a mandril is fixed in the die."—W. M.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Pyrometer, Le Chatelier's. W. C. Heräus. Zeits. f. Elektrochem. 2, 276—277.

A FORM of Le Chatelier's pyrometer, adapted for technical purposes, by W. C. Heräus of Hanau. The thermo-element consists of wires of platinum and of platinum-rhodium alloy, each $1\frac{1}{2}$ metres long and 0.6 mm. diameter, welded or

Fig. 1.

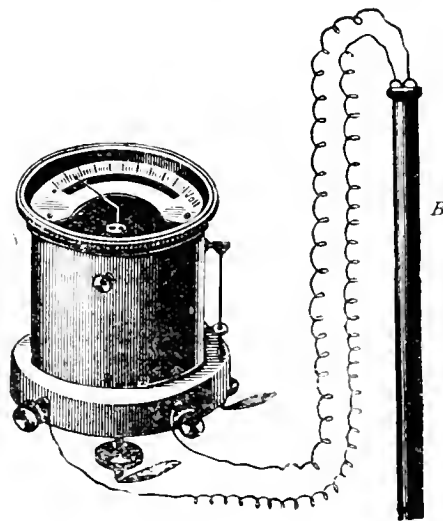
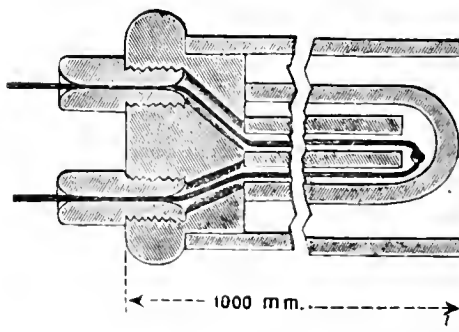


Fig. 2.

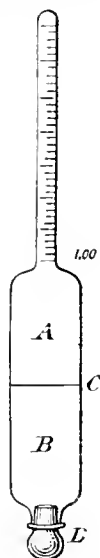


firmly joined mechanically at the hot junction, insulated from one another and protected from the fire-gases by porcelain and metal tubes. A modification of D'Arsonval's galvanometer is supplied with the instrument, reading on a double scale either E.M.F. in volts, or temperatures of the hot junction, from 0 to 1600°. Special forms of the instrument are made for special purposes. Rules are given for its use.—J. T. D.

Hydrometer, A New. L. X. Vandevyver. J. Phys. 1895, 4, 561.

THIS hydrometer is so constructed that when the lower compartment B is filled with distilled water, and the stopper D inserted, the instrument will sink to the mark 1.00 when immersed in distilled water. On replacing the water in the

compartment B by the liquid, the density of which is to be determined, and again placing the instrument in distilled water, the desired specific gravity may be read off on the



scale. This hydrometer gives accurate readings to the third decimal, and even the fourth is approximate.—A. K. M.

Assay Balance, An Auxiliary. Proc. Chem. Soc. 1896, [163], 75—76.

This paper describes a new form of balance applied to bullion assaying, the object of which is to give the weight of the gold "cornet" with sufficient accuracy to enable the assayer to put the correct weight in the pan of the ordinary assay balance, and to decide the remaining fractions by means of the rider alone. This auxiliary balance is of such dimensions as to be easily accommodated in the case of the ordinary assay balance. The advantages claimed are—

(1.) Saving of time in weighing, when gold of varying finenesses is under assay. (2.) Reduction of the wear in the weights. (3.) Increased life for the ordinary assay balance. (4.) Avoidance of much of the concentrated attention which tends to make the assayer's work monotonous.

PATENTS.

High Temperatures, Improved Method and Apparatus for Determining. J. G. Wilborgh, Stockholm, Sweden. Eng. Pat. 6284, March 26, 1895.

This specification describes an apparatus "based on the principle that if an explosive substance which explodes at a definite temperature t' be enclosed in a solid body of temperature t , and this body be exposed to a higher temperature T , then the explosion of the said substance will occur after the lapse of a definite time, the length of which will depend on the explosion temperature t' of the substance, on the distance of the said substance from the surface of the body, and on the difference between the temperatures T and t ." The apparatus may be calibrated by means of an air pyrometer and from the calibration an equation may be obtained, which would allow of the measurement of very high temperatures. The explosive is enclosed in a refractory material, and of course a "thermophone" is destroyed each time an observation is made.—W. M.

Oleaginous Materials, A New or Improved Testing Machine for. G. Mitchell, London. Eng. Pat. 16,571, Sept. 4, 1895.

This is an apparatus for testing the amount of oil which can be expressed from a known quantity of material. It consists of a steam-jacketed cylinder fitted with a ram of 1 sq. in. area, worked by a compound lever, at the end of

which is placed a spring balance, which enables the operator to observe what pressure is on the ram; this would be 2 tons when the spring balance registers 112 lb.—J. J. K.

INORGANIC CHEMISTRY.—QUALITATIVE.

Ammonium Sulphide, Replacement of, in Qualitative Analytical Methods. N. Tarugi. Bull. Soc. Chim. 1896, 16, 670. (Original in Gazz. Chim. Ital. 25, 478.)

AMMONIUM thioacetate forms sulphides with cobalt, nickel, manganese, and zinc, but the decomposition of the thioacetate and subsequent precipitation of the sulphide is not complete. The following method is proposed. The filtered liquid after precipitation with ammonia and ammonium chloride is boiled to drive off ammonia, slightly acidified with hydrochloric acid and slight excess of ammonium ferrieyanide added. This precipitates ferrieyanides of cobalt, nickel, and manganese. The filtrate made alkaline by ammonia throws down barium, calcium, and strontium on addition of ammonium carbonate. In the filtrate, ammonium phosphate precipitates magnesium, and finally on adding acetic acid, zinc is obtained as ferrieyanide.

The ammonium ferrieyanide precipitate is shaken with ammonia and filtered, and from the filtrate nickel ferrieyanide is obtained on acidifying. In the residue cobalt is detected by the bead, and manganese by nitric acid and lead peroxide.—A. C. W.

Cobalt, New Compound of, and a Rapid Method of detecting Cobalt in presence of Nickel. R. G. Durrant. Proc. Chem. Soc. 1896, [164], 96.

The author shows that if excess of sodium or potassium bicarbonate be added to a solution of any salt of cobalt, and then hydrogen peroxide, a green liquid is formed.

This liquid appears to contain a cobaltate or cobaltic acid, H_2CoO_3 , for, although the substance has not at present been isolated, volumetric determinations show that the maximum green colour is reached when the molecular proportions of the cobalt salt and hydrogen peroxide are as 1:2; a probable reaction is—



The green solution may be formed in presence of nickel salts, and the reaction serves as a ready method both of detecting cobalt, even in presence of large excess of nickel, and of detecting nickel in presence of considerable excess of cobalt.

Nessler Reaction, its Application for the Detection of Mercury and of Iodides. G. Deniges. Chem. Zeit. 1896, 20, 70.

By suitable modifications, the Nessler reaction may be made use of for the detection either of mercury or of iodides. For the detection of mercury, 2 c.c. of the solution are mixed with 2 c.c. of ammonia and 2 to 10 drops of a 20 per cent. solution of potassium iodide. If the solution remain clear, the addition of caustic alkali will bring about the Nessler precipitate should mercury be present. If there be a white precipitate, this will not appreciably interfere, but if a coloured precipitate be formed, it should be removed by filtration, before the addition of the caustic alkali. The reaction can be used for the detection of the smallest quantities of mercury.

For the detection of iodides, any metals which might interfere should be precipitated by ammonium sulphide; the filtrate is then acidulated with hydrochloric acid, boiled to expel hydrogen sulphide, and saturated with ammonia. Some caustic alkali and a few drops of mercuric chloride are next added, and if a red precipitate be produced, an iodide is present. The reaction is very sensitive, and can be used also in the case of insoluble iodides.—A. K. M.

Chlorates, A specific Colour Reaction for. G. Deniges. J. Pharm. Chim. [6], 2, 400.

The presence of chlorates in solution, when not exceeding 2 per cent., can be detected by the green coloration (also decidedly manifested in the case of 1 mg. of these salts) produced by adding five drops of a 1 per cent. solution of resorcinol, acidified by 10 drops of sulphuric acid, to one or

two drops of the solution under test, previously shaken up with 2 c.c. of pure sulphuric acid, and cooled. After the resorcinol is added, the mixture is again cooled and agitated.

—C. S.

Molybdic Solution as a Reagent. M. G. Meillere.

J. Pharm. Chim. 1896, 6, 3, 61.

The solution of ammonium molybdate usually prepared as a reagent is unstable and not to be relied upon. The author recommends the following prescription for a preparation said to remain good for several months. 200 c.c. of a 15 per cent. solution of ammonium molybdate are mixed with 20 c.c. of dilute sulphuric acid (1:1 by volume), and 30 c.c. of pure sulphuric acid are added thereto. The reagent thus prepared is very sensitive, and can be heated to 100° C. for a short time, a quality favouring the detection of traces of phosphoric and arsenic acid. In cases where the sulphuric acid is not objectionable, the same reagent can be used for quantitative separations. For this purpose gentle warming suffices, the liquid being then allowed to stand in the cold. Precipitation is complete after 12 hours. No tangible quantity of molybdic acid comes down. Complete precipitation of arsenic acid requires longer warming. In spite of the relative stability of the reagent, it is difficult to hit the point when the arsenic acid is completely precipitated and the molybdic acid begins to come down. Should precipitation of the molybdic acid begin to occur, it can be retained in solution in the subsequent conversion of the arsenic acid into ammonium magnesium arsenate, by the addition of a sufficient amount of an alkaline citrate. The tartrate is not to be recommended, as it considerably delays the separation of the precipitate.—B. B.

**INORGANIC CHEMISTRY.—
QUANTITATIVE.**

Hydrofluoric Acid, Note on the Preparation of Pure, for the Analysis of Silicates. A. H. Allen. Analyst, 21, 87.

HYDROFLUORIC acid for use in the analysis of silicates should be free from fixed impurities. The following is a simple method of preparing the pure acid at the time and in the quantity required:—

A mixture of about equal parts of commercial hydrofluoric acid and strong sulphuric acid is placed in a large platinum crucible. Inside this large crucible and preferably supported on a disc of plaster of Paris, or on a leaden ring, is placed a smaller one containing a weighed quantity of the silicate moistened with three or four drops of strong sulphuric acid. The larger crucible is then covered with a platinum dish filled with cold water. The arrangement is then heated, and the hydrofluoric acid is volatilised, and condenses on the bottom of the platinum dish, from whence it drops on to the silicate in the inner crucible. When about 10 c.c. of distillate has collected, the inner crucible is removed, the contents evaporated off, and the whole process repeated once or twice, to ensure complete decomposition of the silicate.—A. S.

Analysis, Electrochemical Methods which can be usefully applied. B. Neumann. Zeits. f. Elektroch. 2, 231—235, 252—260, 269—272.

A BRIEF history of the discovery and development of electro-deposition of metals and its application to their determination is given. The solution from which the metal is deposited should be one which ordinary treatment yields, the deposited metal should be coherent and easily washed, and variations in the current, within reasonable limits, should not affect its consistency.

From solutions containing more than one metal, a mixed deposit is liable to be thrown down. Separations, however, can be effected by (1) depositing one metal at the cathode, whilst the other is thrown down as peroxide at the anode; (2) preventing the deposition of one or more of the metals by addition of excess of strong acid, by conversion into a higher state of oxidation, or by addition of excess of alkali, and formation of complex compounds; (3) by regulating

the electro-motive force. In practice only the first two plans are really available, and in many cases it is most advantageous to make a separation by chemical means, and then to deposit each metal from a pure solution.

At the cathode come away hydrogen and metals. At the anode separate oxygen, the halogens, sulphur, and other bodies, of which only oxygen (in the form of peroxides) and the halogens need be considered. The halogens can be determined (Vortmann) by using a silver anode in a tartaric acid solution, and finding the increase of weight of the electrodes (both, for silver may go into solution from the anode and be deposited on the cathode), and the author has determined fluorine similarly; but the amounts which can be dealt with in this way are very small, and no separation of the different halogens is possible. Many metals appear at the anode as peroxides, but in most cases the metal itself is simultaneously deposited at the cathode, so that the only metals practically determinable as peroxides are lead and manganese.

Individual metals are then considered, copious references to original authorities being given.

Manganese.—The electrolytic determination of manganese presents no advantage over the ordinary volumetric or gravimetric methods.

Lead from neutral solutions deposits both as metal and peroxide. From neutral acetate solution, solutions with free acetic acid, solution in saturated sodium chloride, or in excess of sodium hydroxide with or without addition of alkaline tartrates or acetates, solution in ammonium oxalate, in pyrophosphoric acid, or solutions containing easily oxidisable bodies, it falls as metal alone; but the process is not suitable for analysis, for the deposit is not firm or coherent, and, moreover, often forms a short circuit between the electrodes. The deposition as peroxide alone, however, is very satisfactory; this takes place from a solution containing at least 10 per cent. of nitric acid. The deposit is coherent at the ordinary temperature or up to 60°—70° C.; at higher temperatures it is apt to peel. The current density should be 1—2 amp. per 100 sq. cm., the E.M.F. 2.3—2.7 volts. The author has deposited in one hour, from a strong solution, at the ordinary temperature (1 amp. per 100 sq. cm., 2.3 volts), 4 grms. of perfectly coherent peroxide. Dilute solutions need a longer time to deposit an equal quantity. The analysis of galena affords an illustration of the application of electrolytic methods; here the lead, coming to the anode, is separated from most associated metals. The ore is dissolved in nitric acid, diluted, filtered, and electrolysed; lead alone appears at the anode; copper, antimony, gold, mercury, may deposit at the cathode; other metals remain in solution. Bismuth, if present, may, in part, come down with the lead, but not silver, if enough nitric acid and a few drops of oxalic acid solution be present. The peroxide must be dried at 180°—190° C.

Of metals deposited at the cathode are to be considered:—

Iron.—This can only be deposited from solutions of complex salts, and the ordinary methods for its determination are so accurate, that the electrolytic method presents no advantage.

Cadmium can be deposited from neutral or ammoniacal solutions, solutions in potassium cyanide, or various alkaline salts. The separation of cadmium from other metals is not practicable electrolytically, and gravimetric methods are, on the whole, to be preferred.

Cobalt and Nickel.—These two metals behave practically alike in their electrolytic relations. They are completely deposited from neutral solutions to which has been added a very small amount of acetic acid, or excess of alkaline tartrate, citrate, or oxalate, or potassium cyanide. The usual method is to electrolyse a solution of the sulphate, to which ammonium sulphate and excess of ammonia have been added. Ohl adds, for 0.1—0.15 grm. of nickel as sulphate, 6—9 grms. of ammonium sulphate, and 2.5—4 grms. of ammonia; but the author finds that the proportion of nickel may be increased tenfold without injury. With 0.5—1.5 ampère per 100 sq. cm., 2.8—3.3 volts at ordinary temperatures, 2 hours suffice to deposit the nickel from 1 grm. of even rich ores or alloys. Attempts to use the chloride as a depositing solution have proved unsatisfactory. In the

analysis of ores, metals of the copper group can be precipitated by hydrogen sulphide or deposited electrolytically from an acid solution; excess of ammonia then precipitates iron, manganese, and aluminium, and the nickel or cobalt can then be deposited, free from every metal save zinc, which, if present, could be precipitated from acetic solution by hydrogen sulphide. To separate cobalt from nickel, Vortmann uses a solution with alkaline tartrate, large excess of sodium hydroxide and some potassium iodide, from which, with currents up to 1 ampère per 100 sq. cm., cobalt alone separates. Nickel and cobalt may well be determined electrolytically, especially as the chemical methods are troublesome and not very accurate.

Zinc.—Does not deposit from strongly acid solutions, and from neutral solutions comes down in a spongy condition. Addition of small amounts of acetic acid, ammonium oxalate, ammonium or sodium acetate, or ammonium phosphate improves this; good deposits are also got from a solution with excess of sodium hydroxide or of potassium cyanide. The deposited zinc adheres strongly to the platinum cathodes, which should therefore be coated with silver or copper. The process is slow (2 hours for 0.15–0.2 gm., with 1–1.5 amp. per 100 sq. cm.), and the current density must be well kept up towards the end, or the last traces of zinc fail to deposit. Separation of zinc from other metals must be done chemically, and on the whole the balance of advantage is on the side of chemical rather than electrolytic methods.

Gold.—Deposits readily from neutral solutions, from the double chlorides of gold and alkali metals, from solutions in potassium cyanide, sodium sulphide, &c. But the deposit is often pulverulent and the amount which can be deposited in a coherent state is very small. The electrolytic method is not advisable for ordinary purposes.

Bismuth.—Almost impossible to separate bismuth electrolytically from other metals.

Arsenic.—Is only very incompletely precipitated from neutral, not at all from acid solutions.

Silver.—Behaves like bismuth. Gravimetric methods are to be preferred.

Mercury.—Can be completely deposited from neutral or slightly acid solutions, solutions with excess of potassium cyanide, sodium sulphide, or ammonium oxalate or tartrate. For separations chemical methods are preferable.

Copper.—Deposited from sulphuric or nitric acid solutions with not too much free acid; from hydrochloric acid solutions is not coherent unless sodium chloride, ammonium chloride, or sodium acetate be added. Ammoniacal solutions can also be used, if sufficient ammonium nitrate be present. Solutions with excess of potassium cyanide, or of alkaline phosphates, oxalates, tartrates, or formates are also available, but in practice only the solutions in nitric or sulphuric acid are used. Copper is in this way separable from iron and the other metals which do not deposit from acid solutions, and (in nitric acid solutions) from lead; not, however, from silver, bismuth, mercury, tin, arsenic, or antimony. From these separation by chemical means is to be preferred, but as in many natural products few or none of these occur, the electrolytic determination of copper is very practicable and largely used. In a solution with 8 per cent. of free nitric acid, the current density should be 1–2 amp. per 100 sq. cm., E.M.F. 2.2–2.7 volts, and temperature, 50°–60° C. Stronger currents may be used, but the amount of copper deposited does not increase proportionately. A solution in sulphuric acid with 3 per cent. of free acid corresponds to the nitric acid solution mentioned.

Antimony.—Deposits from solutions in hydrochloric acid, sodium or ammonium chloride, with or without addition of alkaline tartrates or oxalates. The cathode should have a dead surface, or the deposit is not coherent. The deposition from the chloride is rapid. Tartaric acid solutions give good deposits, but are too slow. The most available is a solution of the sulphide in sodium monosulphide. With a solution containing sodium sulphide of 50–70 per cent. of saturation, 1–2 amp. per 100 sq. cm., and E.M.F. 1.5–3 volts, the process proceeds at the ordinary temperature or at higher temperatures, more rapidly in the latter case (at 60°–80°, 0.3–0.4 gm. antimony in 1½–2 hours). The preparation of the solution

of the sulpho-salt separates the antimony from all other metals save arsenic and tin; the arsenic can be volatilised previously as chloride, converted into arsenic acid, or dissolved as sulphide by ammonium carbonate, whilst tin does not deposit from strong solutions of sodium sulphide. This plan, then, is of very general use in determining antimony.

Tin.—Solutions of stannous and stannic chlorides, or other salts to which hydrochloric acid has been added, are available; also with excess of sodium hydroxide or potassium cyanide, or ammonium oxalate and oxalic or acetic acid. It deposits best from solutions of the sulphide in ammonium sulphide (from weak sodium sulphide solutions very imperfectly, from strong ones not at all). If tin be already in the form of dioxide, it is best weighed straight off; but if we have the sulphides from which arsenic and antimony have been separated as just described, 20–25 grms. of ammonium sulphate are added to the solution, and heated for 10–15 minutes, then a current of 1–2 amp. per 100 sq. cm. and E.M.F. 3.3–4 volts used; at 50°–60°, 0.3–0.4 gm. tin will deposit per hour, with 1 amp. per 100 sq. cm. Tinstone, fused with sodium carbonate and sulphur, gives a solution which can be directly used for electrolysis.

Storage cells form by far the most suitable source of current for this work; where there is no dynamo they can be charged by a thermopile, or by a number of primary cells. A Gülicher thermopile, failing secondary cells, is also a useful source of current, and enables any constant E.M.F. between certain limits to be maintained.

Electrodes are always of platinum and are of two types. In one the cathode is a slit hollow cone or cylinder pierced with holes, and the anode a spiral wire; in the other the cathode is a shallow dish or basin and the anode a horizontal disc.—J. T. D.

Platinum, The Assay of. E. H. Miller. School of Mines Quarterly, 17, 26–38.

AFTER describing and comparing the methods of Berzelius, Gibbs, Deville and Debray, and Perry, and giving results of experiments showing the impossibility of obtaining accuracy whilst employing small quantities in the assay of poor ores, the author suggests the following method of procedure:—

1 gm. of platinum alloy is mixed with test lead and scorified at a high temperature until covered over, poured, and the button, which should weigh about 12 grms. and be malleable, hammered to detach slag. The button is treated with 200 c.c. of nitric acid (sp. gr. 1.08) until the action ceases, and is then filtered and washed with water. The paper containing the residue is burned in a porcelain capsule and then transferred to the muffle and ignited for 10 minutes with the door open. After cooling, it is heated to boiling with nitric acid (1.08) for several minutes washed, ignited, and weighed. The weight is that of the gold, platinum, iridium, and iridosmium. The finely-divided metal so obtained is then warmed with dilute aqua regia (1:3) for a few minutes, which readily dissolves the gold and platinum and leaves the iridium and iridosmium to be filtered off, washed, and weighed together. The iridium is then dissolved out by treatment with strong aqua regia and the iridosmium weighed alone. The gold and platinum are separated by oxalic acid. The solution containing them is evaporated just to dryness to remove all the nitric acid, then dissolved in water and a few drops of hydrochloric acid, and the gold precipitated by warming with oxalic acid and allowing to stand for half an hour. After filtering, the gold is cupelled with silver to remove filter ash and any traces of platinum, parted and weighed. The platinum is precipitated by ammonium chloride after destroying the oxalic acid.

By this method the iridium is separated from both the platinum and iridosmium, the gold result is as accurate as by the wet method, and the platinum result is nearly so. The platinum is equally well determined in any material, from a low grade ore to platinum foil. In the former case the platinum from four to six assay tons is collected by a preliminary treatment in a lead button of about 20 grms., which, after scorification, is a convenient size for assaying

by nitric acid. The ratio of lead to platinum should be 30:1 to obtain a malleable button from which the slag can easily be detached, and the quantity of ore to be taken should be at least 30 grms. in the case of poor Russian ores.—A. W.

Cement, Hot Tests for. L. Erdmenger. Thonind. Zeit. 1896, 20, 2.

THE author discusses the mechanism of the changes which occur when cement test pieces are subjected to hot tests, boiling tests, and his own high-pressure steam tests. He points out that the increased rapidity and intensity of the changes occurring during hardening, which is brought about by tests of this class, may result in an increase of strength or in complete destruction or in some intermediate condition, according to the quality of cement. Cements which are not unexceptionable when tested by these methods generally show improvement after they have been aerated by exposure, although the like treatment may lower the strength as determined by ordinary cold tests. The opinion that the destruction of test pieces exposed to boiling water or the like is due to the presence of anhydrous calcium sulphate, rather than to that of free lime, receives no confirmation from the author's experiments.

—B. B.

Cement Testing. C. Berger. Mitt. k.k. Tech. Gewerbe-Museums (Vienna), 1896, 57—81.

THE paper consists of an account of a considerable number of tests made by the author on samples of Portland and Roman cement. That part not concerned with routine methods of testing is embodied in the following excerpts:—

In general, the tests were made according to the standard methods current in Austria, but an exception is made in respect of tests for constancy of volume, which on account of the short time available, were of the "rapid" class. The rise of temperature occurring on gauging cement with water was also determined, the increase of temperature in the case of Portland cement varying from 1.6 to 11.1 °C., but rarely exceeding 10° C. Seeing that the rise of temperature is largely dependent on the rate at which the reactions concerned in the first setting of the cement occur, an exact correlation between the rise of temperature, and the presence of unsaturated lime in the cement cannot be arrived at. Thus, cements which are perfectly constant in volume and undoubtedly sound may give a rise of temperature as great as, or greater than, that given by cements which have a marked tendency to "blow." It may be noted incidentally that Portland cements may show a rise of temperature of 1.4—2.5° C. before any indication of setting can be discerned. Some relation can be traced between the initial setting and the rise of temperature of a cement, for both phenomena are plainly dependent on the beginning of chemical change of certain of the cementitious constituents. The determination of the initial set is of practical importance, inasmuch as it is undesirable that cement should be worked or handled after this has begun. With regard to the specific gravity, the limits observed for Portland cement were 2.96 to 3.23. Comparative tests were made for tensile strength of cement which, after setting, had been kept in the one case in water and in the other in air, and it was found that in general, cement kept in air had a higher tensile strength at a given date. The difference was most marked with overlined cements, which remained sound in air but were weakened by being kept under water. The question of aeration of cement before use is considered by the author, who shows that in many cases an improvement as to strength takes place on keeping, especially if the cement was originally somewhat overlined. A decrease of strength, on the other hand, is not infrequently observed, particularly in test pieces which have been kept in the air, instead of under water, with cements which are not unduly rich in lime.

It may be noted that a considerable increase in tensile strength may result from the exposure of the test piece first under water and then in air, the figures quoted in one case being greatly in excess of those given by the same cement kept either in air alone or in water alone. The rapid tests used for determining the constancy of volume

of Portland cement, that is, its freedom from tendency to blow, are as follows:—

(1.) *The Steam Test* in which a pat of cement after 24 hours setting in moist air is placed in a double-walled vessel, the outer part of which is filled with water and heated until steam is evolved and penetrates to the inner vessel, the heating of the pat thus effected being continued for four hours.

(2.) *The Boiling Test.* Balls of the cement 4—5 c.m. in diameter are allowed to set for 24 hours in moist air and are placed in water, which is brought to the boil in the space of about 30 minutes, and kept boiling for six hours.

(3.) *The Firing Test.* In this, two balls similar to those used in test No. 2 are allowed to become fully set and are suspended at such height above a Bunsen flame as to become warm to the hand in the course of half an hour, to be heated to 90° C. in a second half-hour, and finally, to become red hot at the point of impingement of the flame.

Portland cement may be considered as free from tendency to blow when test pieces treated in the manner described retain their hardness and coherence, and are not cracked or buckled.

The Roman cements tested were nearly all quick-setting, the initial set being perceptible in about two minutes. In general, Roman cements set the quicker the richer they are in clayey constituents, and the slower the higher is their content of lime. An excess of lime, if evenly distributed, appears to increase the setting time, although it may act in a contrary manner on the initial setting time. This may be explained by the fact that the heat evolved by the slaking of the lime sensibly aids the reactions involved in initial setting, while the presence of this same lime delays the ultimate hardening of the whole mass of the cement. Thus it happens that cements are met with which begin to set quickly and then remain soft for hours. Both from the not infrequent presence of free lime in Roman cement and from its common property of setting quickly, it is to be expected that the rise of temperature which it gives would be greater than that observed in the case of Portland cement. As much as 20° C. may represent this rise. Both Roman and Portland cements show a certain correspondence between the rise of temperature and the rate of setting, the amount of the former, when taken at successive periods of half a minute, falling at or near the time when initial set declares itself. The fallacy of supposing that an unsound cement necessarily gives a high rise of temperature is shown by the figures given by the author for six cements which were indisputably unsound, and yet gave no abnormal results when tested for the heat evolved during their setting. Similarly the fallacy that a cement giving a high rise of temperature is necessarily unsound is shown by the results obtained for Roman cements having as high a rise as 20°, and yet being of faultless quality.

The specific gravity of the Roman cements tested, varied between 2.81 and 3.13, this variation being doubtless due to the somewhat wide range of composition characteristic of this material. A high specific gravity due to comparative richness in lime may not coincide with a high tensile strength, because of the irregular distribution of the lime, making the cement latently unsound and diminishing its strength. It appears to be generally true that Roman cement has a higher strength when kept in air than when kept under water, the differences being in some cases very large, especially when there is reason to consider the cement overlined or containing lime irregularly distributed. Exposure of Roman cements to air causes them to absorb water and carbonic anhydride, whereby their specific gravity is decreased and they become slower setting, while their tensile strength is augmented. The last effect may well be attributed to the character of these cements, which, from the nature of their raw material, the small amount of care expended on their manufacture, and their comparative cheapness, are liable to contain tolerably coarse particles of lime, which are gradually slaked by exposure to air to the benefit of the cement. It may be remarked that an apparently low tensile strength may sometimes be obtained from a cement of good quality on account of the excessive quickness with which it sets making it difficult to gauge the briquettes before setting has begun.

The following rapid tests were used for Roman cement:—

(1.) *The Hot-water Test.* Balls of neat cement, after 24 hours' hardening in moist air, are placed in water, which is brought to a temperature of 50° C. in the course of half an hour, and are kept there for 3 hours.

(2.) *The Steam Test,* which is carried out in precisely the same way as for Portland cement and has been already described. Cement which stands this test is undoubtedly sound, but many cements of fair quality may fail under it, in which case, provided they stand the hot-water test, they may be accepted.—B. B.

Arsenic, A Rapid Process for the Estimation of. R. Engel and J. Bernard. *Comptes rend.* 1896, **122**, 390.

THE following method is intended to replace the delicate and somewhat lengthy process described by Gantier (*Bull. Soc. Chim.* **24**, 251), in which the ring of arsenic obtained by Marsh's test is weighed.

The arsenic solution, concentrated if necessary in alkaline solution to 20–40 c.c., is mixed with three times its volume of hydrochloric acid of 22° B_e, and then with a large excess of hypophosphorous acid (according to the quantity of arsenic, 4–10 c.c. of acid of 30° B_e). After standing 12 hours at the ordinary temperature, the arsenic is completely precipitated in the metallic state; the vessel is then warmed on the water-bath and boiling water added to facilitate the filtration. The vessel is repeatedly washed out with boiling water until the filtrate is no longer acid, no attempt being made to remove the arsenic adhering to its sides; the filter paper is then placed in the same flask and a decinormal solution of iodine added with constant shaking until the liquid remains coloured. The arsenic is now in solution in the state of arsenious acid, then 50 c.c. water and 10 c.c. of saturated sodium or potassium bicarbonate solution are added, and the titration finished, using starch as indicator. The process determines small quantities of arsenic alone or in presence of other metals (nickel, cobalt, manganese, aluminium, zinc), with an error of about $\frac{1}{10}$ mgrm.

—A. C. W.

Arsenic, The Determination of. A. Gantier. *Comptes rend.* 1896, **122**, 426.

THE method of Engel and Bernard (previous abstract) is not suitable for determining accurately quantities of less than 1 mgrm., which the author's method exactly estimates. The volatility of arsenic and antimony affords a means of separating these elements from other metals, in however small a quantity they may be present, and according to his method, these two metals may be then separated from one another and both estimated.—A. C. W.

Cobalt and Nickel, Separation of. Carnot. *Berg. u. Hüttenmänn. Zeit.* **54**, 370.

AFTER throwing down both metals with bromine and potash the liquid is boiled and the precipitated sesquioxides are washed, reduced by heating to redness in a current of hydrogen, re-washed, and weighed together. They are then redissolved in nitric acid and the solution divided. From the one part are precipitated by hydrogen peroxide and potash, the protoxide of nickel and the sesquioxide of cobalt, the latter being titrated with potassium iodide and sodium thiosulphate. The second portion is neutralised with potash and the precipitate redissolved with potassium cyanide. Bromine is added and the precipitated sesquioxide of nickel estimated by means of iodine, the cobalt remaining in solution as cyanide.

Another method of separation consists in adding molybdate to the ammoniacal solution, whereupon rose cobalt molybdate comes down, being almost insoluble in the cold liquid. On the other hand, the molybdate of ammonia and nickel is very soluble. This method is advisable where the quantity of cobalt is small.—C. S.

Pig Iron, Sulphur in; Drown's Method of Determining. G. Auchy. *J. Amer. Chem. Soc.* **18**, [4], 406–411.

THE addition of potassium hydroxide to the potassium permanganate solution used to oxidise the evolved gas, is recommended, since, by reason of the greater oxidising power of this mixture, the gas may be passed through the

solution at a more rapid rate without danger of loss. Moreover, the precipitated manganese oxide is easily washed out with water, instead of having to be dissolved in strong hydrogen chloride. The silica in the potassium hydroxide may be disregarded, being without effect on the subsequent precipitation of barium sulphate.

The addition of oxalic acid in connection with hydrogen chloride in preparing the clear solution of manganese facilitates the operation, without retarding—in fact, assisting—the precipitation of the barium sulphate, or causing contamination from barium oxalate.

It is advisable not to have any ammonium chloride present in strongly acid solutions, and ammonia, if used at all, should therefore be added to near neutralisation.—C. S.

Copper, Quantitative Estimation and Separation of. F. Mawrow and W. Muthmann. *Zeits. anorg. Chem.* 1896, **11**, 268.

FOR the separation of copper from zinc and cadmium the authors apply the well-known reaction of copper salts with hypophosphorous acid. Copper cannot be satisfactorily precipitated by this reagent from solutions containing chlorides, since cuprous chloride is first formed and is difficult of reduction; the presence of sulphates, acetates or nitrates, is permissible, provided there be not too much free nitric acid. Commercial hypophosphorous acid is employed, for its impurities are practically only calcium sulphate and free sulphuric acid. For the separation of copper from cadmium in qualitative testing, the solution containing the metals is mixed with an equal volume of the reagent and the mixture is boiled until the copper has separated in the form of dark-coloured flocks; after filtration the cadmium can be precipitated as sulphide completely free from copper sulphide. For quantitative precipitation, solutions containing hydrochloric acid are evaporated with sulphuric acid and then diluted, until the copper bears the proportion of 0.1 gram. to 100–200 c.c. of water; several c.c. of hypophosphorous acid solution are added and the liquid boiled until no more hydrogen escapes. The precipitate is collected on a weighed filter, washed with water, alcohol, and ether, dried at 100°, and weighed.—A. G. B.

Alumina in Phosphates, Determination of. H. Lasne. *Bull. Soc. Chim.* 1896, **118**–**128**, 146–157, 237–248.

IN the manufacture of superphosphates, the presence of sesquioxides is prejudicial, and a sample containing more than a certain amount of iron and aluminium oxides would be rejected. The analysis of the iron presents no difficulty; its estimation volumetrically in presence of phosphates can be carried out with exactitude. It is, however, otherwise with aluminium, and the estimation of this metal in presence of phosphates is a matter of some difficulty. The new method proposed by the author, which possesses several advantages, amongst others that of rapidity, is carried out as follows:—The solution of the phosphate freed from silica is poured into a solution of pure caustic soda containing sodium phosphate more than sufficient to combine with the whole of the lime. On boiling for about half an hour, the solution contains the whole of the aluminium. The aluminium phosphate, after precipitation with ammonia, is redissolved in dilute hydrochloric acid and finally precipitated with ammonium hyposulphite and boiled for half an hour, a few drops of a saturated solution of ammonium acetate being finally added to ensure complete precipitation. The precipitate, after heating before the blowpipe for 15 minutes, has the composition $\text{PO}_4\text{Al}_2\text{O}_3$. The author gives confirmatory evidence in support of his new method and a series of experimental data with respect to various other methods.

—T. A. L.

Fertilisers, Commercial: Phosphoric Acid in. Various Modifications of the Pemberton Method of Determination. F. P. Veitch. *J. Amer. Chem. Soc.* **18**, [4], 389–396.

THE conclusions drawn by the author, from his experience with modifications by Kilgore of the Pemberton process (*J. Amer. Chem. Soc.* **15**, 382), are that the addition of nitric acid to the molybdate solution gives results fairly concordant with gravimetric estimations, and that no advantage is gained by employing tartaric acid with the molybdate.

He prefers to use the official molybdate solution with 10 per cent. of nitric acid, filtering without pressure, and washing solely with water, as giving quicker results than the usual method.—C. S.

ORGANIC CHEMISTRY.—QUALITATIVE.

Rosin and Rosin Oil, Detection of, in Oils and Varnishes.

F. Ulzer. Mitt. k.k. Techn. Gewerbe-Museum (Vienna), 1896, 91, 92.

THE Storch-Liebermann reaction for the detection of rosin by means of the red coloration produced by the action of sulphuric acid on a solution of the rosin in acetic anhydride, has been modified by Morawski, who uses sulphuric acid of sp. gr. 1.53 instead of the concentrated acid, and has applied the test to the detection of rosin in the sizing of paper and in soaps, and has also stated that rosin and rosin oil may be detected in most fatty oils by shaking out with acetic anhydride and adding to the solution sulphuric acid of the density named above.

The author has found that boiled linseed oil, in whatever manner it may have been prepared, itself gives a reaction when its solution in acetic anhydride is treated with sulphuric acid, the colour produced being red-brown.

It is impracticable to shake out the boiled linseed oil with acetic anhydride, because it dissolves freely in that menstruum and also easily forms an emulsion therewith. An improvement in the process consists in shaking out the boiled linseed oil with absolute alcohol, allowing the mixture to stand for some hours, separating and evaporating the alcoholic solution, dissolving the residue in acetic anhydride and treating it with sulphuric acid. Even the pure boiled oil gives a red colour when thus treated, but large quantities of rosin oil or of rosin, can nevertheless be detected. With regard to the use of the reaction for varnishes, it is necessary first to ascertain what is the behaviour of the many resins used for varnish making. The author's experiments go to show that only a few resins give the reaction, and especially that all the copals tested (Manilla, West Indian, Cowrie, Angola, Zanzibar and East Indian) give only a more or less intense brown colour which is not to be confounded with the reaction of common rosin. Amber behaves similarly to copal; and sandarac, dammar, mastic, and shellac also do not give the rosin reaction, which, however, is afforded by elemi.—B. B.

Mineral Oils, Fatty Oils in; Detection of. G. Halphen. Ann. Chim. Anal. Appliq. 1896, 1, 29.

ROVÈRE's reaction, consisting in the addition to the oil of a fuchsin solution previously decolorised by the regulated addition of an alkali, depends on the presence of free fatty acid in the oil, and is accordingly valueless, because mineral oils may contain sufficient organic acid to cause the formation of a red colour. Moreover, oils containing soap will not give a reaction. A soap present in a mineral oil may be readily detected by use of a solution of Congo red, previously faintly acidified so that its colour is violet. The alkalinity of the soap causes a change of colour to red.

—B. B.

Lubricating Oil, Soap in; Detection of. F. Jean. Ann. Chim. Anal. Appliq. 1896, 1, 31.

SCHWEITZER's reagent, which is a saturated solution of metaphosphoric acid in absolute alcohol, may be used for the detection of small quantities of soap in lubricating oils by adding it to an ethereal solution of the oil, whereby a precipitate is produced. The precipitate may be treated with platinum chloride, and from its behaviour with that reagent some conclusion as to whether it is a potassium or sodium soap, or the soap of some heavy metal may be drawn.—B. B.

Boric Acid, Apparatus for the Detection of. W. M. Doherty, Government Laboratory, New South Wales. Proc. Chem. Soc. 1895, [161], 101.

THE milk, wine, or other substance is made slightly alkaline with sodium carbonate, and after drying, it is thoroughly charred—not burned to an ash. The charred mass is ex-

tracted with boiling water, and the solution obtained made acid with hydrochloric acid, and evaporated gently over the water-bath in a small porcelain boat, which is placed in an apparatus of the following description.

A piece of glass tubing, about 9 in. long and $\frac{1}{2}$ in. in diameter, is turned over at right angles at one end and drawn to a fine aperture. A second piece of tubing about $2\frac{1}{2}$ in. long, and $\frac{1}{2}$ in. in bore is provided with a hole in the side, and placed over the aperture and arranged so as to form a glass Bunsen burner.

The porcelain boat or other vessel containing the properly prepared substance, supposed to contain the boric acid, is placed in the larger tube, which is attached at the wide end to the gas supply, the whole being supported by a clamp. The gas is regulated so as to produce a clear flame about $\frac{1}{2}$ in. long, and free from luminosity at the extremity of the upright tube. The vicinity of the porcelain boat is heated by an ordinary Bunsen burner, and if boric acid be present, even in the most minute quantity, the small flame will show it distinctly. It will be found desirable to apply the heat gently, increasing it slowly, and carefully observing the flame in the meantime.

Formalin, Further Notes on the Detection of. H. D. Richmond and L. K. Boseley. Analyst. 21, 92.

THE authors think that Rideal (this Journal, 1895, 14, 766) in concluding that milk contains a non-volatile aldehydic compound, because all samples give a pink colour with Schiff's reagent, has overlooked the fact that aldehydes do not give a pink colour with Schiff's reagent but a reddish-violet one; alkalis either free or combined with a weak acid give a pink colour. Schiff's reagent, if prepared according to Caro's directions with rosaniline, sodium sulphite, and hydrochloric acid, always contains an excess of the latter, and this excess whilst it has no effect on the colour given by aldehydes, prevents the formation of the pink colour.

With regard to the delicacy of the different reactions for detecting formalin, it was found that the reduction of silver nitrate is, though very delicate, of so general a character as to be misleading, even when following Tollen's directions (Ber. 15, 1635).

Schiff's test is very delicate, but must be performed in a slightly acid solution. It was found that milk sugar, even after boiling with dilute sulphuric acid gave no colour, and the authors consider it quite safe to test the whey produced by adding dilute sulphuric acid to milk, thus avoiding the troublesome distillation.

The authors found that the delicacy of Hehner's reaction (Analyst. 20, 155; this Journal, 1895, 14, 772) may be much increased by diluting the milk with an equal bulk of water, and adding sulphuric acid of 90–94 per cent. In the absence of formaldehyde, a slight greenish tinge is apparent at the junction of the two liquids, whilst a violet ring is formed if formaldehyde be present.

Trillat's reaction with dimethylamine (this Journal, 1893, 789) is less delicate, but does not require any distillation. The blue colour is not very stable.

Pföchl's test (Ber. 21, 2117) is of no use with very small amounts of formaldehyde.

The authors' test with diphenylamine (this Journal, 1895, 772) and Trillat's aniline test (this Journal, 1893, 789) are both less delicate than the foregoing. The authors correct their statement (this Journal, 1895, 772) that the precipitate in their diphenylamine test is coloured green if the acid used contains nitrates. The green coloration appears on continued boiling, even when the acid used contains no nitrates.

The authors think that Hehner's method is the best for the detection of formalin in milk, with Schiff's test (in the whey produced by sulphuric acid) and Trillat's dimethylamine test to confirm.—A. S.

Formalin, the Detection of. O. Hehner. Analyst. 21, 94.

SCHIFF's test for formalin acts very slowly when only very small quantities of formaldehyde are present. The proper amount of formaldehyde present in milk for preserving purposes is 1 part to 60,000 parts of milk,

and Schiff's reagent will only indicate such a trace after some hours standing. The author states that Schiff's reagent may give a red coloration, even with pure distilled water in stoppered cylinders, if the reagent be not added in sufficient excess. The best way of performing Schiff's test is to add about 5 drops of the reagent to the distillate from 100 c.c. of milk (amounting to about 25 c.c.), allow to stand till the next morning, and then add a few drops of sulphurous acid solution. Any colour which may be due to oxidation will disappear after a short time, while that due to the presence of an aldehyde remains. The colour produced by oxidation resembles that of rosaniline, whilst that of the aldehyde compound is violet, and with small traces, only a comparison of the relative colours would allow of a safe conclusion being drawn. The author concludes from his experiments that Schiff's test is a dangerous one, and should only be used as a confirmation.

The author gives the results of some experiments, made in January, as to the rate at which formalin disappears from milk on keeping. The formaldehyde, in a sample which contained 1 part of formaldehyde in 100,000 of milk, had disappeared after one week; from a sample which contained 1 part of formaldehyde in 50,000 of milk, the formaldehyde had disappeared after two weeks; whilst in a sample containing 1 in 25,000, only the faintest trace of formaldehyde could be detected after three weeks.

With the author's test (this Journal, 1895, 772), 1 part of formaldehyde can readily be detected in 200,000 of milk. The author does not agree with Richmond and Boscley (this Journal, 1895, 772) that formaldehyde will give this test with peptone and sulphuric acid, and he states that although egg-albumin gives the reaction, it is probably due to some impurity.

Casein, precipitated from milk, re-dissolved in alkali, and again precipitated and dissolved, gives the reaction most strongly; milk whey also gives it.

The reaction can be used for detecting formaldehyde in wine or vinegar, by adding a drop of milk to the sample and pouring the mixture on to the surface of strong sulphuric acid. A blue ring appears at the junction of the two liquids when formalin is present. Butter can also be tested, by using the aqueous liquor resulting when it is melted.

The following equally sensitive and characteristic test is given:—

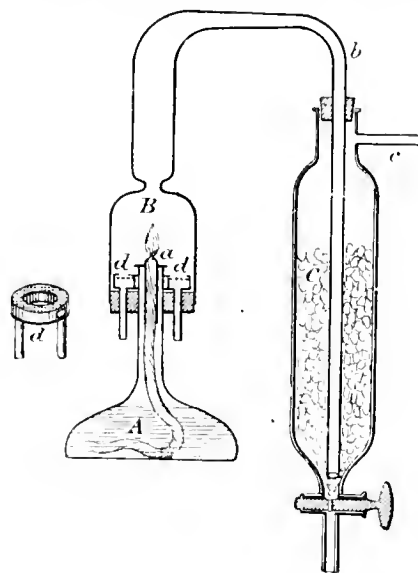
One drop of a dilute aqueous solution of phenol is added to the distillate from a sample of milk, &c., and the mixture is poured on to strong sulphuric acid. If formaldehyde be present, a bright crimson colour appears in the zone of contact. This test acts readily with 1 part of formaldehyde in 200,000 of water. If there be more than 1 part in 100,000, a white milky zone is seen above the red ring, whilst in stronger solutions, a copious white or slightly pink curdy precipitate is obtained. The precipitate obtained by phenol, sulphuric acid, and formaldehyde is so insoluble that it might be utilised for the determination of the strength of dilute formalin solutions.

The milk-, sulphuric, and the phenol-sulphuric tests are more delicate than the silver nitrate test.—A. S.

Petroleum, Sulphur in. C. Engler. Chem. Zeit. 1896, 20, 197—199.

THE development of the Ohio oilfield has brought into the market considerable quantities of burning oil from this district, but objection has been raised against its use on the score of the unusually high percentage of sulphur in the crude Lima oil. In order to see how far this is justified, the author has devised a testing apparatus to determine the amount of sulphur actually present in refined petroleum. In place of potassium permanganate, as proposed by Hensler (this Journal, 1895, 828), he prefers to absorb the products of the combustion of the oil by a solution of bromine in potassium hydroxide or potassium carbonate. A shallow oil receiver A, containing about 100 c.c., is fitted with wick and wick duct *a*, this shape being adopted to keep the level of the oil from sinking too rapidly, and to thereby ensure regularity of combustion. The height of the flame from the base of the lamp is 9 centimetres, and the cylinder B is fused on to a glass tube *b*, which extends

almost to the bottom of the absorption vessel C, filled with small glass balls or pieces of glass rod, and connected



at the upper end with an aspirator, the lower extremity terminating in a tube fitted with a tap. The cylinder B fits on to a ring of cork on the neck of the receiver, air being admitted to the burner through the tubes in the metal capsule *d*, which can be connected with a supply of pure air if the atmosphere of the laboratory contain sulphur. On the other hand, if the air in the testing room be not contaminated, the cork and capsule may be discarded.

The absorbent liquid is prepared by adding to a 5 per cent. solution of potash enough bromine to produce a pale yellow coloration, which is then removed by exposure to air. This solution will absorb and oxidise sulphur dioxide completely, can be readily prepared free from sulphur, and entails no risk of the earthenware connections becoming attacked by the vapour of bromine. Besides, until the gases reach the absorption tube they come in contact with glass exclusively.

The test is performed as follows:—

The absorption tube being filled with 20 c.c. of solution, the lamp, containing a known weight of oil is lighted, and a good draught induced by the aspirator, but not so strong as to make the flame smoke or draw the solution out of the absorption tube. After burning about 5 hours, 10 to 12 grms. of oil will have been consumed, the exact weight being ascertained by difference, and the lamp may then be extinguished. The solution is drawn off, and the vessel rinsed out two or three times with 20 c.c. of water, air being drawn through each time. The sulphuric acid is then determined as barium sulphate in the usual manner.

The method tested on oils containing a known percentage of sulphur, added by means of ethyl sulphide, proved correct to within narrow limits in the third decimal place.

Of a number of commercial oils examined, water-white Ohio oil was found to contain 0.0244 per cent.; Baku oils, 0.0262—0.0267; Pennsylvania oils, 0.0211 to 0.0362; Lima oils, 0.0432 to 0.0509; Austro-Galician oils, 0.0406 to 0.0615; and Alsatian oils, 0.0661 to 0.0684 per cent. of sulphur. The largest amount (0.2098 per cent.) was discovered in a "safety oil," but this is considered as an exceptional case.

These results show that in this respect, Lima oil, when properly refined, comes midway between Pennsylvanian and Alsatian oils, and no reason exists for the objection urged against it on this score. Furthermore, it is evident that the amount of sulphur compounds introduced into the air by the combustion of petroleum oils compares favourably with that resulting from coal gas. For example, a 14-line burner consuming 50 grms. of oil per hour gives off only 0.01 to 0.02 (or at most 0.035) grm. of sulphur

(about as much as an ordinary sulphur match), which is equivalent to about 0.1225 grm. of sulphur per 100 candles per hour, whereas English gas containing the limit of sulphur allowed by law produces on the same basis 0.513 grm., and Karlsruhe gas (0.333 grm. of sulphur per cubic metre) 0.3 grm. of sulphur. Consequently any legislation directed against petroleum on this account would also have to be applied to gas.—C. S.

Petroleum, Estimating Sulphur in Burning Oil. R. Kissling. Chem. Zeit. 20, 199. (See preceding abstract.)

The apparatus is a modification of that of Heusler. It consists of a glass cylinder with the top drawn off, and bent through rather more than 90°; 26 ins. to the top of the bend. The diameter of the cylinder is 2½ ins. The absorbent liquid consists of a 5-per cent. solution of potassium permanganate, 15 c.c. of which are placed in a U-tube filled with glass balls, and 5 c.c. in a vessel similar to those employed in the Will-Varentrapp method of estimating nitrogen, a second vessel of the same kind being connected for catching any of the solution drawn out of the other by the aspirator. The air current, which should be as free from sulphur as possible, is drawn through the apparatus at the rate of some 300 c.c. per minute. In the course of the operation the solution in the U-tube is decolorised, but that in the other two vessels retains its red colour. Finally, the solution and washings are mixed with hydrochloric acid, concentrated to drive off chlorine and the excess of acid, and after filtration, the sulphuric acid therein is determined by means of barium chloride.

The results of the application of the test to 12 varieties of burning oil (all, except a Pennsylvania "Krönen" oil, being from German refineries) show that Lima oil (0.0444 to 0.0453 per cent.) contains little more sulphur than some Galician petroleum (0.0396 per cent.) and less than Alsatian oil (0.0588 to 0.0593 per cent.). Pennsylvania oils contained 0.0269 to 0.0286; "Kaiser" oil 0.0092 to 0.0109; "Safety" oil (85° Abel) 0.0188 to 0.0198; Russian oil 0.0298, and "Krönen" oil 0.0193 per cent. of sulphur. Any prohibition directed against Lima oil would therefore have to include Alsatian petroleum.

Further experiments confirmed the somewhat surprising fact that the percentage of sulphur is reduced by refining with sulphuric acid, the "Kaiser" oil, which at first contained 0.03 per cent., containing after treatment with this acid only 0.01 per cent. of sulphur.—C. S.

Caffeine, Action of Wagner's Reagent. A New Method of Estimation. M. Gomberg. J. Amer. Chem. Soc. 18, [4], 331—342.

The author proposes to utilise the reaction for the quantitative estimation of the alkaloid, by employing as precipitant a solution of a known quantity of iodine in potassium iodide and titrating the unconsumed iodine by deci-normal sodium thiosulphate. In his experiments with varying quantities of the reagent he finds the most accurate results (averaging about 99.5 per cent.) are obtained by the use of double the theoretical quantity, in presence of about 2 per cent. of acid (hydrochloric acid being probably better than sulphuric acid). In applying the method to drugs, the extract is treated with lead acetate and filtered, the lead being then removed by hydrogen sulphide. The liquid is subdivided, one part being acidified with a mineral acid before adding the Wagner reagent. This allows the presence of any other materials that may form precipitates with the reagent to be detected in the acetic solution, the difference in the quantities of iodine absorbed in the two solutions representing the amount combined with the caffeine.—C. S.

Oils, Determination of the Heat of Bromination in. H. W. Wiley. J. Amer. Chem. Soc. 18, [4], 378—385.

The method proposed is a modification of that of Hehner and Mitchell (Analyst. 20, 146), and, briefly, consists in dissolving the fat or oil under examination, in chloroform or carbon tetrachloride (the latter by preference) at the rate of 10 grms. per 50 c.c. (final measurement), and adding the

bromine, also in a state of (25 per cent.) solution, in the same solvents.

The apparatus is composed of a tube, for the reagents and thermometer, 40 cm. long and 1½ cm. internal diameter, inserted in the cylinder of a drying-jar through an air-tight stopper. The air in the jar being exhausted through the lateral tubulure, 5 c.c. of the solution of fat are placed in the bottom of the tube, by the aid of a pipette, without touching the sides, and the thermometer is placed in position. The bromine solution is contained in an Erlenmeyer flask with a side tubulure fitted with a rubber bulb, and is forced into a pipette—inserted through a rubber stopper in the mouth of the flask—by compressing the bulb. 5 c.c. of the solution are then allowed to flow from the pipette into the solution of fat, and the rise in temperature, which will attain its maximum in about a minute, is carefully read off by the aid of a hand-glass.

The operation can be performed in two minutes, and the apparatus will be cool enough in half an hour for another determination.

The advantages claimed are readier manipulation of the bromine and the saving of time lost in weighing out the fat separately for each test. The temperature of the room should be as constant as possible.

The constant factor of relation between the heat of bromination and the iodine absorption number established by Hehner and Mitchell will have to be recalculated for this method, owing to the altered conditions. The liquids should not be agitated, or heat will be lost and the results come out too low.

Carbon tetrachloride is preferable to chloroform, on account of the rise in temperature occurring when the latter is mixed with bromine, this amounting to about 1.3° C., and being due to the reaction set up between them.—C. S.

Pyroligneous Products, On the Determination of the Acidity of. Note by M. Scheurer-Kestner. Comptes rend. 1896, 10, 619.

CRUDE pyroligneous acid obtained by the destructive distillation of hard woods in closed vessels, although consisting chiefly of acetic acid, yet includes many substances of which as yet the composition is imperfectly understood. It contains esters having acetyl as their base, as well as phenols, in notable proportion, and these interfere, though in opposite directions, with the titration by an alkaline solution, so that the error introduced by direct titration is less apparent than if only one disturbing factor operated.

Methyl acetate, which occurs in the crude acid in considerable proportion, resists alkaline titration; nevertheless the result is always too high, owing to the action of the phenols present. The proportion of methyl acetate may be determined by titrating the crude acid with caustic soda solution, using phenolphthalein as indicator; then boiling the same acid with an excess of the soda solution for some hours, and again titrating. The difference found between the two tests gives the proportion of methyl acetate, which is usually equivalent to 15 to 17 per cent. of acetic acid.

Some crude (but limpid) pyroligneous acid was kept in a closed flask for 30 days. The bottom of the flask was then covered by an oily, phenolic layer. The acid, titrated before and after the subsidence, showed a difference of 8 per cent. due to the phenol separated, of which nevertheless, much was still retained in solution by the alcohols and esters present in the liquid.

To obviate these sources of error, the author distils 20 grms. of the crude acid with 50 grms. of phosphoric acid solution of 15° B. When only a small quantity of liquid remains in the retort, 20 c.c. of water are added, and the distillation is continued. After three such distillations, the process is usually complete, and on combining the distillates and titrating, an accurate result is attained. An experiment thus conducted upon a sample taken from a very large quantity of the crude acid, gave a difference of 10.5 per cent. in titration, as compared with the direct test, the latter being in excess.

The phosphoric acid process described, is also available with like precautions, in estimating the acetic acid contained in crude acetates of iron and aluminium.—E. S.

Anthracene Testing, Improved Method of. H. Bassett.
Chem. News, **73**, 178-179.

THE anthracene is subjected to oxidation in the usual manner, using 15 grms. of pure chromic acid. Next morning the product is diluted with 400 c.c. of water, allowed to stand for three hours, filtered, washed with cold water only, and dried on the filter in the water-oven. The quinone is then transferred to a flask of the usual size, with the aid of a funnel, with a short and wide neck, and a glass rod, using a small wash bottle containing 45 c.c. of glacial acetic acid to rinse the filter-paper, rod, and funnel, 2.5 c.c. of chromic acid solution, and 10 c.c. of ordinary pure nitric acid of sp. gr. 1.42 are then added, after which the mixture is boiled for an hour with the usual condensing tube. Next morning, the product is diluted with 400 c.c. of water, allowed to stand for three hours, filtered, washed first with water, then with boiling 1 per cent. alkali, and finally with hot water. The quinone is then washed into a flat dish, dried at 100°, and heated for ten minutes on a water-bath with 10 times its weight of pure concentrated sulphuric acid. It is then left all night to absorb moisture, in a tray of water covered by a glass plate, diluted, filtered, washed with water, boiling alkali, and hot water, and finally dried and weighed as in the ordinary way.

The results obtained with a fairly representative number of commercial and other samples of anthracene are given, showing the percentage loss on the value by the ordinary test. The author suggests that a comparison of the results obtained by the two methods may lead to a reliable conclusion as to the quality of the anthracene under examination. With the ordinary method, the colour of the final product, especially in the case of the so-called "R" qualities, is more or less brownish, but with the nitric acid process, all samples, good or bad, are said to give a clean yellow quinone, which gives rise to less carbonisation on sublimation. The final product is quite free from nitro compounds.—D. B.

Benzidine and Tolidine, Valuation of. W. Vaubel. Zeits. anal. Chem. 1896, **35**, 163.

THE determination of these bases in the commercial article by nitrite is not adapted to the purposes of the Congo-red manufacture, since this reagent also determines the other bases present which will not yield a cotton dye. A volumetric method founded on the precipitation of the sulphate from a hydrochloric acid solution of the base, only gives approximate results because of the greater solubility of the sulphate in hydrochloric acid than in water.—A. C. W.

Naphthols and Naphthylamine, Behaviour towards Nascent Bromine. W. Vaubel. Zeits. anal. Chem. 1896, **35**, 164.

BROMINE, liberated on the addition of a solution of potassium bromide and bromate to an acetic acid solution of the following substances in the presence of strong hydrochloric acid, is absorbed (one atom), and the end-point of the reaction is well marked:— α -acetylnaphthylamine, β -naphthol, the ethers of α - and β -naphthol. Monobromo- β -naphthol methyl ether separates as white shining needles, melting at 85°, the bromomethyl ether in plates melting at 54°.—A. C. W.

Gutta-Percha, Analysis of. J. Montpellier. Ann. Chim. Anal. Appl. 1896, **1**, 1.

DETERMINATIONS are made of moisture; gutta-percha proper; the resins, fluavil and alban; inorganic matters (ash); and extraneous matters, if any should be present.

The moisture is estimated by heating for 6-7 hours at 100° in an atmosphere of carbon dioxide or nitrogen.

The gutta-percha is directly, and the resins are indirectly, determined by extracting with alcohol 0.5-1 gm. of the finely divided sample, and drying the residue of gutta-percha in a current of carbon dioxide at 100°.

An approximate separation of the resins may be effected by concentrating the alcoholic extract, when the alban crystallises out. This is thereupon collected, dried in carbon dioxide, and weighed, the fluavil being estimated by difference.

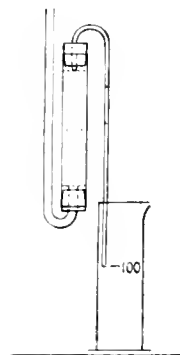
The ash should not exceed in amount 0.5 per cent. Foreign matters may usually be determined by taking not more than 1 gm. of the sample and extracting with chloroform, which dissolves the gutta-percha and resins, and leaves most other matters undissolved.—E. B.

Tannin Estimation, Remarks on the Vienna Method of.

J. Schneider. Casopis českého lékařnictva, 1896, **15**, 4.

INSTEAD of sucking the tannin liquor through the hide-powder filter, the author forces it through by pouring it down a long funnel attached to the wider bent tube shown in the figure.

The tube containing the hide powder (6 grms.) is 13 cm. long and 2 cm. in diameter, and the powder is prevented from passing into the entrance and delivery tubes by plugs of brass wire gauze or cotton wool. The influx tube is



8 mm. in diameter and 150 cm. long to the funnel. At the beginning, the tannin liquor must be added very slowly, so that at no time may the liquid stand in the influx tube at more than 5-10 mm. higher than in the hide-powder tube. When the powder has been wetted by the liquor the influx tube may be completely filled. The first portion of 5 c.c. of the filtrate is rejected, after which the apparatus requires no attention.—A. G. B.

Butter, Method for Determining the Purity of, by Means of the Density. R. Brullé. Comptes rend. 1896, **122**, 325.

EXPERIENCE proves that by taking care to eliminate the water which the fused fat almost always retains in variable proportion, as well as the colouring matter and the casein, so as to render the fats comparable with each other, the density, determined at 100° by a very delicate hydrometer, may be made to furnish very exact indications of the proportion of foreign fat fraudulently added to butter.—L. A.

Butter-Fat and its Substitutes, Examination of. H. Bremer. Forschungs-, Lebensmitt. Hyg. foren.-Chem. Pharmakogn. 1895, **2**, 424.

THE author recommends the following method, which combines the Meissl with the Köttstorfer method and by which the absorption of carbon dioxide is avoided, and likewise the action of the excess of alkali on the alcohol and the fat. Five grms. of the clear melted fat (free from moisture) are heated in a 300 c.c. Schott flask with 10 c.c. of alcoholic potash (containing 1.25-1.35 gm. KOH); the flask is fitted with a long condensing tube provided at its upper end with a Bunsen valve. When the reaction is complete, the flask is allowed to cool, the valve is opened, the tube removed, and the product titrated with alcoholic sulphuric acid. The saponification number can then be calculated. About 10 drops of alcoholic potash are added to the contents of the flask, which is then heated to expel the alcohol; the dry soap is dissolved in 100 c.c. of water (free from CO₂), a few pieces of pumice and 40 c.c. of dilute sulphuric acid (1:10) added and the whole distilled until 100 c.c. have come over for the determination of the volatile fatty acids.—A. K. M.

Gelatin in Meat Extracts and Commercial Peptones, Estimation of. A. Stutzer. *Zeits. anal. Chem.* **34**, 568.

THE extract is dissolved in a sufficiency of hot water in a dish of tin foil, and the solution mixed with enough calcined sand to absorb the liquid. The mixture is then ground, the dish cut up into strips, and the whole placed in a beaker, where it is extracted four times in succession, each time with 100 c.c. of absolute alcohol, the supernatant alcohol being passed through an asbestos filter in such a manner as to bring as little as possible of the solids on to the filter. After cooling in ice, further extraction is effected by means of a mixture of 100 grms. of alcohol, 300 grms. of ice, and 600 grms. of cold distilled water, at a temperature not exceeding 5° C., several times repeated until the liquid is no longer coloured. A separate filter is employed for each operation, and these are afterwards boiled repeatedly in water, the residues being united and concentrated, and the gelatin estimated therein.—C. S.

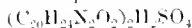
Cheese, Extraction of Fat for Examination. O. Hensold. *Milch. Zeit.* **24**, 729.

THREE hundred grms. of cheese are crushed in a mortar and shaken up in a wide necked flask with 700 c.c. of potash solution (containing 50 grms. of caustic alkali per litre) at 20° C. In a few minutes the cheese will be dissolved, and the fat left floating on the surface in small lumps, which can be induced to coalesce by moving the flask backwards and forwards. Cold water is poured in until the flask is full, and the butter can be collected in a spoon, washed in cold water—to remove the traces of potash and help the fat to set—pressed to remove the water as much as possible, remelted, and filtered. This method leaves the milk fat unchanged, and the author has also found that it likewise remains unaltered during the preparation and ripening of the cheese.—C. S.

Quinine, Note on the Titration of. A. H. Allen. *Analyst*, **21**, 85.

IN estimating alkaloids by titration with standard acid, phenolphthalein is useless as an indicator, whilst litmus will only answer in some cases. With methyl-orange, in the majority of cases, a determination of tolerable accuracy and a fairly sharp end reaction are obtainable. Cochineal, brazil-wood, and logwood may also be used sometimes as indicators.

The ordinary quinine sulphate of commerce—



is strongly alkaline to methyl-orange, although practically neutral to cochineal, brazil-wood, and logwood. In titrating quinine, therefore, with cochineal, brazil-wood, or logwood, the point of neutrality is reached when all the quinine has been converted into $(C_{20}H_{21}N_2O_2)_2H_2SO_4$, whilst, with methyl-orange as indicator, the end-reaction is not obtained until the quinine is converted into $(C_{20}H_{21}N_2O_2)_2H_2SO_4$. The results are similar if nitric or hydrochloric acid be substituted for sulphuric acid.

The sparingly-soluble sulphate $(C_{20}H_{21}N_2O_2)_2H_2SO_4$ is alkaline to litmus, and hence this indicator cannot be conveniently used for the titration of quinine, although the end-reaction is well marked.

The author states that Seaton and Richmond's method for the determination of quinine in medicine (*Analyst*, **15**, 43) is of little value for practical purposes. It is useless in presence of citric and other organic acids, and the colouring matter present in quinine wine prevents the end-reaction being accurately observed.

Experiments made on the titration of cinchonine and cinchonidine with various indicators seem to render it doubtful if the correct constitution of these bases, or at least the composition of the commercial article, is known.

—A. S.

Cinchona Extract, Examination of. I. Hulsebosch. *Ber. Pharm. Ges.* **1895**, **5**, 286.

Estimation of Alkaloid.—1 grm. of extract is diluted with 5 c.c. of water and 5 drops of normal hydrochloric acid and transferred with 10 c.c. of water to an extractor. The extraction is continued for one hour with ether, in order

to remove all matters soluble in ether from the extract solution. A small tared flask is now adjusted, and 2 c.c. of normal caustic soda solution diluted with 3 c.c. of water are added to the contents of the extractor, and extraction continued for two hours with fresh ether. Finally, the ethereal solution is evaporated, the residue of alkaloid dried at 100° C. and weighed.

Estimation of Cincho Tannates.—10 grms. of the extract are diluted with 10 c.c. of sodium acetate solution (20 per cent.) in a weighed glass dish with vertical walls, and heated on the water-bath until the precipitate coagulates and adheres to the side of the dish. The liquid is then poured off, the cincho-tannate precipitate washed once with a little water, the remaining liquid sucked up by means of blotting paper, after which the dish with contents is dried at 100° C. The residue should weigh at least 1.2 grms. (12 per cent.), and, when finely powdered, should be pale flesh coloured.—H. T. P.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

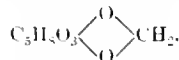
Cereal Celluloses, The Constitution of the. C. F. Cross, E. J. Bevan, and Claud Smith. *Proc. Chem. Soc.* **1896**, [161], 95.

THE general bearings of the subject, of which this is a special part, have been dealt with in previous communications (*Trans.* **65**, 472; **67**, 433; *Ber.*, **1893**, 2520; **1894**, 1061; **1895**, 1940 and 2604; *J. Amer. Chem. Soc.*, **1896**, 8).

It is now shown that the cereal celluloses may be resolved by acids into soluble derivatives of their furfuroid constituents, leaving a residue of a normal cellulose, and a process has been devised which sharply effects this separation.

Two methods of hydrolysis have been studied: (1) treatment with acids of the series, $H_2SO_4 \cdot 2H_2O - H_2SO_4 \cdot 3H_2O$, in the cold, dilution and filtration from reprecipitated cellulose, the furfuroid remaining in solution; (2) treatment with dilute sulphuric acid, 1 to 2 per cent. strength, at 1 to 9 atmos. steam pressure. The best results are obtained on short heating (15 mins.) at 3 atmos. The furfuroid is then obtained quantitatively.

It is concluded that the furfuroid in question is a pentose, monoformal—



Such a compound, having the empirical formula of a normal cellulose, could arise within a cellulose complex by transformation of the terminal, CH_2OH , of a hexose molecule, i.e., an oxidation by internal rearrangement. The formaldehyde residue thus produced is not split off, but remains united by oxygen with the pentose residue which is simultaneously produced.

Fire-Damp, Composition of. Th. Schlæsing, jun. *Comptes rend.* **1896**, **122**, 398.

IT is necessary to know whether other combustible gases than methane are present in fire-damp, since in mines the determination of fire-damp is made by means of the limit of inflammability. Samples of gas were obtained from the principal types of French mines; the analyses of all except three show that practically the only combustible constituent is methane. The other three probably contained another gas; the results obtained would correspond to 2–4 per cent. of ethane.

Some of the samples contained a high percentage of nitrogen; this was shown to have an atmospheric and not a vegetable origin by a determination of the argon it contained.—A. C. W.

Benzene and Naphthalene Hydroxy-Carboxylic Acids, Decomposition of. P. Cazeneuve. *Bull. Soc. Chim.* **1896**, 72–82.

THE author, in a previous paper, pointed out that certain phenol carboxylic acids, when heated in presence of aromatic amines, give off carbonic acid at much lower temperatures, and more completely, than when heated with

water. For instance, gallic acid, when heated with aniline, gives pyrogallol and carbonic acid at 115°C ., whilst in presence of water the decomposition only occurs at about 200°C . An investigation of several analogous compounds has led to the formulation of certain rules regarding their decomposition under the conditions mentioned. (1.) The instability of the carboxyl group attached to the benzene nucleus increases with the number of hydroxyl groups present in the molecule. (2.) The same gradation in instability is observable in phenol carboxylic acids containing halogen or other substituting groups in the nucleus. (3.) Ortho-phenol carboxylic acids lose carbonic acid more readily than the para compounds, and these latter are more easily decomposed than the meta compounds, which possess a very considerable stability. Thus, for instance, guaiacol carboxylic acid is unaltered by heating with aniline to 240°C .—T. A. L.

Nickel and Cobalt Borides. H. Moissan. *Comptes rend.* 1896, 122, 424.

THESE borides, NiB and CoB , are easily obtained crystalline by heating the elements together in a current of dry hydrogen at a temperature above $1,200^{\circ}$. In properties they are quite similar to the boride of iron previously described.—A. C. W.

New Books.

A THEORETICAL AND PRACTICAL TREATISE ON THE MANUFACTURE OF SULPHURIC ACID AND ALKALI, WITH THE COLLATERAL BRANCHES. By GEORGE LUNGE, Ph.D., Professor of Technical Chemistry at the Fed. Polytechnic School, Zürich. Second Edition, revised and enlarged. Vol. III. Gurney and Jackson, 1, Paternoster Row, London. 1896. Price 2*l.* 2*s.*

The first edition of this volume filled 422 pages; the present second edition fills no less than 840 pages, which are illustrated with 248 engravings. Even a brief comparison of the two editions will prove the truth of the author's statement, that the present is not merely a "new edition" but practically "a new book." The Chapters on the ammonia-soda industry, on the more recent soda process, on the Deacon process, and the other chlorine processes, have had to be entirely re-written. Considerable space is also now occupied by electrolytic methods. The work comprises 30 Chapters, Statistics covering 12 pages, Addenda to Vols. I, II, and III, filling some 28 pages, and an Alphabetical Index. The treatment of the subject will be apparent from the following synopsis of the Contents:—

FIRST BOOK.—THE AMMONIA-SODA PROCESS. I. Historical and General. II. The Ammoniacal Solution of Salt. III. Production of Carbonic Acid. IV. Precipitation of Sodium Carbonate by the Carbonating Process. V. Filtering, Drying, and Calcining the Bicarbonate. VI. Recovery of the Ammonia. VII. Analyses, Costs, Statistics. VIII. Other forms of the Ammonia-Soda Process. IX. Manufacture of Commercial Bicarbonate by the Ammonia-Soda Process. SECOND BOOK.—VARIOUS PROCESSES OF THE ALKALI MANUFACTURE. X. Manufacture of Soda from Cryolite. XI. Manufacture of Soda directly from Sodium Chloride. XII. Manufacture of Soda from Sodium Sulphates without previous reduction to Sulphide. XIII. Manufacture of Soda from Sodium Sulphate after reducing it to Sulphide. XIV. Manufacture of Soda from Nitrate of Soda and Felspar. THIRD BOOK.—THE CHLORINE INDUSTRY. XV. General and Historical. XVI. Manufacture of Chlorine by Means of Manganese Ore. XVII. Utilisation of Still Liquor. XVIII. The Deacon Process. XIX. Properties and Behaviour of the Hypochlorites and of Bleaching Powder. XX. Manufacture of Bleaching Powder. XXI. Bleach Liquors. XXII. The Chlorates. XXIII. Other Processes for the Manufacture of Chlorine. FOURTH BOOK.—PREPARATION OF ALKALIS, CHLORINE, AND CHLORATES BY ELECTROLYSIS. XXIV. History, Theories, General Notes. XXV. to XXVII. Special Processes for the Electrolytic Production of Soda and Chlorine. XXVIII. Chlorine from Hydrochloric Acid, Bleach Liquor. XXIX. Chlorates. XXX. Special Forms of Electrodes and Diaphragms. STATISTICS. ADDENDA TO VOLS. I, II, AND III.

DIE DERIVATE DES NAPHTHALINS, WELCHE FÜR DIE TECHNIK INTERESSE BESITZEN. Uebersichtlich zusammengestellt von ERNST TÄUBER und RAGNAR NORMAN. Hermann Heyfelder, R. Gaertner's Verlagsbuchhandlung, Schöneberger-Str. 26, Berlin, S.W. H. Grevel and Co., 33, King Street, Covent Garden, London. 1896. Price M. 18 or 18*s.*

LARGE 8vo. volume, bound in cloth, and containing Preface, Introduction, Table of Contents, and 219 pages of subject-matter.

The work, as a whole, may be designated a *Vade mecum* to those derivatives of naphthalene which possess technical interest. The arrangement is mainly tabular, so that no alphabetical index is necessary. However, alphabetical registers are given of various subsidiary matters, and a valuable one of the Literature of the subject, with Authors', Patentes', or Firms' names, and references to the original papers or publications. Each Chapter describing a set of derivatives, is headed by a table in which the derivatives are placed and classified according to isomeric order.

The following are the derivatives described:—

Amidonaphthalene sulphonic acids, including Amidonaphthalene carbonic acids and Amidonaphthalene carbo-sulphonic acids.

Hydroxynaphthalene sulphonic acids, including Hydroxynaphthalene carbonic acids and Hydroxynaphthalene carbo-sulphonic acids.

Diamidonaphthalenes, including Triamidonaphthalenes. Diamidonaphthalene sulphonic acids, including Diamidonaphthalene carbonic acids.

Dihydroxynaphthalenes including Trihydroxynaphthalenes.

Dihydroxynaphthalene sulphonic acids, &c.

Amidohydroxynaphthalenes, &c.

Amidohydroxynaphthalene sulphonic acids, &c.

Bibliographic references.

Table on the Di- and Trichloronaphthalenes, Naphthalene di-, tri-, and Tetrasulphonic acids and Nitronaphthalene sulphonic acids.

JAHRESBERICHT ÜBER DIE LEISTUNGEN DER CHEMISCHEN TECHNOLOGIE, mit besonderer Berücksichtigung der Elektrochemie und Gewerbestatistik für das Jahr 1895. Von Dr. FERDINAND FISCHER. Mit 226 Abbildungen. Verlag von Otto Wigand, Leipzig, Germany. 1896. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 2*l.*

THE progress and position of Chemical Technology up to the end of the year 1895 are treated of in this Annual Report. Trade statistics, with more special reference to the German Empire, are also given. The Jahresbericht for 1894 contained 1150 pages, whereas the present one contains 1140 pages. Its complete Alphabetical Indexes for authors and subject-matter, extend from page 1111 to 1198, i.e., over 57 pages. An Index of German Patents completes the volume, and it fills nine pages. The text is illustrated with 226 engravings referring to plant and apparatus. The following is a synopsis of the subjects treated of in the volume, the extent of each group and its treatment being indicated by the number of pages filled. (In this connection it may be mentioned that the Table of Contents, itself a complete epitome, covers close upon 35 pages.) GROUP I. CHEMICAL TECHNOLOGY OF FUEL (pages 5 to 108). II. CHEMICAL METALLURGY (pages 109 to 284). III. ELECTROCHEMISTRY (pages 285 to 591). IV. CHEMICAL MANUFACTURES, INORGANIC (pages 392 to 541). V. CHEMICAL MANUFACTURES, ORGANIC (pages 542 to 731). VI. GLASS, POTTERY, CEMENTS, ARTIFICIAL STONE (pages 732 to 782). VII. FOODSTUFFS (pages 783 to 952). VIII. CHEMICAL TECHNOLOGY OF FIBRES (pages 953 to 1041). IX. OTHER INDUSTRIES CONNECTED WITH ORGANIC CHEMISTRY (pages 1042 to 1124). X. APPARATUS (pages 1125 to 1140). It was remarked in the notice of the Jahresbericht for 1894, that the group on Electrochemistry had been added for the first time there. The subject filled 85 pages. In the present issue, for 1895, this subject has 106 pages devoted to its treatment.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

ARGENTINE REPUBLIC CUSTOMS LAW FOR 1896.

See *Board of Trade Journal* for May, p. 554.

SWEDEN.

Tariff Modifications.

Yeast.—The present duty of 25 öre to be reduced to 20 öre per kilo.

Explosives (Sprängämnen).—The following new duties to be imposed:—

Guncotton (bomullskrut), 30 öre per kilo.

Smokeless powder (barksvagt), 50 öre per kilo.

Other explosives (andra olag), 25 öre per kilo.

Common powder (krut) to remain as before with the duty of 12 öre per kilo.

These new duties will come into force on the 1st of January 1897, unless the Government should in the meanwhile decide otherwise.

UNITED STATES.

Customs Decision.

Formaldehyd, or beer preservative, is to pay duty at the rate of 25 per cent. *ad valorem* under paragraph 60 of the Act of August 28, 1891.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

OPENINGS FOR BRITISH TRADE IN THE WESTERN UNITED STATES.

Board of Trade Journal, May 1896, 584.

A memorandum, dated April 13 last, has been received at the Foreign Office from Mr. A. G. Vansittart, Her Majesty's Consul at Chicago, which calls attention to some articles of commerce which should, in the interests of British trade, be watched by British merchants. The memorandum states that there is a good market in the western parts of the United States for earthenware, crockery, china, glass-ware, and enamelled ware. Although the imports from Great Britain are steadily increasing, still they do not increase as fast as the country develops, and cheap American products are being used where British-made goods, if the same were made known, might be utilised. Many large firms in Kansas City, Leavenworth, Topeka, Atchinson, St. Joseph, Lincoln, Omaha, Sioux City, and Denver would probably buy if an opportunity were given. This would appear to be a favourable moment for pushing the above class of goods forward in the western country.

In 1894, Kansas City received from Great Britain 6,000/ value of the above-named goods; in 1895 the value had increased to 15,871/. In 1894, Omaha received 422 crates, and in 1895 as much as 612 crates. The orders are increasing, but there appears to be room for larger ones.

It should also be pointed out that British merchants should observe more closely the market in the following articles, viz.:—Linen, carpets, linoleum, salt, saltpetre, cotton goods, woollen goods, knit goods, caustic soda, plate-glass, quick-silver, and fuller's earth. Mr. Burrough, Her Majesty's Vice-Consul at Kansas City, is of opinion that the trade in the above goods, in his district at least, could be increased materially.

The importation of tin (? plate) from the United Kingdom to Kansas City and Omaha is falling off rapidly this year so far, and American tin (? plate) is coming in and taking the place of the British article. The following table shows the amount of tin used annually in the different cities:—

	Lb.
Kansas City	14,000,000
Omaha	8,000,000
St. Joseph	4,000,000
Denver	3,000,000

One firm in Kansas City uses about 7,000,000 lb. per year, and there are some 10 firms using tin in large quantities in the west. The British merchant should be

able to increase his business, for tin will probably increase as fast and in the same ratio as the packing-house business does.

The following amounts were imported from Great Britain to the cities as named:—

Kansas City, in 1894, 4,825,919 lb.; in 1895, 6,774,851 lb.

Omaha, in 1894, 4,500,000 lb.; in 1895, 4,980,000 lb.

St. Joseph, in 1895, 2,000,000 lb.

Denver, in 1895, 3,102,000 lb.

As regards Portland cement, complaints are made from the above four cities that the British article is too much mixed, and that its diminution is due to that cause. On the other hand, German and Belgian Portland cements are giving universal satisfaction, and their trade is increasing. Of imported cements used in the western cities, 70 per cent. is German, 20 per cent. Belgian, and only 10 per cent. British. More cement is being used every year.

ARGENTINE REPUBLIC: SHEEP SCAB AND SHEEP DIPS.

U.S. Consular Reports, April 1896, 519—522.

The U.S. Consul at Buenos Ayres reports as follows:—

The great plague of the wool growers of the Argentine Republic is the sheep scab (*scabie oralis*). It has spread to all parts of the country, and there is not a sheep estancia, or cabaña but suffers more or less from its presence.

Thus far, nothing in the way of laws going radically to the extirpation of the disease has yet been enacted. The cost to farmers of sheep dips will be appreciated when it is remembered that the number of sheep in the Argentine Republic is now estimated to be 80,000,000.

When it is borne in mind that not merely is the wool ruined by scab, but that the carcass itself is rendered unfit for food when the sheep is thus diseased, the absolute necessity on the part of the sheep farmer of curing scabby flocks will be better understood. Thus the amount expended annually for sheep dips and scab specifics goes on increasing as the flocks and shipments increase. For 1885, the value of the importations amounted to 150,261 dols., and for 1894, to 840,551 dols., an increase in ten years of 650,290 dols. In 1890, the number of tons imported was 1,078; in 1894, it was 2,262, an increase in five years of 1,484 tons. The following table shows the importations by countries for the years named:—

Country.	1891.	1892.	1893.	1894.
	Dols.	Dols.	Dols.	Dols.
Germany	38,826	80,808	101,172	26,585
Belgium	29,000	45,195	27,964	44,842
United States	55,589	32,604	45,126	8,799
France	14,830	3,702	107	929
Great Britain	151,889	671,079	353,121	84,976
Italy	47,800	50,525	30,762	59,364
Uruguay	6,215	12,040	715	4,577
All other countries	2,072	15,945	2,423	10,488
Total	337,852	918,808	561,480	810,551

For the first nine months of the present year the importations have already amounted to 2,980 tons, valued at 745,260 dols., thus showing that the business of supplying the sheep farmers of the Argentine Republic with specifics for the cure of scabby flocks steadily increases with the increasing number of sheep.

It will be observed that a very large proportion of the specifics for scab are imported from Great Britain. The United States, of late years, has contributed but very little to the quantities imported. The ingredients are as cheap in the United States as in England, if not cheaper. Most of that which is shipped from the United States is some preparation of tobacco, and generally comes in barrels. As a general thing, that from England is either a powder to be dissolved in water or a liquid solution which comes in iron kits or drums, holding from 1 to 5 gallons, and is diluted to the proper strength when it is to be used.

The Argentine Government allows all preparations for curing scab to be passed through the Custom-houses free of duty. It is true that, in 1894, a duty of one-fourth of 1 per cent. *ad valorem* was put upon all such specifics, but it was omitted in the tariff which is at present in force, and

it will be omitted, in all probability, from the tariff for 1896.

American Dips.—If there are those in the United States who contemplate engaging in the preparation and shipment of sheep dips to the Argentine Republic, they should first be sure that they have a first-class article to put upon the market; otherwise, while they may succeed in selling it once, its demerits or disadvantages will soon come to be understood. It is only the good, reliable specifics that can be expected to find steady purchasers among sheep farmers; but reliable articles will soon secure a general demand. There are already such articles on sale here, having stood the tests and trials of many years. The most effective way to get a trial here is by sending a man who understands the business along with a consignment of the dip. Having a direct interest in its success, he will not be slow in illustrating to the sheep men what it can do. He would then be in a condition to secure an active and reliable agent here, who understands the trade and the people, and who, by keeping the material always in stock, would be able to supply all demands for it at once, without waiting for an order to be sent to the United States to be filled. Or, if the dip, upon trial, is found to fulfil all the conditions of an infallible specific, manufacturers of the article might be able to find houses here who would buy on their own account, provided they could obtain as satisfactory terms and conditions as those offered by European shippers. So far as the price is concerned, of course that must necessarily depend upon the cost of the ingredients and the expense of compounding them, and manufacturers know at what figures they are able to put their own preparations upon the market. Whether they be of tobacco, arsenic, lime, sulphur, or some other chemicals, the less expensive the material, the cheaper must be the article when prepared for sale. The Custom-house valuation of such specifics is 25 cents per kilo. When it comes in drums the price ranges from 80 cents to 1.25 dols. per gallon, including the drum.

There is always more or less demand for these specifics, for scabby flocks must be taken care of at once, but the general season for administering the dip is just after the shearing is over, as it then acts both as preventive and cure. The special details of the business, however, cannot be anticipated, but must be left for those who buy or sell to arrange for themselves.

GENERAL TRADE NOTES.

THE MINERAL PRODUCTION OF CALIFORNIA IN 1895.

Engineering and Mining Journal, May 16, 1896, 466.

The California State Mining Bureau has just issued in tabular form a statement showing the mineral production of the State for the year 1895. According to its figures the value of the total mineral product of California in 1895 was 22,844,664 dols. against a total of 20,203,294 dols. in 1894, showing the substantial increase of 2,641,370 dols., a considerable part of which was due to the greater production of gold.

The mineral production is divided into four classes. The first is formed by the metallic products, quantities and values of which are shown in the following table:—

Metallic.

Substance.	Customary Measure.	Quantity.	Value.
			Dols.
Gold.....	..	..	15,384,318
Silver.....	..	..	599,790
Chrome.....	Short Tons	1,740	16,795
Mineral paint.....	..	750	8,425
Quicksilver.....	Flasks	36,101	1,337,131
Manganese.....	Short Tons	880	8,200
Copper (fine).....	Pounds	225,900	21,909
Lead.....	..	1,592,409	49,364
Antimony, ore.....	Short Tons	33	1,485
Platinum.....	Ounces	159	900
Total.....	..	..	17,378,308

The most notable increase is that shown in the production of gold; it amounted to 1,763,920 dols. over the production of 1894, and to 3,254,317 dols. over that of 1893.

Next in importance is the output of quicksilver. The mines of that metal are still very actively worked and show a substantial gain in production over 1894, although no new discoveries have been made.

The other mineral products include chrome ore, which was one of the few industries showing a diminished output; antimony, of which a small amount was obtained from the mines in Kern County; lead from Inyo and Mono counties; copper from Amador, Calaveras, and Nevada counties, chiefly obtained in connection with the gold mines; manganese ore and platinum. Of the latter metal 150 ounces are reported which is not assigned to any particular locality, but was obtained in the assay office from refining gold.

The non-metallic substances, which are of considerable importance, are shown in the following table:—

Non-Metallic.

Substance.	Customary Measure.	Quantity.	Value.
			Dols.
Borax.....	Short Tons	5,950	595,900
Coal.....	..	79,859	193,790
Salt.....	..	53,031	180,576
Asbestos.....	..	25	1,000
Gypsum.....	..	5,158	51,011
Magnesite.....	..	2,200	17,000
Soda.....	..	1,900	47,500
Total.....	..	..	1,056,780

The third division of the Bureau's report includes the hydrocarbons and gases. The production of petroleum in California has increased very considerably, the discoveries of new oil territory in and around Los Angeles some two years ago having been utilised by the boring of numerous wells, so that the district is now actively worked. Asphalt and bituminous rock are mined in increasing quantities, as the value of the California product is recognised.

Hydrocarbons and Gases.

Substance.	Customary Measure.	Quantity.	Value.
			Dols.
Asphaltum.....	Tons	25,525	170,500
Bituminous rock.....	..	38,421	121,586
Natural gas.....	..	..	112,000
Petroleum.....	Bbls.	1,245,339	1,000,235
Total.....	..	..	1,404,321

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 30th April	
	1895.	1896.
	£	£
Metals.....	1,351,907	1,683,325
Chemicals and dyestuffs.....	571,941	528,531
Oils.....	661,439	628,705
Raw materials for non-textile industries.....	3,005,266	3,324,050
Total value of all imports.....	31,341,358	35,808,800

SUMMARY OF EXPORTS.

Articles.	Month ending 30th April	
	1895.	1896.
	£	£
Metals (other than machinery).....	2,232,083	2,716,535
Chemicals and medicines.....	675,558	715,256
Miscellaneous articles.....	2,703,189	2,723,558
Total value of all exports.....	17,252,311	18,426,699

IMPORTS OF METALS FOR MONTH ENDING
30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore..... Tons	9,517	3,517	18,482	35,039
Regulus.....	7,080	9,718	101,516	217,468
Unwrought.....	3,786	5,217	152,970	237,938
Iron:—			£	£
Ore.....	377,550	522,637	271,439	310,192
Bolt, bar, &c.....	2,194	3,618	16,187	28,311
Steel, unwrought.....	669	512	7,737	6,754
Lead, pig and sheet.....	11,278	13,118	110,005	116,784
Pyrites.....	59,372	61,701	85,245	119,297
Quicksilver..... Lb.	90,000	22,584	7,500	2,079
Silver ore..... Value £	..	..	137,341	90,122
Tin..... Cwt.	42,383	36,518	128,653	109,067
Zinc..... Tons	3,744	5,516	54,654	84,267
Other articles..... Value £	..	..	149,117	244,733
Total value of metals.....	..	..	1,351,907	1,683,325

IMPORTS OF CHEMICALS AND DYE-STUFFS FOR MONTH
ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	10,942	16,742	8,239	7,873
Bark (tanners' &c.).....	19,697	23,285	7,034	8,107
Brimstone.....	33,453	29,903	6,882	5,003
Chemicals..... Value £	..	..	118,122	98,096
Cochineal..... Cwt.	244	143	1,586	1,128
Cutch and gambier Tons	2,692	2,823	61,139	61,056
Dyes:—			£	£
Alizarin..... Value £	..	..	28,483	22,412
Anilin and other.....	..	..	35,302	31,855
Indigo..... Cwt.	6,267	4,827	92,524	70,343
Nitrate of potash.....	22,114	39,608	20,309	32,837
Valonia..... Tons	1,857	3,319	51,773	33,208
Other articles..... Value £	..	..	139,957	150,353
Total value of chemicals.....	..	..	571,911	528,531

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian..... Cwt.	4,277	4,997	6,590	8,847
Bristles..... Lb.	269,561	389,108	36,523	62,219
Caoutchouc..... Cwt.	25,192	31,788	261,039	341,940
Gum:—			£	£
Arabic.....	1,960	10,813	13,476	32,019
Lac, &c.....	11,070	16,011	79,548	82,816
Gutta-percha.....	3,468	3,623	24,669	31,109
Hides, raw:—			£	£
Dry.....	38,068	35,912	73,951	88,601
Wet.....	57,923	42,920	108,848	97,245
Ivory.....	930	1,077	37,651	41,371
Manure:—			£	£
Gaïno..... Tons	6,384	215	59,203	1,405
Bones.....	7,081	5,918	30,503	22,926
Nitrate of soda.....	8,978	11,173	399,759	90,117
Phosphate of lime.....	30,129	35,467	56,949	49,505
Paraffin..... Cwt.	70,182	59,528	79,283	51,126
Linen rags..... Tons	1,906	1,739	29,621	15,757
Esparto.....	12,823	14,981	53,042	64,779
Pulp of wood.....	21,509	24,497	111,591	118,056
Rosin..... Cwt.	108,940	196,319	24,194	59,576
Tallow and stearin.....	191,097	290,828	222,911	217,013
Tar..... Barrels	1,752	846	933	411
Wood:—			£	£
Hewn..... Loads	133,281	223,926	229,281	111,389
Sawn.....	138,590	229,466	321,424	543,753
Staves.....	4,944	7,757	12,322	42,244
Mahogany..... Tons	3,382	3,297	27,681	31,658
Other articles..... Value £	..	..	798,379	824,147
Total value.....	..	..	3,605,266	3,324,950

Besides the above, drugs to the value of 77,811*l.* were imported, as against 69,869*l.* in April 1895.

IMPORTS OF OILS FOR MONTH ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa-nut..... Cwt.	15,828	14,861	17,479	19,880
Olive..... Tons	1,926	2,498	64,040	77,521
Palm..... Cwt.	85,929	81,922	91,131	84,315
Petroleum..... Gall.	14,907,872	14,389,459	299,777	268,564
Seed..... Tons	4,176	3,175	82,046	61,908
Train, &c..... Tons	994	1,577	17,863	26,232
Turpentine..... Cwt.	13,758	2,517	14,271	1,584
Other articles..... Value £	..	..	76,302	88,251
Total value of oils.....	..	..	664,439	628,705

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,368	9,567	36,290	37,469
Copper:—			£	£
Unwrought.....	41,230	47,516	93,668	113,373
Wrought.....	29,010	25,954	72,119	72,275
Mixed metal.....	32,012	26,045	63,429	56,959
Hardware..... Value £	..	..	149,540	162,803
Implement.....	..	..	107,906	108,374
Iron and steel..... Tons	225,459	289,333	1,506,329	1,967,985
Lead.....	2,941	3,002	36,047	39,333
Plated wares..... Value £	..	..	24,886	21,215
Telegraph wires.....	..	..	35,544	23,065
Tin..... Cwt.	9,337	9,469	32,911	30,406
Zinc.....	18,878	18,860	12,292	11,916
Other articles..... Value £	..	..	61,192	71,420
Total value.....	..	..	2,232,983	2,716,535

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	184,611	164,040	120,488	111,739
Bleaching materials.....	114,718	93,619	42,186	31,974
Chemical manures..... Tons	264,87	25,448	161,131	130,549
Medicines..... Value £	..	..	88,815	88,653
Other articles.....	..	..	267,938	352,241
Total value.....	..	..	675,558	715,256

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 30TH APRIL.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder..... Lb.	624,800	513,400	13,927	13,780
Military stores..... Value £	..	..	186,862	120,471
Candles..... Lb.	1,585,400	1,710,700	26,880	26,997
Caoutchouc..... Value £	..	..	107,051	98,234
Cement..... Tons	36,115	30,150	57,775	49,174
Products of coal..... Value £	..	..	167,405	162,811
Earthenware.....	..	..	116,448	133,420
Stoneware.....	..	..	13,495	17,825
Glass:—			£	£
Plate..... Sq. Ft.	87,010	167,563	4,534	7,287
Flint..... Cwt.	8,465	6,599	16,140	16,283
Bottles.....	56,849	61,488	27,028	30,024
Other kinds.....	16,221	21,399	15,395	16,246
Leather:—			£	£
Unwrought.....	11,527	9,908	100,197	92,447
Wrought..... Value £	..	..	25,926	27,601
Seed oil..... Tons	5,821	5,138	111,514	97,068
Floorcloth..... Sq. Yds.	1,962,500	1,922,390	79,713	79,337
Painters' materials..... Value £	..	..	131,274	139,563
Paper..... Cwt.	82,647	81,130	131,552	129,145
Rags..... Tons	4,024	4,012	23,871	22,312
Soap..... Cwt.	57,732	51,895	58,416	59,041
Total value.....	..	..	2,703,189	2,723,558

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

8250. T. O'Hara and J. R. and T. Ashmore. Improvements in or relating to valves. April 20.

8273. J. G. Nash and J. M. Borrow. An improved process of and apparatus for preventing the incrustation in boilers. Complete Specification. April 20.

8805. C. H. C. Rudd. Improvements in cocks or taps for use with various chemical corrosive fluids. April 27.

8888. J. B. Readman. Improvements in apparatus for obtaining cyanides. April 28.

8964. O. Imray.—From D. Graham. Improvements in electrical furnaces. April 28.

9084. J. Longshaw. Improvements in vacuum apparatus for frying, distilling, concentrating, and other like purposes, and in the method of and means for obtaining and maintaining vacuum therein. April 30.

9098. J. Maynes and C. L. Waterhurst. Apparatus for the separation of gases. April 30.

9127. M. Douane. Improvements in apparatus for producing cold by means of volatile liquids. April 30.

9475. H. Gerling. An instrument to be employed in skimming molten iron and the like. May 5.

9557. H. Herzog. Improvements in or connected with the overflow pipes of distillation and absorption columns. Complete Specification. May 5.

9560. A. H. Wethey. Improvements in calcining furnaces. Complete Specification. May 5.

9709. R. H. F. Finlay. Improved apparatus for removing solids from vacuum and other pans. May 7.

9775. E. E. Heyliss and C. G. Oppermann. The H. and O. filter funnel for rapidly increasing the filtering of tinctures, decoctions, infusions, and other liquids. May 8.

10,177. J. E. Tolson. A new or improved retort for engendering gases. May 13.

10,431. J. Fielden. Improvements in apparatus for drying wool and other fibrous material. Complete Specification. May 15.

10,547. C. H. C. Rudd. Improvements in diaphragm and disc valves for chemical, corrosive fluids, gases, &c. May 16.

10,609. F. Espir.—From W. C. Jack. A material for coating pipes and vessels to lessen conduction of heat to or from their interior. May 16.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

12,383. E. Hart. Improvements in condensing and cooling apparatus for acid vapours. May 7.

12,528. C. Linde. Process and apparatus for liquefying gases or gaseous mixtures and for producing cold, more particularly applicable for separating oxygen from atmospheric air. May 20.

1896.

3575. A. J. Boulton.—From M. W. Judell. New or improved heating or cooling agent. May 13.

3859. A. Ludwig.—From S. Moser. Improvements in apparatus for drying vegetable and animal matter. April 29.

5833. J. D. Morel. Improvements in mechanism for cleaning or removing the burrs, thorns, and other impurities from wool, cotton, and other fibrous substances. May 6.

6318. J. F. Lester. Apparatus for treating vegetable and animal fibre with liquids. May 6.

6749. H. Krack. Cooling apparatus for liquids. May 7.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

8247. M. E. Solon and Maquis Bibbero. The Bunsen retort superheating gas-burner. April 20.

8304. C. Bourquin, J. Besson, and P. H. Pute-Cotte de Reneville. Improvements in the manufacture of briquette fuel. Complete Specification. April 20.

8384. B. H. Thwaite. Improved process and plant for generating combustible gases. April 21.

8402. C. D. Jenkins. Improvements relating to the preparation of peat for fuel and to apparatus therefor, and for analogous purposes. April 21.

8509. P. G. de Schodt. New or improved system and means of illuminating and heating applicable with gas and mineral oils. Complete Specification. April 22.

8704. F. L. Perken, E. T. Perken, and A. Rayment. Improvements in or relating to apparatus for producing acetylene gas or the like. April 24.

8807. A. Kohler. Gas lighting by means of carburating elements. April 27.

8861. O. Imray.—From E. Rousseau. Improvement in apparatus for generating, purifying, and liquefying acetylene. April 27.

9037. J. Browne and J. Rice. Improvements in and connected with the quenching and conveying of coke from gas retorts, also applicable to quenching and conveying coke and ashes from other furnaces. April 29.

9047. T. D. Farrall. Method of and apparatus for heating by electricity. April 29.

9184. J. T. E. P. Cosson. New process for the decomposition of water into its component gases and apparatus therefor. May 1.

9244. W. Nicholls. Improvements in the manufacture of incandescence bodies for illuminating purposes. May 1.

9316. C. E. Botley and C. F. Botley, jun. Improvements in and relating to the treatment of gas for illuminating and other purposes. May 2.

9499. S. Diplock and W. T. Lalonde. Improvements in the combustion of gases or other illuminants. May 5.

9599. R. Bradshaw. Improved artificial fuels. May 6.

9630. C. Coppeaux. Method and means or apparatus for facilitating the combustion of acetylene gas. May 6.

9681. H. L. P. Boot. An improved method of street lighting by glow lamps. May 7.

9861. E. Hutter. Improvements in burners for use with acetylene gas. May 8.

9862. E. Hutter. Improvements in apparatus for liquefying acetylene and like gases. May 8.

9922. J. Sibley. Improvements in apparatus for making, lighting, and heating gas. Complete Specification. May 9.

10,372. E. Andreoli. Improvements in apparatus for the production of ozone. May 14.

10,407. R. Goodwin. A portable lamp standard to produce and burn acetylene gas or acetylene and carbonic acid gas combined. May 15.

10,480. P. C. Frewin. Improvements in generators for producing acetylene gas. May 15.

10,568. V. I. Feeny.—From P. Carmien, A. Yvonnet, and M. Billion. Automatic gas-producing apparatus and burner therefor. May 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

2224. J. Moeller. An improvement in illuminant appliances for incandescence gas lights. May 7.

10,414. W. P. Gibbons and G. B. A. Gibbons. Improvements in apparatus for charging gas retorts. May 6.

11,082. G. Haycraft. Improvements in machines or presses for use in the manufacture of artificial fuel or briquettes. May 6.

11,887. H. Gardner.—From La Société Française de l'Éclairage. An incandescent irradiator for gas without the preliminary admixture of air. April 29.

11,966. A. B. Willway. Improved construction and arrangement of container for ether saturation of oxygen for limelight. April 29.

12,344. J. H. Exley. Apparatus for generating acetylene gas. May 7.

24,015. C. Wurster. Improvements in the combustion of carbohydrates of high boiling point in incandescence burners and apparatus therefor. April 29.

1896.

322. J. C. Bayley. An improved apparatus for generating, storing, and purifying acetylene and like gases. May 6.

2563. W. Schoning. Process for producing fuel from turf or peat. April 29.

3982. E. J. Shaw. Incandescent gas lamps or burners. May 6.

4674. S. S. Bromhead.—From A. Niel. A self-regulating gas generator. April 29.

5279. G. Ragot. Improvements relating to the production of acetylene gas and to the utilisation of the same for lighting purposes. May 13.

5423. R. J. Seblight. Improvements in and relating to the promotion of combustion in furnaces, fireplaces, lamps, burners, and the like. April 29.

7242. W. C. Clarke. Method of and apparatus for generating acetylene. May 6.

7243. W. C. Clarke. Method of generating illuminating gas. May 6.

7429. J. B. de Lery. Mantles for incandescent gas and oil lamps. May 13.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

APPLICATIONS.

8718. E. Morrice. Nathaline. April 25.

9944. A. C. Thomson. Improvements in vertical retorts for the destructive distillation of carbonaceous substances. May 11.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

8582. H. H. Lake.—From Lepetit, Dollfus, Gausser, and Co. Improvements in and relating to the manufacture of dyestuffs and tanning extracts. April 23.

8770. H. Imray.—From The Basle Chemical Works, Bindschedler. Manufacture of alkyl glycolic acid derivatives of paramidophenol ethers. Complete Specification. April 25.

8857. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Improvements in the manufacture of colouring matters of the rosinduline series. April 27.

8860. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Process for discharging para-nitro-aniline red fabrics, white and coloured, and manufacture of a discharging colour therefor. April 27.

9122. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The production of azo colouring matters on fibre. April 30.

9343. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of basic disazo dyestuffs. May 2.

9477. L. P. Marchlewski, E. S. Wilson, and E. Stewart. Improvements in the production of dyes. May 5.

9912. E. Ritter von Porthelm. Process for producing black azo dyestuffs on the fibre. Complete Specification. May 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

5796. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs. March 4.

5797. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of colouring matters. March 12.

5861. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of colouring matters. March 4.

10,669. H. H. Lake.—From Farbwerke Mülheim. Manufacture of colouring matters. April 29.

12,094. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of purpurine-sulpho-acid. April 29.

12,162. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Process for the partial or total destruction of beta-naphthol on the fibre by oxidation by means of persulphates. April 29.

12,465. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. Production of *y*-oxyperidine carbo acids and derivatives therefrom. May 6.

12,607. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new brown to black azo colouring matters dyeing direct on cotton. May 7.

12,667. H. E. Newton.—From The Farbwerke vormals F. Bayer and Co. The manufacture or production of derivatives of hydroxyanthraquinone. May 7.

17,160. W. Majert. Process for obtaining pyrocatechin mono-acetic acid. May 6.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

8323. C. M. White.—From The Electro Waterproofing and Dye-Fixing Company. A new or improved process of electrically treating fabrics for waterproofing and other purposes. Complete Specification. April 21.

8517. A. R. Waddell. Improvements in or relating to the treatment of rhea and other fibrous materials. April 22.

9877. T. Illingworth. A new or improved process for stopping or reducing the liability of certain fabrics to shrink. May 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

11,546. B. J. B. Mills.—From V. Crepet. A new or improved process for the decoration or ornamentation of velvets, plushes, and other pile fabrics. May 6.

12,218. R. W. E. MacIvor and J. Chester. Improvements in the treatment of rhea or ramie (*boehmeria tenacissima*) and china grass (*boehmeria nivea*). April 29.

13,626. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of colouring matters. May 20.

13,947. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of direct-dyeing azo colouring matters. May 7.

14,633. H. H. Lake.—From K. Oehler. New brown azo dyestuffs and method of producing the same. May 7.

1896.

5532. C. E. Puller and A. Biemann. Improved process for loading silk and silk waste. May 7.

7405. C. Effros. Improvements in the treatment of vegetable fibre. May 13.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

8297. W. H. Caldwell. Improvements in the bleaching of paper pulp and other fibrous materials. April 20.

8311. L. C. G. Lesage. An improved process of and apparatus for use in colour-printing. April 20.

8318. C. M. White.—From The Electro Waterproofing and Dye-Fixing Company. Improvements in the art of fixing dyes in fabrics. Complete Specification. April 21.

8491. B. Thies. Process of and apparatus for bleaching, dyeing, washing, &c. spun fibres and stuffs of every kind. Complete Specification. April 22.

9767. J. Reixach and F. Blamford. Improvements in dyeing pile fabrics. May 7.

9941. T. Parry-Jones. Liquid process for woollen bleaching. May 11.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

8288. O. Imray.—From La Société Christiania Minnekompani. Process for the production of ammonia and other compounds of nitrogen and hydrogen, also nitrous and nitric acids. April 20.

8634. S. A. Sadler and R. H. Wilson. A new process for the manufacture of chlorine. April 24.

8652. C. F. Wulffing. Improvements in the manufacture of oxalic acid. April 24.

8826. J. A. Wanklyn and W. J. Cooper. An improvement in the manufacture of cyanides. April 27.

9544. P. Jensen.—From D. Cappelen and H. Cappelen. Process for purifying chlorine gas. Complete Specification. May 5.

10,252. D. A. Peniakoff. A process for obtaining an or extracting caustic alkalis from alkaline aluminates, and hydrates of barium and alumina from barium aluminate. May 13.

10,574. E. Cuyllits. Process for utilising phosphate ore deficient in phosphorus with a view to produce monocalcic superphosphates of high standard and, in connection with the said process, a special kind of drying-oven. May 16.

10,577. A. Wolf and W. S. Blythe. Improvements in the manufacture of chlorates of potassium and sodium. May 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8449. C. Hoepfner. Improvements in and relating to the manufacture of solutions of zinc chloride and other metal chlorides. April 29.

10,476. J. Raschen and J. Brock. Improvements in the manufacture of cyanides and ferrocyanides from sulphocyanides and the recovery of by-products. May 20.

10,956. J. Raschen and J. Brock. Manufacture of cyanides and ferrocyanides from sulphocyanides and the recovery of by-products. May 20.

1896.

1729. F. Perez. Improvements in or relating to the manufacture of salt. May 7.

7123. A. von Siemens. Process for working metallic sulphides. May 20.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

8642. G. B. Ford. Application of ceramic colours to the surface of tiles by means of a composition roller. April 24.

9078. W. Stranbe and The Actien-Gesellschaft Maschinenfabrik Landsberg-on-the-Lech. Improvements in presses for the manufacture of glass wares. April 30.

9601. E. W. Brock. An improved method of decorating glass for leaded lights and similar goods. May 6.

10,474. W. West. Improvements in apparatus for the manufacture of moulded clay, earthenware, and ceramic articles. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,104. W. Illingworth. Machines for casting pottery ware. May 13.

13,522. W. Illingworth. Improvements in or applicable to ovens or kilns for firing pottery ware and the like. May 13.

1896.

5622. C. Mayer. Improvements in and relating to pottery ware and like glaze-firing furnaces and kilns. April 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

8314. L. Preussner. Improvements in the production of artificial stone. April 20.

9100. J. C. Nichol. Improved material to be used as a substitute for wood, and to be known as "fabricoid." April 30.

9556. R. H. Davis. Improvements in the manufacture of fireproof buildings. May 5.

9838. J. Wilkinson. New or improved manufacture of compositions suitable for use as building materials for architectural and other purposes. Complete Specification. May 8.

10,532. P. J. Neate. Improvements in kilns for burning Portland cement, clinker, or substances requiring similar treatment. May 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

11,627. W. Stark. Manufacture of cement. May 6.

11,586. H. L. Doulton and A. J. Smith. Manufacture of tiles. May 7.

12,242. E. M. Arndt and G. de Bruyn. Manufacture of artificial stone. April 29.

12,382. J. J. Bloomfield. Manufacture of plaster. April 29.

13,073. C. A. Allison.—From The Marguctelle Mosaic Company. An improved substitute for wood and the like. May 13.

14,187. A. Hirsch. Manufacture of vitreous artificial stone. May 13.

21,537. J. Holroyd. Manufacture of terra-cotta and like blocks for building purposes. May 13.

1896.

3799. W. P. Thompson.—From La Société Anonyme la Neo-Litho. Improvements in the manufacture of artificial stone and apparatus therefor. May 13.

3800. W. P. Thompson. From La Société Anonyme la Neo-Litho. Manufacture of artificial stone. April 29.

5386. O. Kleinberger. Building bricks. May 6.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

8331. F. W. Popp. An improved metal. April 21.

8368. T. Doherty and P. D. Crear. Improvements in the process of melting iron. Complete Specification. April 21.

8595. T. Smith. Improvements in or connected with readily fusible metal or alloy and the manufacture of articles therefrom, or from other metals or alloys. April 23.

8690. S. O. Cowper-Coles and S. Learoyd. Improvements in the manufacture and production of metallic alloys. April 24.

8781. C. T. J. Vautin. An improved process for the reduction of composite lead and zinc ores. April 25.

8882. A. Tracy. An improved method of combining hard metal and soft metal or other material to form non-slipping and non-extensible floor covering and stair nosing. April 28.

8907. T. Twynam. Improvements in the production of an alloy of iron and an alkaline metal for use in the manufacture of steel from phosphoric pig-iron and for other purposes. April 28.

8946. H. H. Lake.—From Hawkins Steel Co., Lim. Improvements relating to the purifying and refining of iron and apparatus therefor. Complete Specification. April 28.

8959. J. D. Grey. Improvements in the method of and apparatus for preparing sheet iron and steel in the manufacture of tin andterne plates, or for galvanising. Complete Specification. April 28.

8967. S. Vivian. Improvements in apparatus for the recovery of gold, silver, and other precious metals. April 28.

8998. C. J. Ellis. Improvements in separating solutions containing precious metals from clayey, slimy, or adhesive materials. April 29.

9041. S. O. Cowper-Coles. Improvements in the treatment of tin ore and tailings containing tin, and the obtaining of metallic tin therefrom. April 29.

9123. F. Ellershausen. An improved process for the treatment of refractory ores. April 30.

9220. C. T. J. Vautin. An improved process for the reduction of argentiferous or non-argentiferous complex sulphide ores of lead and zinc. May 1.

9232. F. B. Aspinall and The Electrical Oil Refining Co., Lim. Improvements in the treatment of cotton-seed and other oil. May 1.

9388. C. A. Burghardt and G. Rigg. Improvements in the method of and means for obtaining copper from copper ores. May 4.

9408. E. Rousseau. An improved method for galvanising iron. May 4.

9514. W. Kirkham and D. Evans. Improvements in the method of casting ingots, and in ingot moulds and appliances connected therewith. May 5.

9524. J. A. Bruce-Fraser. A new or improved process for extracting gold and other metals from their ores, especially applicable to the treatment of refractory ores. May 5.

9552. W. P. Thompson.—From W. E. Harris. A new or improved method of and apparatus for treating and annealing sheet metal. Complete Specification. May 5.

9577. J. H. Pollok. An improved method of treating auriferous slimes. May 5.

9656. The Improved Electric Glow Lamp Syndicate, Lim.—From C. Schwabe. An improved process for depositing metals on silver coatings. May 6.

9772. J. Lyle. Improved method and apparatus for concentrating or separating and recovering metals and metallic ores from metalliferous substances. May 8.

10,097. J. Jones. An improved method or process for the treatment of gold-bearing antimony ores. Complete Specification. May 12.

10,494. J. R. Wyld, J. W. Kynaston, and J. Brock. Improvements in the extraction of zinc from ferruginous liquors, specially applicable to the treatment of the spent liquors of copper works. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8328. C. Hoepfner. Improvements in and relating to the treatment of ores or materials containing zinc, lead, and silver. April 29.

8376. A. Schmidt. Improvements in and relating to the extraction of gold and silver from their ores. April 29.

10,865. W. J. Clapp and J. F. Wake. Improvements in furnaces, and apparatus for, and in the method of manufacturing and purifying the waste products from blast and other furnaces, cupolas, and for other purposes. May 20.

12,018. L. Mond. A process for reducing certain metallic oxides by means of amalgams or alkaline metals. May 20.

12,452. H. E. Fry, J. David, and C. le Donx. Improvements in the extraction of lead with silver, gold, or other metals from galena or sulphides of lead and zinc, and from mattes and refractory ores. May 13.

13,536. M. Crawford.—From R. Keek. Improvements in treating slimes from ores of the precious metals. May 20.

1896.

4776. W. H. Bailey. Improvements in and relating to furnaces for heating metal. May 20.

6242. J. Mait. Apparatus for separating and saving gold. May 13.

7272. F. B. Last and J. R. Wright. Improvements in the manufacture of steel. May 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

20,542A. G. Bell and G. W. Bell. Improvements in or connected with apparatus for the electrolytic decomposition of liquids. Date claimed Oct. 31, 1895. Filed May 4.

8410. J. C. Graham. Improvements in the electro-deposition of metals, particularly applicable to the deposition on wires. April 21.

8660. F. W. Schneider. Improvements in the construction of cells for electric accumulators. Complete Specification. April 24.

8666. The Battery and Motor Co., Lim., and H. T. Barnett. Improvements in and connected with battery electrodes. April 24.

8695. W. Majert. Improvements in electrodes for accumulators. Complete Specification. April 24.

8906. L. B. Atkinson and P. G. Treharne. Improvements in the generation of electricity. April 28.

9289. W. E. Heys.—From E. Dumoulin. Improvements in and connected with the electro-deposition of copper. May 2.

9910. A. Schanschieff. Improvements in secondary batteries. May 9.

10,095. P. Schmidt. Improvements in electric batteries. Complete Specification. May 12.

10,267. C. Hoepfner. Improvements in electrodes for galvanic batteries. May 13.

10,349. A. M. Clark. A process of preparing metals for galvanic, electrolytic, and for other purposes. May 14.

10,472. G. A. Grindle. An improvement in active material for secondary voltaic batteries. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

8904. C. L. R. E. Menges. Improvements in primary and secondary battery plates, and in moulds for producing the same. April 29.

12,417. C. H. Weise. Improvements in the manufacture of positive plates for secondary electrical batteries. May 20.

1896.

3091. R. Linde. Improvements relating to the composition of the filling paste of accumulator batteries. May 13.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

8289. G. E. G. Terouanne. See Class XVII.

8575. O. Schoning. An improved soap for use in chemical cleaning, laundries, and the like. April 23.

COMPLETE SPECIFICATION ACCEPTED.

1895.

19,960. W. P. Thompson.—From A. des Cressonnières and E. des Cressonnières. Improvements in the mixing and kneading of soap and other like plastic substances, and in apparatus therefor. May 13.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

8267. E. W. Barnsley. Improvements in varnish and in the mode of manufacturing the same. Complete Specification. April 20.

8706. W. I. Grylls. Improvements in furniture polish. Complete Specification. April 24.

8981. S. Ganelin. Improvements in the production of a substitute for white lead and of other oxysalts of lead from lead sulphate and lead chloride. Complete Specification. April 28.

9760. W. H. Forester and G. Bland. Improvements in the manufacture of transparent coloured enamels. May 7.

10,181. H. Rudge. Improvements in the manufacture of colours, paints, and stains. May 13.

10,462. A. H. Sandiland. Improvements in the manufacture of white lead. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,648. W. W. Cabena. The manufacture of an improved waterproof elastic cement. May 20.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

8582. H. H. Lake.—From Lepetit, Dollfus, and Gansser and Co. See Class IV.

9581. F. Humphrey. Antiseptic animal size. May 6.

9582. F. Humphrey. Antiseptic mineral size. May 6.

9583. F. Humphrey. Antiseptic clair colle. May 6.

10,263. A. Levinstein. Improvements in or relating to tanning. May 13.

10,390. A. Levinstein. Improvements in tanning apparatus. May 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

3715. J. W. Peirson and F. A. T. Moor. Improvements in the art or process of treating skins. May 20.

6410. W. L. Wise.—From Knoll and Co. Manufacture or production of an albumen tannin compound. April 29.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

9789. F. M. Mooney and A. Dickson. Improvement in the manufacture and storing of superphosphates and the like. May 8.

10,109. O. G. Blunden. A new or improved artificial manure or fertiliser, and process for manufacturing the same. May 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

11,460. F. Nobbe and L. Hiltner. Improvements relating to the inoculation of soil for the cultivation of leguminous plants. April 29.

12,470. H. Mehner. Improvements in fertilising by the aid of artificial nitrogenous manure. May 7.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

9842. H. Edwards, jun. Improved process for the preparation of milk sugar from skim milk. May 8.

10,330. C. Friedheim and A. Rosenheim. Process for the extraction of white starch and other valuable products from the various species of the sorghum, also applicable to the depriving of other kinds of starch colour. May 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,555. R. Haddan.—From R. M. y Olivares. A method of producing a vegetable gum adapted to replace gum arabic. May 13.

1896.

7337. J. Perichon. Improved method and apparatus for the treatment of bagasse. May 13.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

8289. G. E. G. Terouanne. Manufacture of a charcoal for filtration of spirits and oils. April 20.

9676. J. A. Fawcett. Treatment of materials used in brewing liquors. May 7.

9740. H. Gronwald. Process for preventing the escape of carbonic acid and other volatile matters from beer in casks. Complete Specification. May 7.

9923. H. Gronwald. New or improved process and apparatus for increasing the stability of beer and other liquids containing carbonic acid. Complete Specification. May 9.

10,555. W. P. Knight and E. Cave. An improved purifying material for use in the manufacture of beer and other malt liquors. May 16.

COMPLETE SPECIFICATION ACCEPTED.

1896.

766. E. Davies and H. M. H. Goodfellow. Improvements in the treatment of spent hops for preparing the same for use as a stuffing material, and in machinery therefor. May 6.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

8580. H. Boisselier. A new preparation of tea. April 23.

9908. M. P. Hatschek. Improvements in the production of compressed bakers' yeast. May 9.

B.—Sanitation.

8352. W. H. Higgin. Improvements in the treatment of sewerage. April 21.

10,437. J. T. Norman. Improvements in treating water for the purpose of neutralising or hardening it when acid or soft, together with apparatus relating thereto. May 15.

C.—Disinfectants.

9345. J. Ascough. Improvements in and connected with the manufacture of antiseptic preparations for the preservation of animal and other foodstuffs, for use in the manufacture of butter, for the prevention of or removal of taint from animal food substances, including beef, mutton, bacon, fish, game, and poultry, and for use in the production of beers, light wines, aerated and non-alcoholic and other drinks, and for other purposes. Complete Specification. May 2.

10,067. R. N. Lennox. New process for the use of chlorine and sulphurous acid or their hydrates as disinfectants. May 12.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1895.

14,250. O. Inray.—From C. Rach. Manufacture of cocoa compounds. May 20.

22,886. C. M. U. Dable. An improved process for the preservation of fish liver. May 7.

1896.

2176. A. B. Pinto. Preserving meat by the help of electricity. May 13.

1896.

6920. C. L. Villar. Preservation of meat. May 6.

B.—Sanitation.

1895.

8877. P. O'Dowd. Apparatus for the disinfection of sewage. May 6.

11,527. J. J. Hood and A. G. Salamon. An improved means for treating sewage and the like. April 29.

12,067. J. H. Osbourn. Improvements in the method of and apparatus for softening and purifying water. May 7.

21,142. D. Cameron and F. J. Commis. Treatment of sewage and apparatus therefor. April 29.

XIX.—PAPER, PASTRBOARD, Etc.

APPLICATIONS.

8309. H. Thame. Improvements in the manufacture of hollow pulp ware, particularly applicable to buoyant articles. April 20.

8464. H. J. Rogers and W. M. Mordey. Improvements in means and apparatus for the treatment of paper and other fabrics during and after the process of manufacture. April 22.

8672. S. W. Wilkinson and The Grove Co., Ltd. Improvements in the manufacture of substitutes for celluloid. April 24.

9100. J. C. Niehol. See Class IX.

9914. L. Capazza. Improvements in the manufacture of stylographic paper. May 9.

COMPLETE SPECIFICATION ACCEPTED.

1895.

11,546. B. J. B. Mills.—From V. Crepet. See Class V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

8298. K. G. Georgi. Improvements in the manufacture of tabloids. April 20.

8785. W. Bevan. Improvements in the manufacture of arsenic. April 25.

9076. T. P. Sims and W. Terrill. Improvements in the manufacture of white arsenic. April 30.

9521. S. S. Bromhead.—From Gretsch and Mayer. Improvements in the process of making artificial musk. Complete Specification. May 5.

9576. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. Improvements in the manufacture of a pharmaceutical substance. May 5.

10,003. J. Y. Johnson.—From C. F. Boehringer and Soehne. Improvements in the manufacture or production of cinnamic aldehyde. May 11.

10,004. E. Fischer. Improvements in the manufacture or preparation of derivatives of xanthine from alkylated uric acids. May 11.

10,005. E. Fischer. A method of preparing alkylated uric acids. May 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

12,295. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. Manufacture of a pharmaceutical substance, and in the purification of the same. April 29.

1896.

6157. F. Brunjes. An improved process for the separation of silicic acid from argillaceous substances. May 7.

7692. O. Preu. Manufacture of vanilline. May 20.

XXI.—PHOTOGRAPHY.

APPLICATION.

8394. J. M. Davidson. Improvements in and connected with photography. April 21.

COMPLETE SPECIFICATION ACCEPTED.

1896.

6651. R. E. Schoenfelder and E. Kehle. Improvements in chemical compositions to be used for preparing the surface of suitable material for photographic prints. May 13.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

9574. H. Hohendahl. Improvements in or connected with safety fuses. May 5.

9578. J. C. Donnelly. Improvements in apparatus for making lucifer matches or the like. Complete Specification. May 5.

10,403. H. Boyd. A new explosive. May 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6271. T. Hawkins, S. H. Hawkins, H. Hawkins, and The Donnithorne Gun Patents and Ammunition Co. A new or improved smokeless explosive or gunpowder. April 29.

12,380. J. C. Thompson. Improvements in fuses for explosive projectiles or shells. May 7.

1896.

5687. W. P. Thompson.—From B. T. Steber and W. E. Cook. Apparatus for making lucifer matches or the like. May 13.

7711. M. Wagner. Manufacture of fuses or match-cords. May 20.

THE JOURNAL OF THE Society of Chemical Industry:

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 6.—Vol. XV.]

JUNE 30, 1896.

[Non-Members 30/- per annum; Members
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NOTICES.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those Members whose names are placed in italics in the list of Council will retire from their respective offices at the forthcoming Annual General Meeting.

Dr. Edward Schunck, F.R.S., has been nominated to the office of President; and Mr. Thomas Tyrer has been nominated Vice-President under Rule II.

Prof. A. K. Huntington, Mr. A. H. Mason, and Mr. G. N. Stoker have been nominated Vice-Presidents under Rule 8; and the Treasurer and Foreign Secretary have been nominated for re-election to their respective offices.

Mr. George Beilby, Mr. Oscar Guttman, and Mr. B. E. R. Newlands have been nominated under Rule 18, and Mr. R. Forbes Carpenter under Rule 19, to fill four vacancies among the Ordinary Members of Council.

A Ballot List and Member's Ticket are enclosed herewith, or have already been despatched under separate cover.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in London on the 15th, 16th, and 17th July next. A notice of a modification in the programme is enclosed herewith.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready in the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

The prices will be as follows:—

To Members (see Rules 25 and 27) who make application with remittance not later than July 31, 1896.....	Each Copy	5s.
To Members (see Rules 25 and 27) who make later application; Libraries, Corporations, and Exchanges on the Society's List, and Past Members (see Rule 30).....	Each copy	10s.
To Subscribers	"	12s. 6d.
To others.....	"	15s.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. FYRE and SCOTTISWOODE, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,000 per month.

LIST OF MEMBERS ELECTED 23rd JUNE 1896.

- Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
- Bibby, John, 92, Orrell Lane, Aintree, Liverpool, Student.
- Cubley, G. A., c/o Harrington Bros., Oliver's Yard, 53A, City Road, E.C., Chemist.
- Dempsey, J. C., P.O. Box 210, Watertown, Mass., U.S.A., Chemist.
- Dickenson, F. M., 31, Queen Street, Melbourne, Victoria; and (temp.) c/o Broken Hill Proprietary Company, 3, Great Winchester Street, E.C., Secretary.
- Ewen, Eric D., Port of Spain, Trinidad, B.W.I., Chemist.
- Graves, Walter G., 347, Euclid Avenue, Cleveland, Ohio, U.S.A., Chemist.
- Kingdon, G. Holman, c/o Jos. Crosfield and Sons, Warrington, Technical Chemist.
- Lynn, Arthur H., Pension Schmeltzberg, Fluntern, Zürich, Switzerland, Student.
- Machalski, F. J., 159, North Fifth Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
- Merck, Geo., Corner of University and Clinton Places, New York City, U.S.A., Chemical Manufacturer.
- Rapkin, J. B., c/o Waterlow and Sons, Limited, Skinner Street, Finsbury, E.C., Stationer.
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- Skelton, S. T., 13, Derby Street, Ramsbottom, near Manchester, Chemist (Paper Mills).
- Spoor, J. L., Madras Cement Works, Madras, India, Portland Cement Manufacturer.
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- Tyrer, A. J., 3, Norwich Road, Forest Gate, E., Student.
- Ullman, Dr. Sabbati E., 167, West 85th Street, New York, U.S.A., Manufacturing Chemist.
- Weicker, Theodore, c/o Merck and Co., New York, U.S.A., Chemical Manufacturer.
- Young, Henry S., c/o Sta. Francisca G.M. Co., Limited, Leon, Nicaragua; and (temp.) 13, Balham Grove, Balham, S.W., Technical Chemist.

CHANGES OF ADDRESS.

- Bailey, Walter P., 1/o Seville; 29, Segismondo Moret, Cadiz, Spain.
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- Blagden, W. G., 1/o 1; 4, Fenchurch Avenue, E.C.
- Butterfield, W. J. A., 1/o Beckton; Ebor House, Redhill.
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- Down, T., 1/o Cardiff; Tharsis Villa, Calstock, Cornwall.
- Duncan, A. W., 1/o Higher Broughton; 42, Trevelyan Street, Eccles, Manchester.
- Dyson, Septimus, 1/o Apperley Bridge; 2, Exchange Place, Middlesbrough.
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- Grinshaw, H.; Journals to Sunnyside, Clayton, Manchester.
- Hart, H. W.; Journals to 10, Falcon Avenue, Darwen.
- Hogg, A. F., 1/o Stanhope Road; 4, Cliffe Terrace, Woodlands Road, Darlington.
- Hutchinson, C. C., 1/o Stratford; 3, Harcourt Buildings, Temple, E.C. (T.N. 65,107; T.A. "Videatur," London), Barrister-at-Law.
- Johnson, E. C., 1/o Loughton; 245, Romford Road, E.
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- Vantin, C., 1/o Old Broad Street; 28, Basinghall Street, E.C.
- Watson, J., 1/o Hawick; 30, Bolan Street, Batterssea, S.W.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1895.

REVENUE.		EXPENDITURE.	
	£ s. d.		£ s. d.
Annual Subscriptions for 1895:—		Journal Expenses:—	
1 subscription received in 1893.....	1 5 0	Publishing.....	1,557 18 8
77 subscriptions received in 1894.....	95 18 3	Insurance of Stock.....	3 15 0
2,541 subscriptions received in 1895.....	3,175 18 4	Editorial.....	1,240 0 10
33 subscriptions received in 1896.....	11 5 0		
(Sundry balances of subscriptions).....	0 16 0	Sundries—Printing.....	2,801 14 6
<u>2,652</u>	<u>3,315 2 7</u>	Sectional Expenses.....	36 7 6
160 Entrance Fees.....	168 0 0	Secretary's Salary (Portion not included in Journal	283 2 10
1 Life Composition Fee.....	15 0 0	Editorial Expenses).....	300 0 0
		Expenses in connection with "Annual Meeting".....	175 2 4
Subscriptions received on account of the		Honorary Treasurer's Assistant.....	52 10 0
"Collective Index".....	28 15 0	Office Expenses.....	113 9 7
Interest on Metropolitan Consolidated Stock	129 16 4	Library.....	10 3 3
Interest on North British Railway Con-		Stationery.....	44 10 1
solidated Lien Stock.....	31 9 2	Auditors' Fee.....	10 10 0
Interest on Midland Railway 4 per cent.		Bank Charges.....	2 11 6
Preference Stock.....	17 15 9	Donation to "Lavoisier Statue".....	10 10 0
Interest on Gas Light and Coke Company's		Amount paid on account of the preparation of "Col-	
6 per cent. Debenture Stock.....	17 8 0	lective Index".....	361 2 0
Interest on Deposit Account at Bank.....	6 2 2	Treasurer's Petty Cash.....	18 1 3
Journal:—		Secretary's Petty Cash.....	41 6 11
Advertisements.....	536 0 0	Balance of Revenue over Expenditure.....	162 0 3
Sales.....	349 13 0		
	<u>876 13 0</u>		
	<u>£ 4,423 2 0</u>		<u>£ 4,423 2 0</u>

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY FOR THE YEAR 1895.

Dr.		Cr.	
	£ s. d.		£ s. d.
To Balance at Bank (1st January 1895)....	288 11 1	By Journal Expenses:—	
Balance in Treasurer's hands (1st January 1895).....	45 0 0	Publishing.....	1,634 5 2
Balance in Secretary's hands (1st January 1895).....	6 2 5	Editorial.....	1,261 12 7
	<u>339 13 6</u>	Insurance of Stock.....	3 15 0
Annual Subscriptions:—		Sundries, Printing, &c.....	2,809 12 9
3 subscriptions for the year 1893.....	3 15 0	Sectional Expenses.....	37 4 6
49 subscriptions for the year 1894.....	61 5 0	Secretary's Salary (balance not included in Journal	266 14 4
2,541 subscriptions for the year 1895.....	3,175 18 4	Editorial Expenses).....	300 0 0
105 subscriptions for the year 1896.....	131 0 1	Honorary Treasurer's Assistant (for work in 1894).....	52 10 0
3 subscriptions for the year 1897.....	3 15 0	Stationery.....	53 19 9
<u>2,701</u>		Expenses in connection with Annual Meeting.....	175 2 4
Sundry Balances of Sub-		Office Expenses.....	113 9 7
scriptions for the year		Library.....	10 3 3
1895 (amounts on account		Auditors' Fee.....	10 10 0
of 1896 and 1897).....	1 12 9	Donation to "Lavoisier Statue".....	10 10 0
	<u>3,377 6 2</u>	Bank Charges.....	2 11 6
Entrance Fees (160 at 17. 1s.).....	168 0 0	Subscription returned.....	1 5 0
Life Composition Fees (1 at 15/.).....	15 0 0	Solicitor's charges.....	2 0 8
Subscriptions received on account of the		Amount paid on account of the compilation of the	
"Collective Index".....	28 15 0	"Collective Index".....	361 2 0
Interest on Investments:—		Treasurer's Petty Cash.....	18 1 3
Metropolitan 3 per cent.		Secretary's Petty Cash.....	41 6 11
Consolidated Stock (4,476 9 2).....	129 16 4	Cash on Deposit (31 December 1895).....	300 0 0
North British Railway 4		Balance at Bank (31st December 1895) ..	322 13 10
per cent. Consolidated		Balance in Secretary's hands (31st De-	
Lien Stock..... (813 10 0)	31 9 2	cember 1895).....	6 16 5
Midland Railway 4 per			<u>* 629 10 3</u>
cent. Preference Stock .. (460 0 0)	17 15 9		
Gas Light and Coke Com-			
pany's 6 per cent. De-			
benture Stock..... (300 0 0)	17 8 0		
	<u>(6,049 19 2)</u>		
Deposit Account at Bank.....	6 2 2		
	<u>202 11 5</u>		
Journal:—			
Advertisements.....	528 0 0		
Sales.....	326 8 0		
	<u>854 8 0</u>		
	<u>£ 4,985 14 1</u>		<u>£ 4,985 14 1</u>

* In addition to this there are the following Investments:—Metropolitan 3 per cent. Consolidated Stock, £476l. 9s. 2d.; North British Railway Consolidated Lien Stock, 813l. 10s.; Midland Railway Company 4 per cent. Preference Stock, 460l.; Gas Light and Coke Company 6 per cent. Debenture Stock, 300l.

We have compared the above Statement with the Vouchers, Counterfoils of the Receipts issued, and Books of the Society, and certify it to be correct. The amount of the Metropolitan 3 per cent. Consolidated Stock has been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected, and the Bankers have verified the Balances upon the Deposit and Current Accounts.

(Signed) MIALl, WILKINS, RANDALL, & Co.,
Chartered Accountants.

23, St. Swithin's Lane, London, E.C.,
21st February 1896.

London Section.

THE CHEMICAL SOCIETY'S ROOMS, BURLINGTON HOUSE, W.

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Vice-Chairman: R. Messel.

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<i>C. F. Cross.</i>	<i>F. G. Adair Roberts.</i>
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<i>R. Messel.</i>	<i>Lewis T. Wright.</i>
<i>H. de Moenthal.</i>	

Hon. Local Secretary: John Heron,
110, Fenchurch Street, E.C.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Chairman: R. Messel. Committee: W. J. Dibdin, R. J. Friswell, D. Howard, B. E. R. Newlands, B. Redwood, and T. Tyrer.*

Meeting held Monday, May 4th, 1896.

DR. R. MESSEL IN THE CHAIR.

CHROMATIC PHOTOGRAPHY.

BY E. J. WALL, F.R.P.S.

The title of my notes is sufficiently comprehensive to enable me to briefly glance at all the known methods of reproducing objects with all their colours by photography.

There are three different methods of attaining this end—the first, which may be called the direct method; the second, the interference method; and the third, the indirect. The very first experimenters in photography were naturally struck with the idea of reproducing the colour as well as the form of objects, and the researches of Seebeck in 1810 were followed by Herschel, Becquerel, Poitevin, and others, all of whom endeavoured to obtain the colours directly, that is, by printing from a coloured object on to a salt of silver—the sub-chloride; and Becquerel especially was really successful in obtaining very good reproductions of the solar spectrum in this way. He employed paper coated with silver chloride, which was reduced by the action of light to the violet sub-chloride, and also formed the sub-chloride by direct electrolysis of a silvered plate. Some of his examples are, it is said, in existence at the present time, but they possess really no practical value, for the simple reason no means have been found of fixing the colours—that is to say, when exposed to white light the colours bleach out and turn to the ordinary purple or brown of a common photograph. The reason for this is of course obvious, when I state that any chemical which was applied to these photographs to dissolve out the unaltered silver sub-chloride which had not been affected by light, destroyed the colours, and, of course, if the unaltered chloride was not dissolved away, the light would naturally still act upon it.

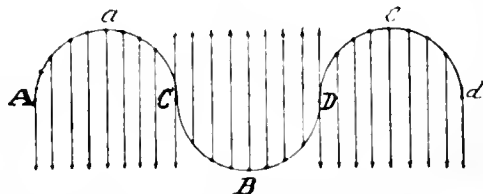
Numerous have been the attempts to get over this difficulty, and up to so recent a date as 1892 experimenters were not wanting who still strove to obtain photographs in natural colours by this direct method. There seems, of course, an initial difficulty in inducing one metal like silver to take on or reproduce all the innumerable tints of nature, but Carey Lea, of U.S.A., has been able to prepare allotropic forms of silver, some of which possess extraordinary colours, ranging from violet, through blue, green, yellow, to red, and one similar in appearance to metallic gold, and another soluble in water. It is to me extremely doubtful whether even with further advances this process would become of any commercial value.

The second method, by interference, was the practical outcome of the theoretical reasoning by M. Gabriel Lippmann, of Paris, a well-known physicist, who argued that as we obtained colour by the interference of light, caused by extremely

thin laminae of various substances, it ought to be possible to obtain silver deposited in stratifications so as to give us colour; and in February 1891 his results were shown in Paris, and created no little talk and possibly natural jubilation on the part of the knowing journalist, who immediately hailed it as the long-looked-for philosopher's stone of photography. To enable you to thoroughly understand this process, I am going to explain it in detail, even at the risk of appearing to teach my elders what they already know; but my excuse must be that there may possibly be one present who is not quite posted up on the theory of interference.

You have on the screen here a diagram which represents a ray of light proceeding in the direction of *A d*, the small dots representing the particles of the ether which vibrate backwards and forwards, their several paths being represented by the arrows, and naturally one particle moving as it does at so rapid a rate as 186,000 miles per second jostles its neighbour, and thus we have set up a series of

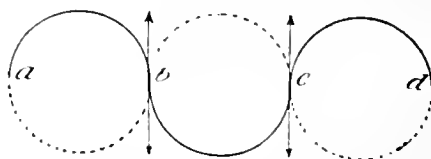
Fig. 1.



wave-like motions which propagate in the ether the sensation we call light. Each little wave of light has a definite length, and the length of the wave is calculated from any two similar points as regards the axis; for instance, *A c* is a wave length or *b d*, and it is obvious that *a b*, *b c*, or *c d* is exactly half a wave length. Now, it is assumed that colour is due primarily to these wave lengths, and the red has a wave length of about 760,000 tenth metres or microns, one micron being the ten-millionth part of a millimetre.

In this diagram you see merely the same thing, but when the light reached *d* it met with a reflecting surface, and was sent back along the same path; the result was that at *b* and *c* the vibration of the ether molecules was in contrary directions, as shown by the arrows. Now, when we get two forces of equal power pulling in contrary directions it is obvious that the result must be not motion but quiescence,

Fig. 2.



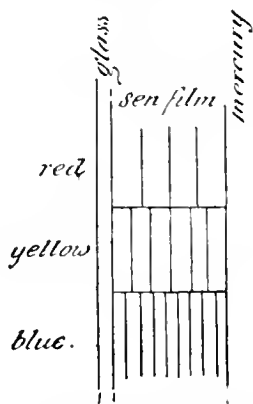
and as light and colour depend upon motion for their existence, it is obvious that we should obtain what are called stagnant waves, separated by nodal points where there would be no light. If such a series of stagnant waves fell upon a film of some silver salt, which was easily affected by light, we ought to obtain on development a series of stratifications or particles of silver deposited at definite distances apart.

The result of this is that when such a result is examined at a particular angle, we have reflected from these deposits of silver, light which has a wave length of just double the distance that these silver particles are apart, and thus we obtain colour; for light which is not of exactly that wave length is not reflected.

I will now explain to you Lippmann's method of obtaining such a result. He prepared an extremely transparent emulsion of silver bromide in albumen or gelatin; the emulsion is so transparent that only when in any appreciable thickness does it show even a faint opalescent appearance. Such an emulsion was coated on glass as thinly as possible, and the glass with its film, when the

latter was quite dry, placed in a dark slide, the film being in contact with very pure metallic mercury, as shown in this diagram: the result was that when this was exposed in the camera, the light passed through the glass and the film,

Fig. 3.



struck the surface of the mercury, and was thence reflected back on itself, and gave rise to the stagnant waves of light, and on development, of course, the strata of silver.

Numerous experimenters have repeated with more or less success this experiment, and we have actually a process by means of which it is possible with three minutes' exposure in sunlight to obtain photographs in natural colours. Lippmann has also been able to obtain by the same apparatus the reproduction of the spectrum in its colours by using a film of bichromated gelatin, when of course no silver was used, but strata of insoluble gelatin would be formed by the action of the light.

The operations in this process, I need hardly say, are extremely delicate, for the thickness of the film itself is not much, if any, more than one-tenth of a millimetre, and in this film there must be no less than about 500 little particles of silver separated by layers of gelatin to give us the violet of the spectrum, for the yellow about 400, and for the red about 330.

The only drawback to Lippmann's interference method of reproducing colours is that the exposure is fairly long, as I have stated—about three minutes—and, further, if more than one copy is required there is no method of reproducing them, and a fresh exposure has to be made for each proof—two facts which at present place the process rather in the domain of the experimental laboratory than in the ordinary studio.

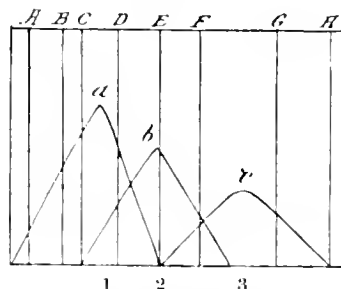
The third and indirect method is the one which at the present time has the most importance commercially, and is the one which I myself have worked at and paid most attention to. It was suggested as early as 1861 by Clerk Maxwell, subsequently by Collen, quite independently, in 1865, and since then, particularly within the last few years, enormous strides have been made, particularly in Germany and America—not in England. Whether it is that we Englishmen are too conservative, or whether there is a general want of real technical training amongst our photo-mechanical printers, I do not know; but the fact remains that in Germany this process is extensively used for book illustration. In America prints such as are on the walls to-night are used by commercial travellers instead of taking round the actual rugs and carpets, and it is used for book illustration also; yet in England there is but one firm that is actually producing the work on any commercial scale.

You all know that what we call white light can be split up into a band of colours called the spectrum, and that we obtain all the innumerable colours of nature by admixture of these spectrum colours; and, further, that although we have the six spectrum colours and the millions of tints in nature formed from them, yet it is assumed that we have what are called three nerve fibrils in our retina, which fibrils respond to three primary colour sensations—red, green, and violet; this theory being called the Young-Helmholtz theory of primary sensations. The indirect

method of reproducing the colours of nature is founded on this theory.

I show you here a diagram which represents the primary colour sensations. 1, 2, and 3 are the spectrum colours which excite the primary colour sensations; *a*, *b*, *c* are the curves which show the relative power of the different spectrum rays to excite the respective fundamental colour sensations. From this you will see that the red sensation

Fig. 4.



is excited by all the rays from red to green, but most powerfully by the orange. The green sensation is excited by the rays from yellow, green, and greenish-blue, and the blue-violet sensation by the blue-green, blue, and violet rays.

There are two methods by means of which we can reproduce objects in colours by this theory, first by using coloured light, and secondly by using pigments. The first process is one which may be looked upon rather as of subsidiary importance, because it is not possible except by means of an optical lantern to show the results to more than one person at a time, and obviously this method is not applicable to the ordinary requirements of everyday commercial life.

To explain to you the production of three-colour prints, such as you see round the room, it is necessary to have recourse to a chart of the spectrum and some explanatory elementary statements. These three-colour prints are produced by using three inks only—red, yellow, and blue, the old artists' so-called primary colours. It may justly be asked, why do we not use the three colours, red, green, and violet, which excite the primary colour sensations? The reason is this. When we use pigments we do not add light to light, but subtract or suppress light; in fact, we make use of the law of absorption.

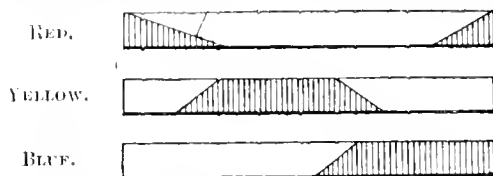
If we mix red and green light together we get a more or less pure yellow, but if we mix red and green pigments together we obtain a dirty brown. In the same way, if we mix green and blue-violet light we obtain a pure blue, whereas if we mix green and violet pigments we obtain a dirty black. In using pigments we can easily calculate what would be the resultant colour of any mixture. I have said we use the three pigments, red, yellow, and blue; if we place in tabular form these, with the colours they reflect, you will find that it is possible to simulate every colour of the spectrum—

Red	{ Violet. Red. Orange.	Yellow	{ Orange. Yellow. Green.	Blue	{ Green. Blue. Violet.
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The red reflects the violet and orange, but red is visually the only colour we see. The yellow reflects orange and green, and yellow is the visual colour. The blue reflects green and violet, but visually appears blue. So that, if we take red and yellow, the colour of the resultant mixture must be orange, because it is the only colour common to both, the red suppressing the green, and the yellow the violet. In exactly the same way, by mixing yellow and blue, the resultant mixture must be green, because this is the only colour common to both; and in mixing red and blue, the resultant colour must be violet. We have thus from our three pigments formed the whole of the six spectrum colours, and the composite colours will be formed by suitable admixture of two or even the three pigments in varying proportions. Black is formed by admixture of all three in equal proportions.

In printing we do not necessarily mix our colours, but lay them down on paper so close to one another that when examined at the distance of normal vision the result is practically a mixture. If this is so, it is obvious that we must have our red ink or pigment in particular places, our yellow also, and also the blue. To make this quite clear, we will take the spectrum as the object to be reproduced, and we will first of all take the red ink.

At the extreme end of the spectrum at A it is obvious that we shall want the red ink in all its intensity, but as we approach the orange we want less red, till in the pure yellow we want no red at all. This can be represented by the diagram as shown here. In the yellowish-green, the green



and blue, we want no red; but again in the violet we want red. In the same way, we can trace the proper position of the yellow; we want none in the red, gradually increasing quantity in the orange, full intensity in the yellow, and decreasing through the green, till in the pure blue there must be none. This can be shown by another diagram. In the case of the blue, we want none in the red, none in the orange, none in the yellow, but commencing with the green, through blue, into the violet.

Probably, as you all know, these results are obtained in a printing press, and, to make it quite plain, we will assume that we are going to use the ordinary process block for typographic printing. These blocks are made on zinc or copper. When we use a sheet of copper coated with some sensitive compound and expose the same under a negative, we have the coating under the bare places of the negative rendered insoluble; and the result, if such plate is etched, is that the parts not etched stand up in relief, and take the ink from a roller and again transfer it to paper.

It is obvious, therefore, that it is those parts of the negative which are bare glass, or the shadows, which give us the printing surface. So that if we want to print in red, all the red in the picture must be represented in the negative by bare glass. In exactly the same way we find that to make the printing surface for our yellow ink, all the yellow in the picture must be represented by bare glass, and for the blue ink, the blue in the picture must be bare glass in the negative.

To obtain such negatives, it is necessary to stop out or absorb the red during one exposure, and to absorb the yellow for a second exposure, and the blue for the third exposure. This is done by using screens or light filters, which may be either solutions of aniline or other colouring matters, or collodion or gelatin stained with the colours and spread on glass.

The light filter to suppress the red must be green; that to suppress the yellow, a violet; and that to suppress the blue, an orange. It is, I think, unnecessary for me to state the particular dyes which I use; there are so many which can be used, that anyone can adjust the screen by the aid of a photo-spectroscope.

The sensitive salts of silver as used in ordinary photographic plates do not see colours the same way as we do. To the human eye the most luminous part of the spectrum is undoubtedly that about D in the yellow, whilst the particular region of the spectrum which acts most strongly on the bromide and iodide of silver, which are the salts usually employed, is that lying between F $\frac{1}{2}$ G and H. I show you here a spectrogram on an ordinary plate, in which you will see that with an hour's exposure to diffused sky light the action has extended only from H to F. On the screen also is another spectrogram on the same make of plate, exposed for precisely the same time, under as nearly as possible the same conditions, in which you see the action has extended right up to D. In the second case the plate had been rendered colour-sensitive, as we call it, by being

bathed in an aqueous solution of one of the eosine group of colouring matters. This first plate would, if used to photograph an object with bright yellow and dark blue in it, reproduce the yellow as black and the blue as nearly white, whereas the second plate would reproduce the colours more nearly in their visual values. This colour-sensitising of the plates is an extremely important point in three-colour printing, as without it it would be almost impossible to do anything at all.

It is an extremely nice little point in photo-chemistry, as to the precise nature of the combination between the dyes used for colour-sensitising and the silver salts. Some authorities consider that the resultant compound is more of the nature of a lake, whereas others equally as competent consider that a true chemical compound is formed. This, however, I need not enter into.

Briefly summing up the necessary operations as to the production of the prints by this three-colour or indirect method, we can put the whole of the information in tabular form, thus:—

Light Filter.	Plate.	Printing Ink.
Red. Green. Violet.	Red and yellow sensitive. Yellow and blue sensitive. Red and blue sensitive.	Blue. Red. Yellow.

There are, of course, several very important minor points, such as the use of a lens which will give images through the light filters all of the same size; secondly, the nice adjustment of the exposures so as to obtain true tone values of the colours, but these possibly belong more to the fine technicalities of the subject.

Having obtained our negatives, we may use one of three methods for producing the prints: photo-lithography, colotype, or typography. The principle of photo-lithography is that a lithographic stone is coated with some sensitive compound, generally asphalt, exposed to light under a negative, and then developed. The action of light upon asphalt is to render it insoluble in the ordinary solvents of bitumen, such as turpentine; the result is that where the light acts on the asphalt it is not only rendered insoluble, but, as recent researches have shown, it actually enters into some sort of chemical combination with the stone, which is mainly composed of calcium carbonate; and therefore a plate exposed under a negative and treated with turpentine will give us an image which protects the surface of the stone from any etching fluid, such as gum and gallic acid, and the image will repel water, but take up any greasy substance like printing ink. It is obvious, therefore, we can obtain impressions from such an image in any colour.

A colotype plate is obtained by coating a sheet of plate glass with a mixture of bichromate of potassium and gelatin, drying at a fairly high temperature, and exposing under a negative. Where the light acts the gelatin becomes insoluble, and there it will not absorb water. The plate is then thoroughly washed to free it from the bichromate salts, allowed to dry, and again damped, and then rolled up with a roller charged with a greasy ink, which will only take on those parts of the gelatin affected by light. It is thus possible from such a plate to also obtain impressions in any colour.

Typography is the process which is most used at the present time, and it is possibly so used because the results can be obtained in an ordinary printing press. To prepare a block, as it is called, we have first to make a suitable negative by breaking up the half tones into dots of various sizes by using sheets of glass ruled with very fine parallel lines, from 80 to 200 to the inch. Through this negative we print on to asphalt or bichromated gelatin spread upon zinc or copper, and after development the metal is etched away by acid or ferric chloride solution where the light did not act. To make this quite clear, I will ask you to imagine the block to be a piece of cloth, into which we stick innumerable pins, so close together that practically no cloth can be seen. If now we take some of the pins out so as to leave a pattern, and pass a roller charged with a greasy ink over the surface, it is obvious that only the tops

of the pins will take the ink, and if we press a piece of paper on to these, the ink will be taken up by the paper; and if the pins are further apart in one place than another, there will be less ink transferred to the paper, and we shall thus get a representation of light and shade. This is exactly what we do with our block by means of the etching fluid: we take out the metal according to a pattern which has been drawn by light, and leave more or less isolated points which take the ink and transfer it to the paper.

From our three negatives we prepare, then, three printing surfaces, and an impression in yellow is printed first, then on top of this one in red, and finally one in blue, with the result that we obtain a more or less faithful reproduction in colour of the original object.

There are certain requirements which must be fulfilled by the inks: they must be transparent, or else the top printing would not allow the underneath ones to show through; they must be absolutely pure red, pure yellow, and pure blue, and I think I am right in stating that it was only by the aid of Mr. J. W. Lovibond and his tintometer that this was attained; and, thirdly, they must have all the same visual intensity, or else one ink or colour would preponderate in the finished result.

For the indirect method, by using coloured lights instead of pigments, very much the same considerations apply as I have just stated, only of course in this case we use ordinary transparencies on glass which have in themselves absolutely no colour, the silver image merely stopping the light from passing on to the screen. I do not think it is necessary for me to enter in detail into the method of working, but the difference will be most strikingly shown by tabulating the data as we did for printing, thus:—

Light Filter.	Plate.	Projection Colour.
Red. Green. Violet.	Red Sensitive. Green Sensitive. Violet Sensitive.	Red. Green. Violet.

For printing we want two colours to act and one to be transparent in each negative, whereas in projection we want one colour to act and two to be transparent. The results thus obtained may be projected on to a screen by means of lanterns or viewed in an instrument such as you see on the screen.

Instead of utilising glass transparencies, we may from our three negatives prepare three films by exposing bichromated gelatin under them, which would, of course, be rendered insoluble where the light acted, and we should thus obtain on development with hot water—which is, of course, merely the dissolving away of the still soluble gelatin—an image composed of varying thicknesses of gelatin, and these films, if soaked in solutions of various dyes, one red, one yellow, and one blue, would give us when superimposed a faithful reproduction of the original. This method was used by Cros and Ducois du Haumon about 1867, and was revived by Mr. F. E. Ives, of Philadelphia, in 1888. Yet within the last two years an exactly similar process was patented in England and attempts were made to sell the patent for 20,000*l.*, whether the vendors were finally successful I do not know, but in one case at least I was able to prevent a large firm from parting with their money. I might add that the field of reproducing objects in colours has been so well worked that any process now offered for sale as new must be looked upon with considerable suspicion.

There is yet another process which is founded upon the theory of the three primary colour sensations, which was discovered by Dr. Joly of Dublin. In this process he takes advantage of the fact that when fine lines are ruled very close together in different colours the result will be a mixture resulting from the admixture of the coloured lights transmitted by the various colours. He used red, green, and violet pigments ruled on glass in fine lines varying from 300 to 400 per inch, through such a screen one negative is taken and from this negative is made a transparency, which will, of course, be divided up into parallel lines of deposit, according to the light transmitted by the coloured

pigments, and on the top of the transparency he places another sheet of glass, also ruled with the pigments necessary to excite the three primary sensations, and when such a positive is projected on to a lantern screen, or viewed at the distance of normal vision, the result is the production of colour. I see now that instead of using pigments Dr. Joly proposes to use silk fibres dyed to the required shade.

It has been stated that MacDonough in America anticipated Joly by using irregular dots of colours instead of parallel lines, and this process has now been applied to the production of printing surfaces, but till I see some results I am unwilling to do more than record the fact as stated, because there seem to me to be some big difficulties in the way of successful results.

The rationale of these two processes is, of course, that instead of using three separate screens and making three exposures the light filters are placed on one glass and only one negative is used.

DISCUSSION.

The CHAIRMAN, in inviting discussion, said that each of the papers read that evening had an important position on the borderland of chemistry, and as there were several members present having an intimate knowledge of the subjects dealt with, he hoped they would throw further light upon them.

Mr. J. W. LOVIBOND had listened with the greatest attention to the very interesting address. The part which appealed to him most was that which dealt with the loss of the trichromatic printing industry to this country, and its success in America and on the Continent, and he agreed with Mr. Wall that the lack of technical training here was in a large measure responsible for this loss. Speaking as one who had worked at and studied that special subject for many years, he had come to the conclusion that the teaching of the Young-Helmholtz theory as a final explanation of colour phenomena had barred the way to progress in this country; as he frequently found scientific men who had adopted this theory, and were reluctant to accept evidence on colour questions unless that evidence chimed in with it. It was extremely interesting to find in practice that the three colours red, yellow, and blue, provided they were pure, were all that was necessary to give the most natural reproduction of colours. He was astonished at some of the beautiful greens that had been produced on some of the plates shown, as that colour had usually been the weak point in such processes. Another bar to progress had been that they had not dealt with colours as having different degrees of intensity. For instance, to produce a pure orange, red and yellow of equal intensity must be used; but yellow was seldom found with more than 16 units, while red frequently had 32 to 40 units. It must therefore be fully realised that to get a pure orange a double quantity of yellow must be used in order to get a proper reaction for transmitting the orange rays purely. He understood the author to say that all three colours must be transparent, but he was not sure whether the yellow might not be opaque and put on first, but, if so, greater care must be taken with the stippling. Two transparent colours might lie over yellow. He looked upon a paper of the character of that just read as one which would do something to redeem our technical men from the slur of our having to go abroad for such work as had just been passed round.

Mr. F. W. T. KROHN wished to know whether it was possible by the Lippmann process to obtain reproductions by taking fresh negatives of the original negative by reflected light, obtaining the colours used in successive negatives from the original one. He had frequently heard it stated that out of 20 prints obtained by the three-colour process, only one would be exactly true to the original, owing to the difficulty of superimposing the necessary quantities of pigments. He would like to know whether these difficulties had been overcome, and whether it was possible to get a larger number of correct prints.

Mr. J. D. GEDDES, referring to Mr. Krohn's remark, said that some of the worst specimens shown he had had a hand in preparing. If Mr. Wall would allow him to answer Mr. Krohn's question, he would say that in the collotype

process it had been his experience that even prints could not be obtained in a large quantity because the collotype plate gave up its ink according to the moisture and ink-holding power of the gelatin employed. In printing red, blue, and yellow, each print varied from its predecessor in taking up ink, and so the balance would be wrong in one or other colour. That had, to a large extent, been got over by using blocks, and specimens obtained in that way were much more even. How far they might have to go before the exactitude of fine chromo-lithography was reached he could not say, but they were on the high road to producing a printing process which would overcome the difficulties of photographic lithography, and at a lower cost when only a small quantity was required.

Mr. W. BRAMM wished to know whether the coloured photographs shown in shop windows were produced by this process.

Mr. P. McEWAN asked whether Mr. Wall could give any information as to the permanency of the prints. One naturally supposed that the red was produced from vermilion, and that the yellow was chromate of lead. Had experiments been made to determine whether there would be a gradual blackening of the yellow in the course of time? He would like to mention that French printers had also done excellent work in the same direction, and it would be a pity if the meeting closed without reference to it.

Mr. J. F. FÜRST wished to say on behalf of Messrs. Lumière that they had lent their original coloured photographs so often, and had had so many narrow escapes of losing them in transit, that they had at last decided not to do so any more.

Mr. E. J. WALL, in reply, said that with regard to Mr. Lovibond's remarks as to the Young-Helmholtz theory having barred progress, it might be so, but it was a very convenient theory, and that was the only reason why he had referred to it. Having been brought up in the old school, he had, to some extent, a lingering belief in the old theories; at the same time, Mr. Lovibond was doing his best to convert him to the new. With regard to the necessity of having the three colours absolutely pure, he ought to state that it was not until Mr. Lovibond came to the aid of the printing-ink maker that it was possible to obtain these colours pure. He had referred to the reproduction of greens as being the weak point hitherto, and that that had something to do with the purity of the inks. That was not so. When a plate was sensitised for colours, green was the most difficult colour to deal with; there was always found a want of sensitiveness to the green of the spectrum. An ordinary plate would give a closed band of ordinary deposit running up to F unless exposed for an abnormal time and a deep screen were used. If a plate was sensitised with one of the cosine dyes (and there were only about three dyes that could be used to sensitise the green), a closed band from H to F would be obtained, and then there was very little sensitiveness until about D $\frac{1}{2}$ E was reached, so that a bad reproduction of the green was always obtained, because until within the last few months it was not known how to sensitise the bromide of silver for the green in the spectrum. When a plate was sensitised for the yellow or green in the ordinary way it really showed a want of sensitiveness in the green. That was always overcome in the three-colour process by making an allowance and cutting down the blue rays so as to give the green time to act. He had said that an ordinary plate was not sensitive to green. As a matter of fact it was possible to take a picture on ordinary bromide of silver by the red rays, it being a question of length of exposure. Mr. Lovibond had referred to the necessity of all the three colours being transparent. Theoretically that was true. He said he did not think it was necessary to have the yellow transparent. The reason why yellow was printed first was because it was not quite transparent. It was exceedingly difficult to get a yellow printing ink which was at the same time permanent and transparent. If the inks were absolutely transparent it would not matter in what order they were printed. Another member asked whether it was possible to obtain a reproduction of Lippmann's photographs without a second sitting, that is to say, by re-photographing the original. That question had occurred to him, but he had been told that it was not possible to do

so. Personally he did not quite see why it should not be, and he hoped at some future time to test that point practically. The same speaker also said that he had been told that it was only possible to get about one print out of 20 correct. As Mr. Geddes had stated, only about one in 30 was satisfactory, because the plate did not take the ink equally. With his native modesty, Mr. Geddes referred to the worst of the specimens shown as his, but he was one of the first to produce three-colour plates in England, and it would be some time before his three-colour printing would be beaten. He (the author) thought with Mr. Geddes that in photo-lithography we had the process of the future, but it wanted working up. He was still engaged in that pursuit, and he hoped at some future time to show how to turn out the three-colour prints so that they were perfectly even, and still better than the present ones. With regard to the question as to whether the prints shown in the shop windows were photographs in natural colours, he presumed the speaker referred to the Photochrome Zürich Company's specimens. They were not produced by pure photography. One negative only was taken, and from that five prints were made and were coloured by hand, and then those were transferred to stone; the greater part was handwork. There were several other processes in which handwork was used to a large extent, but he confined himself to the photographic reproduction of colours without any handwork, because it was extremely difficult for artists to know exactly how much colour must be stopped out to reproduce the original. He was perfectly convinced that he could reproduce the colours, and he did not see why he should need an artist. Handwork was uncertain and expensive, and the photographic process was the only process of the future. With regard to the permanence of the prints, it depended entirely on the pigments used for the inks. The red was not produced from vermilion, but from madder; the yellow was not from chromium, but from zinc. The blue he was not at liberty to mention, because he discovered its origin accidentally. Some of the specimens were printed in inks that were not permanent; the others were permanent. He had had prints with these latter inks exposed to daylight and not under glass, where the sun could reach them, for seven months, and there was no sign of fading at all. It was, of course, an important point in the manufacture of inks that they should not fade. With regard to the French work, he had to confess that he was ignorant of any that had been produced by the three-colour process without handwork. Most that he had seen depended to a great extent on artist's work, either on the negatives or on the plates. He could easily understand Messrs. Lumière's hesitation in sending specimens; for they were valuable, and to have them lost would be a very great trouble. He believed they prepared them for the love of the thing, and they looked upon them as their children.

Meeting held Monday, June 1st, 1896.

MR. B. E. R. NEWLANDS IN THE CHAIR.

JAPANESE METALLURGY.—PART I.—GOLD AND SILVER AND THEIR ALLOYS.

BY W. GOWLAND, A.R.S.M., F.I.C., F.C.S.

Late of the Imperial Japanese Mint.

GOLD is called by native writers the "King of the Five Metals" because say they it never rusts and may be melted many times without appreciable loss of weight. Following the teachings of the old Chinese philosophers, it was believed that under special conditions, other metals could be converted into gold, but this transmutation could not be effected in a laboratory, as a space of not less than 200 years was required for its completion even under the influence of celestial agencies. Probably, in consequence of this belief in the all important influence of time, alchemy does not appear to have been practised in Japan, and much as the acquisition of gold was sought after, no records of any attempts to transmute a baser into the more noble metal have been handed down by tradition.

The source of the gold in Japan, as in all countries in early times, was the sands of rivers, from which the metal was obtained by a series of simple washing processes. At the present day some is still similarly obtained, and sometimes from sands containing such small quantities that western washing processes fail to compete successfully with the primitive methods of the Japanese gold washer.

In treating these sands, the coarser particles and pebbles were first separated by a kind of hand-jigging in tubs of water with a series of circular baskets of bamboo about 2 ft. in diameter and 6 ins. deep of varying fineness.

The "fines" were then washed on vanning dishes of wood about 20 ins. in diameter and 2 ins. in depth.

Sands containing not more than 180 grains of gold per ton can be thus washed with profit, and a skilful washer will detect the gold in material containing only 30 grains per ton.

The old gold washers are said to have received no wages, sufficient gold dust adhered to their garments, and it is naively added, that sometimes even a nugget became accidentally attached, and this was sufficient to recompense them for their labours.

When the sands and gravels were unusually poor in gold, they were treated by a method of washing in short sluices in the nearest stream. These sluices were either made in the stream itself, or trenches were dug parallel with it and the water of the stream was directed through them in a current of considerable force. The washing portion of each sluice usually measured about 20 to 25 ft. long by 2 to 3 ft. broad.

The gravel was first well washed at the upper end of the sluice and the larger pieces were picked out. After this rough washing, coarsely woven straw mats were placed lower down, and the gravel was then shovelled gradually upon them in such a manner that it was carried over their surfaces by the current. During this operation the heavy

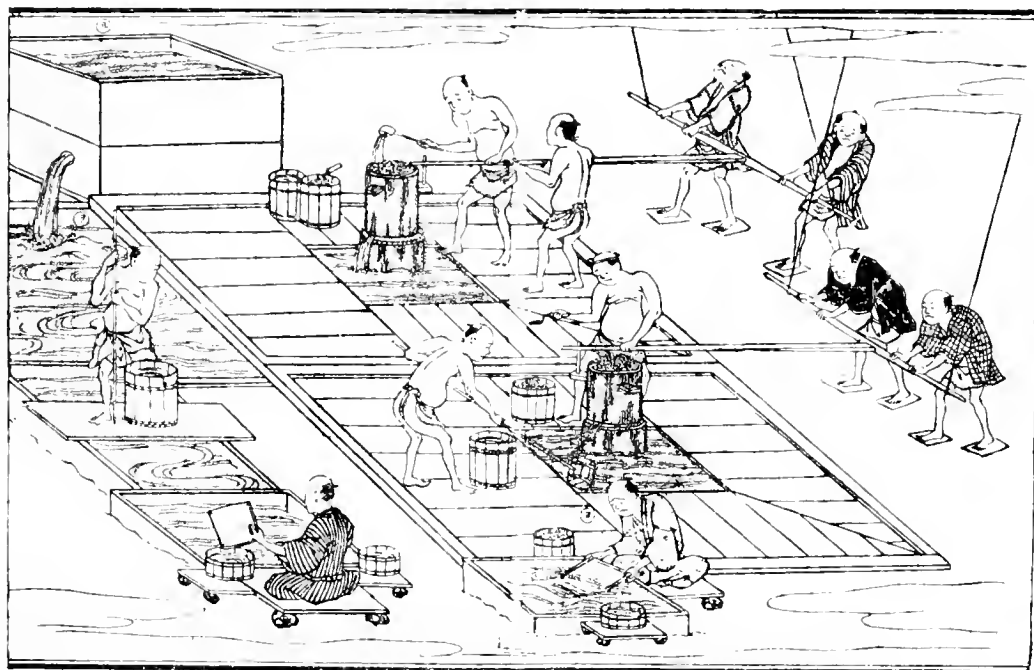
magnetic iron sand and the gold were caught between the fibres of the mats. The mats were then taken up and the concentrated material which had been retained by them was washed on vanning dishes. This method can be strongly recommended for prospecting poor auriferous gravels as the appliances required are so simple. It was tested in Yezo on a large scale by Prof. H. S. Monroe, an American mining engineer, and from his experiments he concluded that where there was an abundant supply of water, and with the cheap labour available in Japan, gravels yielding only 6 cents worth of gold per cubic yard could be washed with a small profit.

In later times mineral veins bearing gold were discovered and the precious metal was separated from them by washing after the ores had been reduced to powder. The appliances used for crushing were of the simplest kind. The large pieces of rock were broken up with hand hammers to the size of large walnuts, and then reduced to coarse powder by means of a curious form of stamp which was worked with the foot.

The stamp consists of a horizontal beam of wood with an axle set near one end, resting on bearings on an upright block. To one end of this beam the stamp head shod with iron is fixed, and also several blocks of stone to increase the force of the blow. The other end is prolonged by fitting to it a plank of wood and on each side of this is an inclined platform. In working the stamp the workman steps from this platform upon the plank at the end of the horizontal beam with one foot, resting his whole weight upon it and thus raising the stamp head, he then quickly steps back to the platform and the stamp head descends with great force into the mortar. The mortar is generally cut out of a large block of stone.

After the ore was thus roughly ground it was treated in the manner shown in Fig. 1, which is copied from an old manuscript of last century.

Fig. 1.



GRINDING AND WASHING GOLD ORE.

The ore was ground with water to a fine pulp in a horizontal mill resembling a flour mill. When rich it was washed at once in "dolly" tubs and the "concentrates" on vanning dishes, otherwise it was taken to the cistern shown on the left of the diagram, from which it was allowed to flow on to straw mats, thence down the inclined troughs on the bottom of which long sheets of cotton cloth were laid.

The particles of gold were caught on the rough surface of the cloth and the earthy material was carried away by the water. After a time the cloths were washed in tubs of water and the gold separated. But little gold has been obtained during recent times by the processes I have just described, and the chief sources of the metal have been silver ores, in which it always occurs, sometimes only to

the extent of a few pennyweights or even less per ton, but occasionally reaching as much as 3 or 4 ozs. or more.

Japanese gold dust is always in the form of very small flakes, the largest of which rarely exceeds 8 grains in weight. The composition of five typical specimens which I examined is given in the following table:—

TABLE I.—COMPOSITION OF JAPANESE GOLD DUST.

	From the Province of Iyo.			From the Province of Bizen.	
	1	2	3	4	5
Gold.....	90.52	90.38	90.35	87.52	88.62
Silver.....	9.25	9.40	9.10	11.05	10.30
Iridium.....	present	..	..	..	..

It differs from the gold dust of Korea in its higher proportion of gold and also in being sometimes associated with iridosmine.

I first discovered iridium in Japanese gold dust in a sample from Iyo in 1884, but it had been a source of trouble in old times to the makers of gold ornaments for the sword, owing to its dissemination through the metal in crystalline particles as iridosmine which resisted the action of their steel chisels. Since then my friend and former assistant Mr. Koga, now the chief assayer of the Imperial Mint, has found it in some of the coins of 1716 A.D.

Uses.—Gold, although found in many localities in Japan, was never abundant, and the glowing accounts of the early voyagers respecting the wonderful richness of the country in gold have no foundation in fact. Doubtless they had their origin in the erroneous assumption that the ornamental plates and appendages which were seen to adorn the principal temples and even many ordinary dwellings were of solid gold, whereas they are only gilded copper. But the sumptuary laws which were enacted from time to time prove that gold was always a precious metal to be used sparingly.

To 1875, before which date the mineral statistics of Japan are not very trustworthy, the total quantity of gold produced in the year was only 5,599 ozs.; but during the 18 years which followed, this amount has been greatly exceeded owing to the extensive introduction of European processes, and in 1893, the date of the last returns, the annual production had reached 23,675 ozs.

One of the earliest uses of gold was as a coating for other metals to protect them from oxidation and for purposes of display. Thus in the early centuries of our era, we find it thus employed for coating bronze and copper rings and other objects for personal adornment, and iron horse-bits, and ornamental appendages which were attached to the trappings of horses.

In later times, especially after the introduction and establishment of Buddhism in the 6th and 7th centuries, gold comes into use on a more extensive scale, its chief application being for the gilding of bronze and wooden images of Buddhist Divinities and of copper vessels and objects for ceremonial purposes, and plaques and studs for the decoration of shrines. Considerable quantities of gold were needed for their purposes as the leaves of the metal employed were of much greater thickness than those now used in Europe.

The method by which the surface of copper and bronze were coated with gold, even in very remote times, depends on the use of mercury, and as no ores of mercury had then been found in Japan there is but little doubt that the process had been introduced from China where it was known some centuries B.C.

The process is a very simple one. The object of copper or bronze to be gilded was immersed in vinegar made from the juice of anripe plums until a clean metallic surface was obtained. It was then washed with water and dried over a brazier, and mercury was applied to it whilst it was still warm. When the surface had thus been amalgamated, the gold was laid upon it in the form of leaves. A stronger

heat was then applied, the mercury was volatilised, and the gold left perfectly adherent.

Even up to recent times, objects of solid gold, excepting those of very small size, were seldom made. Gold plate was unknown, and in the palaces of the wealthiest military nobles, the only vessels of the precious metal, either for use or ornament, were a few wine cups and diminutive kettles for heating water or wine and these were by no means common.

Two gigantic fishes about 9 ft. in height which adorn the roof of the chief tower of Nagoya Castle are said to be of solid gold; but some years ago I had an opportunity of examining one of them and found that like many objects of historical interest they are not what tradition represents them to be but are only of copper coated with gold.

Gold jewellery—in our acceptance of the term—was worn but sparingly, so that the use of gold in the art of the metal worker was practically confined to the decoration of the furniture, of the sword, and the fittings of the pipe and tobacco pouch. The latter, and also the small ornaments “menuki” attached to the sides of the grip of the sword, were often made of gold of great purity. One specimen which I analysed contained, gold, 98.1 per cent.; silver, 1.4 per cent.; copper and lead, 0.5 per cent.

For other objects, alloys of gold with silver, containing much less gold and approximating in composition to the mint coins were generally employed.

In the 17th and 18th centuries there were no less than three different standards of fineness for the gold coins issued by the mint, viz.:—

	Per Cent.	Per Cent.	Per Cent.
Gold.....	86.0	67.0	54.0
Silver.....	13.0	28.0	44.0

and gold articles of this period vary similarly.

But in the 19th century, before the establishment of the Imperial Mint on foreign principles there was a further debasement of the gold standard, still poorer alloys were issued, in which the proportion of gold fell to 35 per cent., 20 per cent., and even to 12.3 per cent.; the last being the poorest alloy which by any pretence might be called gold. Yet from the peculiar treatment to which they were subjected—which I will describe later—they are undistinguishable from pure gold in external appearance.

The 16th century was chiefly remarkable in the annals of gold for the first coinage of the metal by the Government of Japan. In earlier times bags and quills containing definite quantities of gold dust fulfilled the purposes of a gold currency, and their use survived even up to the present century.

Japanese Gold Coins.—The first Government mint was established about 1569 A.D.

One of the first issues of this mint was called an ōban. It is a very large coin in the form of an oval plate, measuring 7 ins. in length and about 4 ins. in breadth, its average weight being 5.3 troy ounces, and its average composition—

	Per Cent.
Gold	73.84
Silver	24.00

Its actual value in our money is about 18l. 8s. The inscription on the obverse is written in Chinese ink, the upper portion indicates its value, viz., 10 ryō, and the lower is the monogram of the master of the mint, made especially complicated to prevent counterfeiting. The reverse is an illustration of the mode of decorating the surface of metals termed “tsuchime” or “hammer face,” in which long shallow oval indentations produced by a hammer of peculiar form are arranged in symmetrical order.

Of the smaller coins of the same date, which were used in making payments in ordinary commercial transactions, the largest was the “koban” or one ryō piece, the value of which is one-tenth of the “ōban.” It is about 2½ ins. in length. There was also the “nibuban” or half koban.

The “ōban” of the Keichō period (about 1601 A.D.) is composed of gold 67.43 per cent., silver 28.50 per cent.,

and its value is about 16 guineas. It is chiefly interesting to us from the curious texture of its reverse side, which is called "ishime" or "stone face" as it represents the structure of the surface of stone, and was produced in early times by hammering the metal on a stone anvil, but later by the use of punches of various forms.

The "Goryōban," coined in 1843 A.D., is $3\frac{1}{2}$ ins. long, weighs 1.08 troy ounce, and is composed of gold 84.2 per cent., silver 15.4 per cent. It is equivalent in value to five koban or half an ōban, and is probably the most beautiful of all the old Japanese coins. Oblong and square pieces of smaller denominations, viz., the half, eighth, and sixteenth of a koban, were also made.

In addition to the production of coins it was also a function of the mint to prepare for the Government from time to time large bars of gold called "Homa," which were to be kept in the Treasury as a reserve against war, famine, or other calamities. An inscription on the upper surface of one of these bars prohibited its use for any but extraordinary expenditure. On another we find "Peace and treasure endure together," meaning that "a reserve against war is a guarantee of peace."

Many other examples of the old coins might be mentioned, but they would scarcely interest you, as they all closely resemble the above. They are, however, well illustrated in the plates exhibited, and in the small collection of repre-

Fig. 2.



SEPARATION OF AU FROM AG.

sentative specimens on the table. The similarity which the various coinages of the Japanese bear to one another is a feature which we would hardly expect from such an artistic people; the designs are singularly deficient in artistic merit, and exhibit no traces of that fertility of conception which distinguishes all their other works in metal.

But the methods pursued in the old mints for their production are of special interest, as they are for the most part identical with those practised by all workers in gold and silver, almost up to the present day, and many are unique in the art of working metals. The operations are all illustrated in minute detail in the manuscript rolls exhibited, a few of the most important only I will now describe briefly.

On the receipt of gold bullion at the mint it was necessary to determine the actual proportion of gold present in it. The assay was performed by means of the "touchstone," and a series of small bars or plates of gold alloyed

with definite proportions of silver according to a decimal scale. These trial plates were prepared by the Government, and were used not only in the mint but all goldsmiths' wares are said to have been compared with them, even in mediæval times, in order to determine their fineness.

The "touchstone" is a small flat piece of black siliceous shale. The gold to be assayed was rubbed on the smooth surface of the stone, and the colour of the streaks produced was compared with that of similar streaks made near them by rubbing on it one or more of the definite alloys. No acids or chemicals were used. This method is still practised by craftsmen working in gold, and by it a skilful expert will obtain results not differing in extreme cases more than 10 parts in a 1,000 from assays made by our methods.

When the gold was found to contain an undue proportion of silver it was submitted to a curious process for the separation of the latter metal. (Figs. 2 and 3.)

Fig. 3.



SEPARATION OF Au FROM Ag.

It was first reduced to a coarse powder by heating it to near its melting point and then rubbing it on an iron plate with a stone or iron rubber.

The coarsely powdered gold was then mixed with common salt and a certain proportion of clay and piled up in the form of a cone on an earthen dish. The whole was then placed in a furnace containing charcoal as fuel, and was kept at a red heat for at least 12 hours, by which means the silver was converted into chloride. The dish with its contents was then removed, washed with hot brine and water, the silver chloride was dissolved and the gold left in a purified state.

The gold was then melted and assayed by the touchstone, and if too much silver was still present it was again treated as above.

(This method was in universal use in Japan up to the establishment of the Imperial Mint in 1870.)

If the gold was found to be sufficiently pure it was melted with the proper proportion of silver required for the coinage alloy and cast into bars in iron moulds.

The melting room of the old mint contained furnaces of a very simple kind—mere cavities in the ground, lined with fireclay, to which a blast is supplied by means of a box bellows. The fuel was charcoal.

The Crucible used consisted of a thin inner cup of hard porcelain enclosed in an outer cover of fireclay, and its construction affords a good example of the ingenuity of Japanese metallurgists in overcoming the difficulties arising from the non-refractory character of their fireclays.

When the gold bars were taken from the moulds they were hammered with sledge hammers into long plates of

suitable thickness for the coins, being annealed when necessary by heating them over a charcoal fire.

The hammered plates were then taken to an assay department where they were tested for copper by a method which is unique in assaying operations.

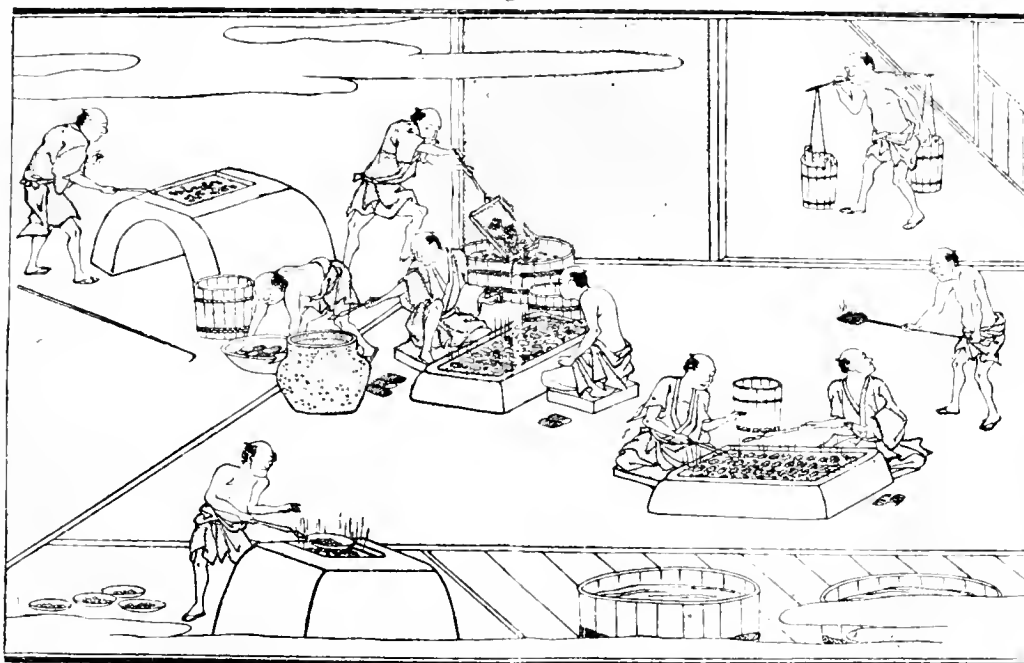
Here the metal was heated to redness over a charcoal fire and when at the proper temperature was rubbed with a stick of "hinoki" (the wood of the *Chamaecyparis* or *Thuya obtusa*) and then immersed in water. The presence of copper and its approximate amount was determined by the colour and appearance presented by the part to which the stick of wood had been applied. So successful were the old operators in the application of this test that it is rare to find more than 0.25 to 0.35 per cent. copper in the old coins.

If the copper was found to be in excess the plates were subjected to the process of cupellation with lead for its removal. Otherwise, they were now cut up with shears into pieces of the shape and approximate size of the intended coins. After the weights of these had been adjusted, the peculiar texture and markings I have already described were given to their surfaces. The devices and the private marks of the inspectors were now stamped by hand with small iron stamps on each coin. They were then sent to the colouring room.

Owing to the large proportion of silver which, as we have seen, all Japanese gold coinage alloys contained, the coins were still nearly white in colour, and it was necessary to give them a surface of gold.

This was effected, not by any ordinary gilding process, but by dissolving out the silver from the upper layers of the alloy.

Fig. 4.



COLOURING GOLD COINS IN THE MINT (18TH CENTURY).

The coins were first painted with a brush with a mixture composed of iron sulphate, copper sulphate, potassium nitrate, calcined sodium chloride, and resin, made into a paste with water. They were then carefully heated on a grating fitted over a charcoal fire. After this they were immersed in a strong solution of common salt, washed with water, and dried. By this means the silver was dissolved out from the upper layers of the alloy and a surface of pure gold left.

The operations were repeated, if necessary, two or three times for the poorest alloys, until the surface had the colour of fine gold.

These old processes were, with a few trifling modifications, practised by all craftsmen when working in gold.

SILVER (Jap. GIN).

"Gin," or, as it is sometimes called, "shiro-kane," "the white metal," has been in use in the country from an early period.

The first examples we have of its use are bronze and copper rings coated with silver, bands of the metal encircling the scabbards of swords, and beads for personal ornament, several of which I discovered in the chambers of the ancient burial mounds.

From this time until the mediæval period objects of silver are not very common. The cold and sober colour of the metal unfitted it for the gorgeous display aimed at in Buddhist temples and ceremonies, so that it was used but seldom for their religious vessels or altar ornaments. Hence, up to near the beginning of the 16th century specimens of a few coinages and a few sword mounts are the only examples of its use which are in existence. From that time there was a marked extension of its use, especially in the form of its alloys with copper, for the ornamental guards and other furniture of the sword; and in the 18th, but more particularly during the present century, objects rarely made of the metal heretofore, such as kettles, vases,

and ornaments, have been largely produced, many of which are masterpieces of the decorative art of the Japanese workers in metal.

The chief ores from which silver was obtained in Japan until recent times were galena, copper pyrites, and iron pyrites, with which were associated argentite, tetrahedrite, native silver, and pyrrargyrite. A common ore consisted of copper and iron pyrites, galena, and zinc blende, with one or more of the above-mentioned silver minerals, and in which in some mines the copper pyrites predominated, and in others the galena. In the former case the ore was smelted for copper and the silver was concentrated in that metal; in the latter it was smelted as a lead ore, and

Fig. 5.



CUPELLING SILVER LEAD.

the silver was obtained in the lead reduced. Ores of an intermediate character yielded copper which sometimes contained large quantities of lead. Those which contained less than about 20 oz. of silver per ton were concentrated by dressing up to this value, or were mixed with richer material for smelting, and in all cases as much of the zinc blende as possible were separated by hand picking. If they contained only small percentages of lead or copper they were smelted with ores containing larger proportions of these metals.

No wet methods of extraction were known, so that all the silver was obtained by furnace processes.

The silver-bearing ores as they were taken out of the mines contained generally from about 6 to 32 oz. of silver per ton of ore, but occasionally the veins yielded rich pockets of ore, which in one case, at the Handa mine, assayed 2,776 oz. 12 dwt. per ton.

Since 1875, when the annual outturn of silver was only 224,831 oz., the production has increased about tenfold, that of 1893 having been 2,226,717 oz.

There is not a single modern process in the metallurgy of either silver or gold, which is practised in Europe or America, which has not been introduced into the country, especially for the treatment of poor ores, and in future the production of these metals will certainly further increase.

The furnace which was universally used for smelting all ores of whatever kind, I have already described before the Society (this Journal, 1894, 465, Fig. A); when thus employed it was partially covered with a thick semicircular lid of clay.

The process of smelting argentiferous copper ore was conducted as follows:—The furnace was first filled with ignited charcoal, and after the blast from the two box bellows which were placed behind it had been started, a layer of ore was spread over the upper surface of the fuel, then a layer of fresh charcoal, then a layer of ore, and so on, until a conical heap of ore and charcoal was formed about 2 ft. in height with a base of about 3 ft. in diameter. As the charge melted, additional quantities of ore and fuel were added until the furnace cavity was nearly full of molten material, consisting of copper matte containing the silver, and slag. The fire was then raked away and the slag skimmed off from the matte with a skimming tool with a wooden head.

The argentiferous copper matte was then reduced at once to metallic copper by directing a strong blast upon its surface by a steeply inclined twyer, a little charcoal being placed around the sides from time to time to prevent chilling. When the whole of the matte had been reduced, the copper was taken out of the furnace by sprinkling water upon its surface with a straw brush, and lifting out the thin solidified crusts thus formed with an iron bar. In some cases the matte was reduced to metallic copper in a separate furnace.

About $1\frac{1}{2}$ to 2 tons of ore could be thus smelted in one furnace per day.

The silver was separated from the copper by liquidation with lead, a process which I have described in a former paper (*Ibid.* 1894, 463).

When the ores contain an excess of lead and but little copper, the smelting process is precisely the same as the above, excepting that a more moderate blast is used to avoid as far as possible excessive volatilisation of lead. When the charge has all been melted down, the slag skimmed off and a little matte which is always formed removed, the argentiferous lead is laded out into shallow cavities in the floor of the smelting house.

For smelting cupriferous ores the furnace is an excellent one. For lead ores it is not satisfactory. For example:—In smelting a galena in which I found 69 per cent. lead and 125 oz. 8 dwt. of silver per ton of ore, only 40 per cent. of lead was obtained, and there was besides a considerable loss of silver.

The argentiferous lead, whether it is obtained from the liquation of copper or by the direct smelting of ores rich in galena, is cupelled in the furnace shown in Fig. 5.

A bellows is placed at one side and the blast is delivered above the middle of the hearth by a twyer bent at right angles.

The hearth of the furnace is composed of wood ash, from which the soluble salts have been washed out with water. A square box about 3 ft. wide and 3 ft. deep is first fixed in the ground forming the floor of the cupellation room, and in this the wood ash is firmly stamped down, the upper surface of the ash being about level with the surface of the ground. A circular shallow cavity 12–16 ins. in diameter and $2\frac{1}{2}$ ins. deep is then made in the surface of the ash and carefully smoothed. Ignited charcoal is then piled in the cavity and slabs of fireclay incurved at their upper edges are placed around, forming a rudely circular chamber about 18–20 ins. diameter, which is open at the front, but partially closed at the top with a fireclay slab.

The argentiferous lead to be cupelled is now placed on the charcoal, the bellows are started gently, and when the metal has melted and filled the cavity in the hearth, the charcoal is pushed away and piled around the molten lead. The lead being thus fully exposed to the action of the blast is gradually oxidised, the lead oxide formed is absorbed by the hearth, and any scorific of infusible oxides are removed by means of a small skimmer. More argentiferous lead is added from time to time if required, and when all has been oxidised, a cake of silver remains on the hearth. From 70 to 90 lb. of lead can be thus cupelled in about three hours, with a consumption of about one-fourth its weight of charcoal.

The silver thus obtained is generally very impure from the presence of copper, bismuth, arsenic, &c., and is hence again cupelled with pure lead in another but similar furnace.

The native metallurgists were very skilful in conducting this process, and seem to have had no difficulty in producing silver of considerable purity by means of it. I have assayed the silver thus treated very often, and the most impure specimen I have ever found contained 98.5 per cent. and the purest 99.7 per cent. silver. Its average composition deduced from the assays of 555 samples was 99.3 per cent. silver. Even in very ancient times, during the period of the dolmen builders, the Japanese seem to have been skilled in the metallurgy of this metal, as the silver beads of that date contain but very small proportions of lead and copper.

In making silver objects, and also for the older coinages, the metal was sometimes used in this pure form, but generally small quantities of copper were added, not for the purpose of debasing it, but to increase its hardness, and also in order to obtain castings free from vesicular cavities—a matter of some difficulty with pure silver. The composition of some of the older silver coins, sword mounts, &c. is given in the following table:—

“OLD” SILVER COINS, SWORD MOUNTS, &c.

Description.	Silver.		Copper with a little Lead.	Analyst.
	Per Cent.	Per Cent.		
Silver coin “Nishu,” 1773 A.D.	97.81	0.13	2.06	Koga.
“ “ “Nanryo,” 1764 A.D.	97.55	0.20	2.25	Dillon.
“ “ “Kō-ichibu,” 1837.	99.15	0.22	0.43	
“ “ “Akita Gimban,” 1854 A.D.	98.70	0.07	1.23	Gowland.
“ “ “Nishu,” 1868 A.D.	84.76	0.04	15.20	Koga.
Silver sword mounts “Seppa,” 18th century.	97.20	0.19	2.61	Gowland.
Silver sword mounts “Kojiri,” 18th century.	95.90	0.25	3.85	“
Silver sword mounts “Fuchi,” 18th century.	94.50	0.53	4.97	“
Silver finger ring, 19th century.	65.60	0.23	34.17	“

Poor alloys are sometimes found, although never in silver work by good artists, and they may contain not more than 50 per cent. of silver, and occasionally very much less. But these are generally special alloys, bearing the generic name “shibuichi,” which are not used as or considered to be silver, but are employed by art workers for producing special decorative effects of colour, owing to the beautiful grey patina which they may be made to assume.

Unfortunately they have also been used for the sake of gain, in the production of what may be termed counterfeit silver articles, by subjecting them to a series of processes which will be described subsequently.

The methods and processes practised by the Japanese in the working of silver are analogous to those which I have described under gold. Its value was determined by means of the touchstone and trial plates or needles of definite alloys of silver and copper—a method not so accurate as for gold, although a skilful expert will ascertain the proportions of the metal present in a rich alloy within $1\frac{1}{2}$ to 2 per cent.

In the old mints and silver refineries, the metal was melted in a furnace consisting simply of a hemispherical cavity in the floor of the melting room, lined with refractory clay mixed with charcoal. The bellows were started, and when the silver was completely melted and the necessary proportion of copper had been added, the fire was raked off, the molten metal stirred well with a stick of pine wood, and ladled into iron moulds with an iron ladle.

It was never cast in ornamental forms, but always in small cakes or bars, which were fashioned solely with the hammer and chisel.

Crucibles were rarely used excepting for melting very small quantities in the workshop of the craftsman, and then the metal was poured into moulds of stone (a volcanic tuff), clay, or loam.

When bars of debased silver, *i.e.*, silver containing undue proportions of copper, were cast, a practice which unfortunately was not seldom followed, even in the old mints—especially for commercial bars—when the military rulers of the country were in need of money, a special mode of procedure was adopted. The silver was then poured into canvas moulds, which were set in troughs of hot water, the reason for this being, that the alloy contained so much copper that, if cast in the ordinary way, the bars would

be coated with a black layer of oxide from the action of oxygen of the air on the copper, and this was difficult to remove. By placing the moulds under water this oxidation was prevented, and castings with a clean metallic surface were obtained. Those bars were, however, of a coppery hue, and this required removal. They were therefore heated to redness over a charcoal fire, and then plunged into vinegar—made from the juice of unripe plums—containing common salt in solution. After digestion in this for some hours they were washed with water and then boiled in plum-vinegar without salt for one or more hours, when they were washed with boiling water and dried. By these operations the copper in the alloy was removed from the surface layers and a coating of pure silver left.

These mint bars sometimes contained only 13 per cent. of silver. Yet so successful were the Japanese in carrying out this method of treatment that these low alloys often cannot be distinguished from purer silver without special examination.

The operation of digestion or boiling in plum-vinegar was also practised for all coins and other objects, even when they consisted of silver of considerable purity. But the chief works by which the old metal workers of Japan have made themselves famous, not only in technology but in art, were not executed in either gold or silver, but in their alloys.

Of these the most important are “shakudo” and “shibuichi,” the former being an alloy of gold with excess of copper, and the latter of silver with an excess of the same metal.

Shakudo.—Shakudo is of a dark copper colour, differing but little from ordinary bronze, and its value as a decorative alloy is entirely dependent on the beautiful black patina which may be produced on its surface by suitable treatment.

Its composition is given in the following table of analyses:—

ANALYSES OF THE ALLOY “SHAKUDO.”

—	Gold.	Silver.	Copper.	Lead.	Iron.	Arsenic.	Total.	Analyst.
1	4.16	0.08	95.77	..	..	..	100.01	Kalischer.
2	3.73	1.55	94.50	0.11	Trace	Trace	99.89	Gowland.
3	2.67	2.06	94.90	0.11	..	..	99.74	..
4	2.45	1.24	96.00	0.06	..	..	99.75	..
5	1.52	2.01	96.10	0.08	..	..	99.71	..
6	1.00	1.37	97.40	0.07	..	..	99.84	..
7	0.49	0.29	99.04	..	..	..	99.82	Atkinson.

The presence of not less than 3 per cent. of gold is absolutely essential to obtain the finest black surface with violet sheen, which is seen in the choicest specimens of the alloy.

There are, however, according to the classification of the Japanese craftsmen, not less than 15 grades of shakudo; the lowest, which is known as “chu sho,” contains only traces of gold. The shakudo of the Satsuma craftsmen is generally considered to be the richest and most valuable, although that used by Ishiguro Masatsune, of Tōkyō, and by one or two others, approaches and often equals the former in excellence.

The alloy has been long known to the Japanese, but there are no records of its first use, and the date of its origin cannot be even approximately determined. Perhaps the least doubtful of the earliest specimens known to me are the mounts of the sword of Ashikaga Takauji, who held the position of shōgun from 1335 to 1357, which is preserved in the temple of Itsukushima.

There may be earlier examples, but it was certainly not known in the 9th century.

The oldest specimen of Buddhist art metal work in the decoration of which shakudo appears, so far as I have been able to trace, is a reliquary containing fragments of the bones of St. Nichiren in the famous temple of Minobu (date 1580).

In many temples there are statues of divinities and saints which are said to be composed of this alloy, but those I have had an opportunity of examining were all of ordinary copper-tin-lead bronze.

In the 17th century it was extensively employed, but the finest examples of its use as a decorative alloy are found in

the guards and other furniture of the sword of last century and the first half of the present.

The addition of gold to bronze in order to obtain a black patina has been long known to the Chinese; it is hence possible the Japanese may have learnt from them this peculiar property of gold; but the pure alloy of copper and gold, the true shakudo, is essentially Japanese, and is unapproached in the beauty and richness of its patina by any alloy of the Chinese, either of old or recent times. Its deep, rich tones of black and the splendid polish which it is capable of receiving, render it alike a perfect ground for inlaid designs of gold, silver, and copper, and for being similarly inlaid in them.

This alloy, too, possesses physical properties which are of extreme importance to the worker in metals, and enables him to manipulate and fashion it as he desires. It can be cast into any form, can be hammered into sheets and drawn into wire; no large castings have, however, been made of it.

The method by which the black patina is produced is as follows:—The object is first boiled in a lye prepared by lixiviating wood ashes, after which it is carefully polished, if necessary, with charcoal powder. It is then immersed in plum-vinegar containing common salt in solution, and after being washed with a weak lye is placed in a tub of water to remove all traces of alkali. After this treatment it is digested in a boiling solution of copper sulphate, verdigris, and water, to which sometimes potassium nitrate is added, until the desired patina is produced.

It may interest you to know that the Japanese are still adding to the number of their curious alloys, the last

addition being a variety of "shakudo" containing no gold. It has been introduced by my friend and former assistant Mr. Y. Koga for the preparation of medals for the soldiers who took part in the late war. It was decided by the Government that these medals should be made from the bronze guns which had been captured from the Chinese, but that "they must not present an undignified appearance like a cheap copper coin," but must have a black patina resembling shakudo. After several experiments he succeeded in producing an alloy with the desired patina by adding to the bronze of the guns small quantities of an iron arsenic speise termed "bajirome," containing 60 per cent. Fe and 32 per cent. As. The medals, after being struck and carefully burnished, are boiled in a solution of the following composition:—

Copper sulphate.....	2½ grms.
Verdigris.....	8½ "
Water.....	2½ litres.

After this treatment they possess a very fine black patina almost rivaling that of "shakudo." The above solution

does not differ very much from those generally used for shakudo, but it possesses this great advantage, that the burnished surface of objects treated by it is not in the least impaired.

Shibuichi.—Of equal or even greater importance than shakudo, and certainly in more extensive use in ornamental metal work, is the alloy of copper and silver called "shibuichi." Its name denotes that it consists of one part of silver in four of the alloy, *i.e.*, one part of silver is alloyed with three parts of copper; but it is rather a generic than a specific name, as under it must be included, not only two other definite alloys, *viz.*, "sambo-gin," consisting of one part of silver to two parts of copper, and "hoji-gin," composed of equal parts of each metal, but also several other lower and intermediate alloys. And in fact the alloy most generally employed by the chief art metal workers was not "shibuichi," in the strict meaning of the term, but "sambo gin."

The composition of the members of this group of alloys is given in the following table:—

ANALYSES OF SILVER ALLOYS OF THE "SHIBUICHI" GROUP.

	Hoji-gin.		Eiji-gin.		Sambo-gin.		Shiho-gin.	Ansei-gin.
	1. Mint Trade Bars. 1706 A.D.	2. Sword Mount. (Kalscher.)	3. Mint Trade Bars. 1710 A.D.	4. Mint Trade Bars. 1710 A.D.	5. Sword Mount. Early 18th Century.	6. Mint Trade Bars. 1711 A.D.	7. Mint Trade Bars. 1854 A.D.	
Silver.....	50.70	48.93	41.60	32.65	32.07	20.40	13.50	
Copper.....	49.18	51.10	58.32	67.27	67.91	79.58	86.48	
Gold.....	0.12	0.12	0.08	0.08	Trace	0.02	0.02	
Lead.....	..	..	..	..	0.52	..	..
	100.00	100.15	100.00	100.00	99.90	100.00	100.00	

It will be observed that there is a great range in the proportions of silver present, from 13.5 to 50.7 per cent. The value of this alloy in decorative metal work is, like that of shakudo, entirely dependent on its patina. It possesses no special beauty when cast, its colour being that of pale gun-metal, or a common pale brouze, but when its surface is subjected to appropriate treatment it assumes a patina of charming shades of grey, which gives it a unique position among art alloys. No other affords the artist such a delicate, unobtrusive, and effective ground for inlaid designs of gold, silver, or other metals.

It was not known to the Japanese in mediæval times; in fact, it does not appear to have been used until much later than shakudo. The descriptions given of the ornamental appendages of historical swords even as late as the 17th century do not mention it, and the first record we have of the alloy only dates from the beginning of the 18th century (1706 A.D.), when it was used in the Government Mint for the preparation of debased silver bars, termed "chûgin" (trade silver), (analysis No. 1), which were used for commercial purposes. There are several examples of its use in sword-guards about the same date, but it seems then to have been chiefly employed as a substitute for a richer alloy, a pure silver surface having been given to it by the process I have already described, and not the fine grey patina of later times. The patina is produced by precisely the same operations which are practised for shakudo, the solution in which the objects are boiled having the same composition as that used for the arsenical bronze, with the addition of 1 c.c. plum-vinegar to each litre. I may say that all the alloys given in the table of analyses, including No. 8, yield a grey patina when treated with this solution, but the finest grey tints are only obtained with those containing from 20 to 50 per cent. of silver.

By the use in his designs of both these classes of alloys—shakudo and shibuichi—together with gold, silver, copper, and iron, the Japanese craftsman has achieved results in colour which are unrivalled in the metal work of the world.

The white of silver, the black of shakudo, the yellows of gold of various grades, the greys of shibuichi, and the reds

and browns of copper—all he employs in perfect harmonious combinations to enrich the effects of his sculptured work, and shows himself in all to be a true master in the art of metal decoration.

I have endeavoured to give you a brief account of some of the strange, unique, and primitive processes which have been practised by the Japanese for many centuries in the metallurgy of gold and silver. They are fast becoming obsolete, and will soon be forgotten. The age of steam and of griny works and factories has set in, and the craftsmen—to their credit, be it said—are rapidly adapting themselves to these new conditions, and are carrying out our Western metallurgical processes with as much zeal and skill as they formerly displayed in the old methods of the mediæval workshop.

The paper was profusely illustrated by diagrams, lantern slides, and specimens.

DISCUSSION.

In inviting discussion the Chairman said that he was sure the Section owed Mr. Gowland their warmest thanks for his very interesting paper. That was not the first occasion they had had to thank him for appearing amongst them. Though now resident in this country he had spent many years in Japan, and had come back with the most vivid recollections of what he had seen in that distant land. He (the Chairman) looked forward to his giving them, out of the abundant material at his disposal, further papers on metallurgy.

Mr. KERSHAW, referring to Mr. Gowland's statement that the pickling solution used for producing the very fine effects on the gold alloy shakudo contained 2 to 4 per cent. of gold, asked whether the same pickle was used for treating the shibuichi gold coinage. (Mr. Gowland: No.) He also wished to know whether the chemical action of the pickling solution in producing that decoration had been studied, and of what it really consisted.

Mr. GOWLAND, in reply, said that the composition of the pickling solution was sulphate of copper, verdigris, and water, to which sometimes potassium nitrate was added. As to the composition of the patina, Prof. Roberts-Austen

had worked on that, and it seemed to be a compound of copper and gold. On account of its extreme thinness it was very difficult to strip it from the metal, but he was still investigating it, and hoped at some future time to give its exact constitution.

THE ELECTRO-DEPOSITION OF ZINC.

BY SHERARD COWPER-COLFS.

MANY experiments have been carried out at different times with the object of cheapening the process of coating iron with zinc, and of avoiding the deterioration of the quality of the material which usually follows pickling and hot-galvanising, as the records of the Patent Office bear ample evidence.

Amongst these improvements are those based upon electrolytic methods. Most authorities recommend a current density of 15—20 ampères per square foot of cathode surface, at an E.M.F. of three volts at the terminals of the depositing bath, the solutions employed being zinc sulphate, acetate, or chloride, ammonium chloride or tartrate. An improved electrolyte invented by Herman has been tried on a commercial scale, the chief feature being the addition of the sulphate of the alkalis or alkaline earths to a weak solution of zinc sulphate.

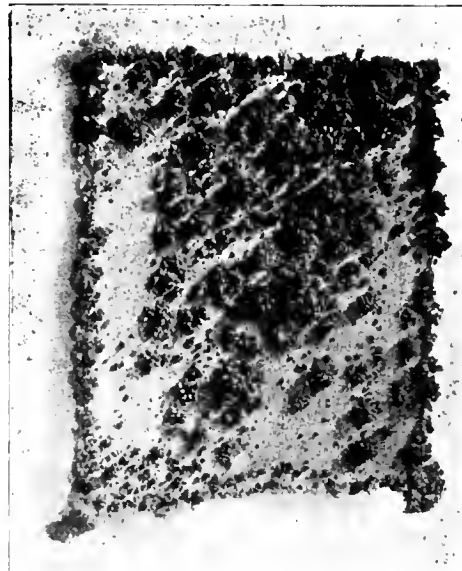
I have obtained good, bright deposits from a solution composed of 10 oz. of zinc sulphate (sp. gr. 1.1770 = 19 per cent. of crystallised zinc sulphate) and 5 oz. of ferrous sulphate to the gallon of water, the anodes being of lead. The iron salts should be brought to the ferric condition, as no deposit of iron can be obtained from a solution of a ferric salt. The generation of hydrogen at the cathode reduces the salt to the ferrous condition, which is again converted into the ferric by the corresponding oxygen liberated at the anode; the formation of zinc sponge is thus considerably reduced. Thin coatings of zinc obtained from acid solutions under favourable conditions are very adhesive when proper care is exercised in the preparation of the receiving surface. I have here some specimens of zinced iron plate, double folded, and boiler tubes which have been reduced under the steam hammer to one-fourth their original length, the zinc coating being still intact and the weight of zinc per square foot averaging about $\frac{3}{4}$ oz. Electro-deposited zinc appears to adhere better to surfaces which have been cleaned with the sand blast than to surfaces which have had the scale and oxide removed with acid.

Fig. 1.



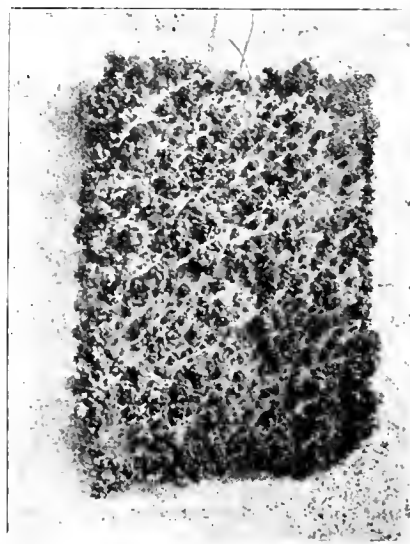
When zinc is deposited of a thickness corresponding to more than $1\frac{1}{2}$ oz. per superficial foot upon iron or steel, it does not form a continuous adherent coating. Attempts have been made by the late Dr. Leeson and others to overcome this difficulty in the same way as the want of adhesion in silver-plating was overcome, namely, by quickening—that is, immersing the copper or copper alloy in an aqueous solution of mercury; but in the case of iron the mercury has to be deposited electrolytically, as the iron will not

Fig. 2.



amalgamate with the mercury. Under unfavourable conditions the zinc coating is of a transitory nature, its durability being incompatible with hot-galvanising, as the deposit is porous and retains some of the acid salts, which cause a wasting of the zinc and rusting of the steel or iron. I exhibit some specimens of zinc deposited from an acid zinc sulphate solution which have been stripped from bright rolled steel; when held up to the light they will be

Fig. 3.



seen to be pierced with a number of small holes. On the other hand, zinc can readily be deposited free from pin-holes and ductile, having more the properties of rolled instead of cast zinc, when the proper current density and

strength of solution are carefully maintained. The presence of free acid appears to accelerate the formation of zinc sponge, as shown by the following experiments.

Each experiment was of about 17 hours' duration, the same solution and rolled zinc anodes being used in every case.

Fig. 1 shows a zinc deposit upon an iron cathode from a freshly prepared zinc sulphate solution, a fringe of zinc sponge having been formed around the plate at the water line. As the electrolyte apparently became more acid, so the amount of zinc sponge increased, as shown in Figs. 2 and 3.

Zinc electro-deposited upon iron and steel is found to resist the corroding action of a saturated solution of copper sulphate (Post Office Test for Telegraph Wires) as well, if not better than zinc applied by the hot or dry method. Fig. 4 shows the thickness of zinc required to withstand varying number of one-minute immersions in a saturated copper sulphate solution. Other matters of serious moment are the slowness of ordinary electro-zincing, the trouble experienced in coating articles of irregular shape, and the

Fig. 4.

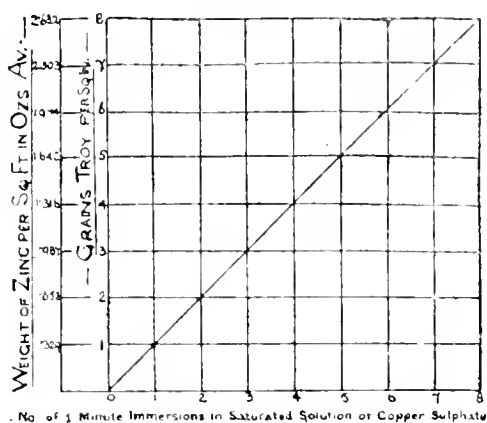


Fig. 5.

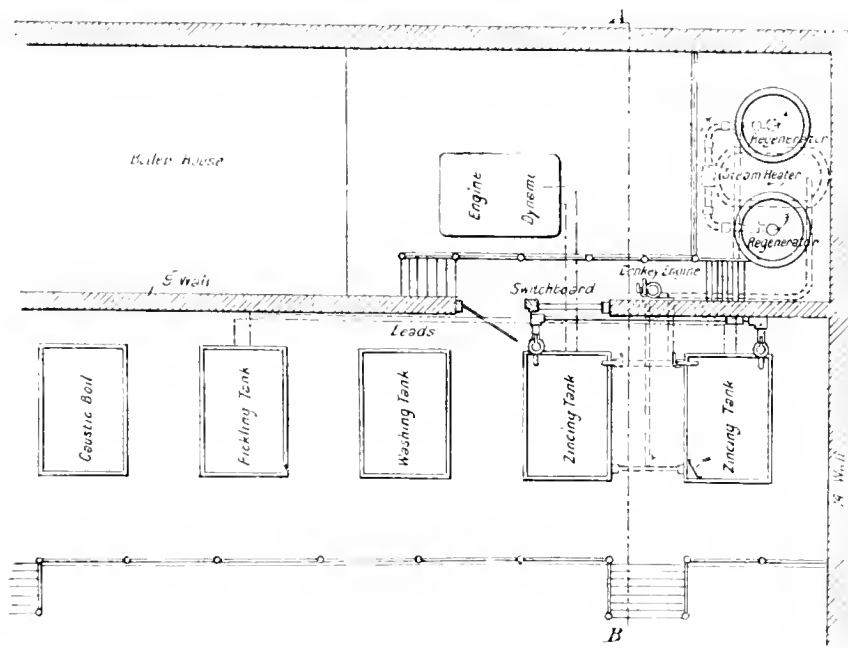
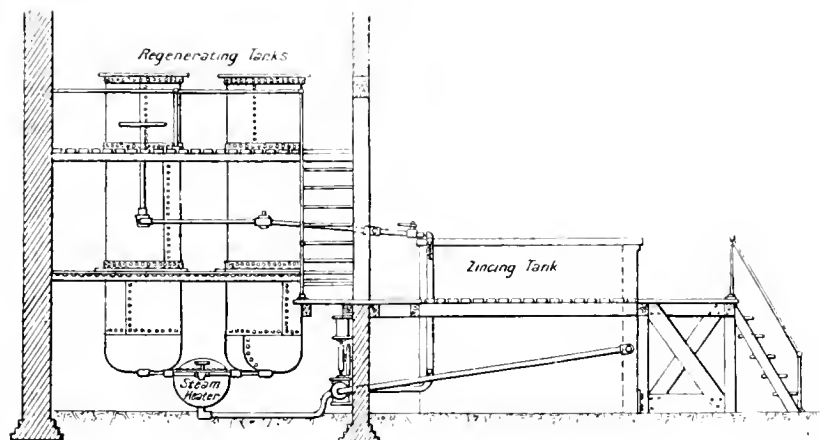


Fig. 6.



difficulties occasioned by the formation of loose, dark-coloured patches. These difficulties and the unhealthy non-metallic look of the zinc coating obtained by the humid process, its want of brilliancy and glitter, has prevented ordinary electro-zincing articles finding favour with engineers and the trade for many purposes.

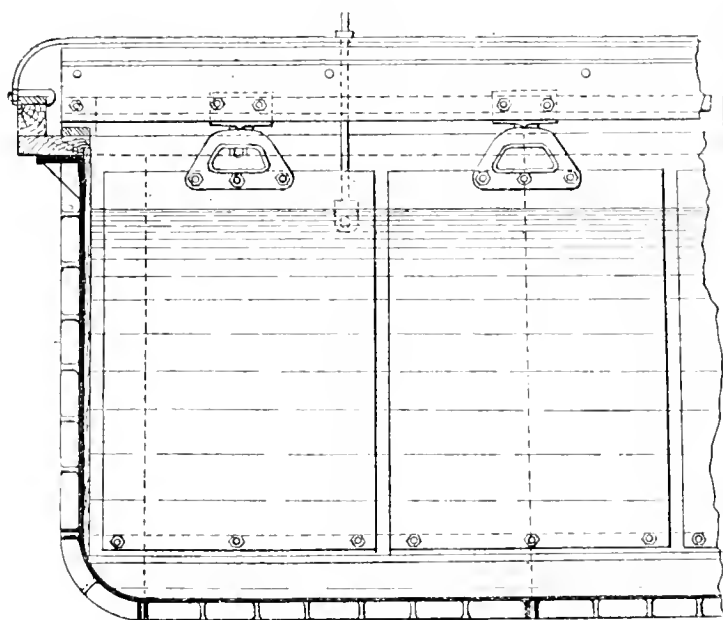
Troubles are also experienced from the scaling and furring up of the anodes, the electrolyte constantly getting out of order when working with a large current density, as more metal is taken out of the solution than can possibly be dissolved from the anodes, on account of the rapid formation of an insoluble scale on the surface of the anode. The scale is constantly peeling off, and has a tendency to settle on the cathode, spoil the zinc deposit, and forms a thick sludge at the bottom of the depositing tank, rendering it impossible to circulate the electrolyte freely. I have found the loss of zinc in many cases to amount to 30 per cent. Figs. 5 and 6 show a plan and sectional elevation of a plant suitable for depositing zinc upon iron sheets. Two steel tanks are provided for containing the electrolyte, which is circulated through the regenerating tanks by means of a small donkey pump or a steam injector, the connections being so arranged that the regenerating tanks can be charged

and discharged alternately. In the regenerating tanks is placed from time to time zinc dust, which is dissolved by any free acid present.

The spent electrolyte is passed through a steam heater (shown on the sectional elevation, Fig. 6) before being injected into the bottom of the regenerator; the revived liquid, as soon as the undissolved zinc dust has had time to settle, is allowed to return to the depositing tanks by gravity. I have found the addition of zinc dust to the electrolyte to be the only practical method of keeping the electrolyte in working order, as zinc anodes—whether cast, rolled, amalgamated, or in the form of granulated zinc—fail to keep the solution up to its normal strength. The anodes which give the best results when working with zinc dust are lead. The economy effected by the use of zinc dust is considerable, as it can be obtained 7 $\frac{1}{2}$ or 8 $\frac{1}{2}$ per ton cheaper than rolled zinc anodes.

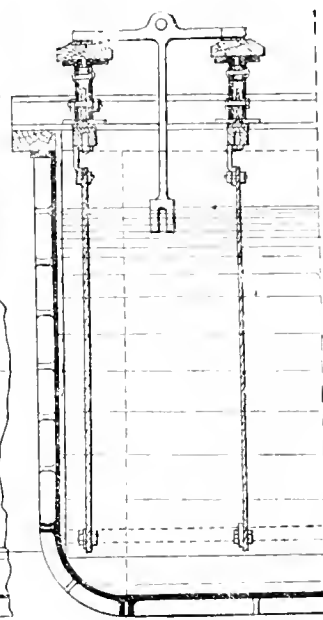
Figs. 7 and 8 illustrate a very convenient method of arranging the anode and cathode suspension bars, enabling the electrodes to be brought much closer together than would be otherwise the case; it also reduces the first cost of the plant, and forms a very stiff girder, which is an important feature when dealing with tanks 30 feet long.

Fig. 7.



SECTIONAL ELEVATION.

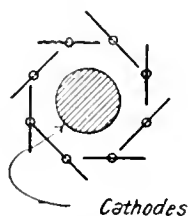
Fig. 8.



SIDE ELEVATION.

Figs. 9, 10, and 11 illustrate an arrangement of rotatable anodes adapted to conform to the irregularities of different

Fig. 9.



Cathodes

Fig. 10.

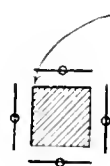
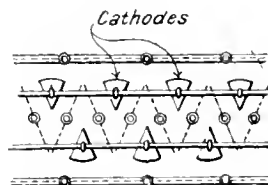


Fig. 11.



shaped articles. In Fig. 9 four anode bars are required, one cathode bar; in Figs. 10 and 11, three anode suspension bars and one and two cathode bars. This arrangement of anodes has been found very convenient for the zincing of various parts of sugar machinery.

The capacity of the dynamo for such a plant as shown in Figs. 5 and 6 would be 4,000 amperes at an E.M.F. of

7 volts, the current being conveyed to the tanks by bare copper strip having a sectional area of 1 sq. in. for every 1,000 amperes.

DISCUSSION.

Mr. F. PLATTEN wished to thank Mr. Cowper-Coles for his extremely valuable paper. It dealt with a matter of great interest, and would be read with more than ordinary care by people situated, as he was, in a district where

enormous quantities of the sulphate and other salts of zinc were annually run to waste. He would like to ask whether the electrolytic zinc was comparatively pure, as was the case with other electro-deposited metals, and particularly if the electrolyte must necessarily be pure; if not, it seemed to open up great possibilities for the utilisation of large quantities of impure oxide of zinc, for which, apparently, there was no market whatever. He referred chiefly to the oxides given off in reverberatory brass casting, which contained arsenic, antimony, &c. in appreciable quantities; and he would be personally much indebted to Mr. Cowper-Coles if he could give any information as to the action of these impurities in the electrolyte, or state if it was in any way analogous to the behaviour of the same bodies in a copper sulphate electrolyte, which has been very carefully studied. Mr. Cowper-Coles had stated that he considered a current density of 14 to 20 amperes per square foot to be most satisfactory; he (the speaker) found that with over 20 amperes there was a tendency to deposit trees of zinc round the edges and on the base of the cathode. He had tried to obviate this by dipping the cathode edges in wax, but the trees formed just the same at the junction of the wax and metal. Possibly the fact that copper cathodes were used might bear on the matter, but, curiously enough, the trees did not form at first, when the presence of a zinc and copper couple may have complicated the matter, but after a good, firm coating of zinc had been obtained. He thought if Mr. Cowper-Coles could elucidate these points, it might be of interest to the Society.

Dr. W. S. SQUIRE said that one very important factor had been omitted from the paper, namely, temperature. According to his experience the question of temperature considerably affected the deposit of zinc. At the freezing point of water a current density of 10 amperes per square metre would produce a good deposit, but as the temperature rose it seemed necessary to increase the density, until at the temperature of 30° C. the current density most favourable was about 200 amperes per square metre. As the current density increased so also must the electro-motive force be increased to get the current through, but not altogether in the same ratio, because the specific resistance of the bath would be to some extent diminished by an increase of temperature. Now the use of high electro-motive force to drive a large current through a given resistance would have the effect of warming the resisting liquid. That again would modify the conditions. It is clear therefore that some means should be adopted of keeping the bath at a constant temperature in order to obtain constant results. There was another point about which he would like to have some information. A lead anode is used upon which oxygen must be evolved. In the usual process of forming accumulators this results in the formation of peroxide of lead. If this took place in this process, the consequence would be considerable polarisation and counter electro-motive force, requiring increased electrical pressure to overcome it.

Mr. WM. THORP asked whether there was any explanation of the fact that the sand blast gave a better cleaning effect than the acid process.

Mr. W. F. REID wished to know whether any experiments had been made with regard to the durability of iron coated by the process just explained, when exposed to the atmosphere, especially in London. There was an essential difference from the ordinary coating produced by fusion. In the latter case there was an alloy of iron and zinc, as in tin-plating, which it was almost impossible to remove. With respect to the production of pure zinc from impure materials by electrolytic processes, there always seemed a difficulty on account of the spongy nature of the zinc produced, and he hoped that Mr. Coles had got over that difficulty. It was the chief difficulty in a process he had tried, a process which appeared to be good, but there was an enormous loss in running the deposited zinc down into bars. By putting half an inch of petroleum on the surface of the liquid, he found that the deposit was less porous. Unless overcome, this difficulty would render it difficult for this process to compete with the ordinary one.

Mr. COWPER-COLES intimated that he would send his reply to the discussion in writing.

The CHAIRMAN said that one remark in particular had interested him, namely, that the process was used in producing cube-sugar-making machinery. Anyone who had examined the articles put before them would see that the surface of the moulds was exceedingly smooth, and that was very necessary for casting sugar. When the moulds were galvanised in the ordinary way, their surfaces had very often to be coated with varnish to prevent the mass adhering to them.

In moving the customary votes of thanks to the authors, he wished to bid farewell to the Section as its Chairman. Dr. Messel had been elected to succeed him, and would, he was sure, fulfil the duties of the position in a thoroughly worthy manner. Speaking for himself, he could say that he had always had the interests of the Society at heart, and he thought that the record of work done during the session might be regarded as of a satisfactory character.

Mr. TYRER moved that the warmest thanks of the Section be given to Mr. Newlands for his services as Chairman during the past two years.

Mr. WM. THORP seconded the motion, which was carried by acclamation.

Mr. B. E. R. NEWLANDS briefly thanked the meeting for the cordial way in which the motion had been received, and concluded by congratulating his successor on the fact that he would have the able services of Mr. John Heron as Honorary Secretary of the Section.

Mr. S. COWPER-COLES, replying to Mr. F. Platten's remarks, said he had found zinc deposited from pure electrolytes to be free from impurities, but if much ferrous sulphate was allowed to accumulate, then considerable quantities of iron were deposited with the zinc. With reference to the formation of zinc trees, if the electrolyte were circulated rapidly, so as to produce skin friction, the formation of trees was much reduced. Constant temperature was necessary for good deposits; increase in temperature reduced the resistance and therefore increased the current. Nihusen had conducted some researches on this point of temperature and current density, and his latest views, as stated by Bocher, were opposed to those given by Dr. Squire as to the advantage of working at 0° C. Lead peroxide was formed when lead anodes were used, but the peroxide remained attached to the anode, and did not cause much loss of free acid. Probably the reason why electro-deposited zinc was found to adhere better to sand-blasted surfaces than surfaces which had been pickled, was that the rougher surface gave a better holding.

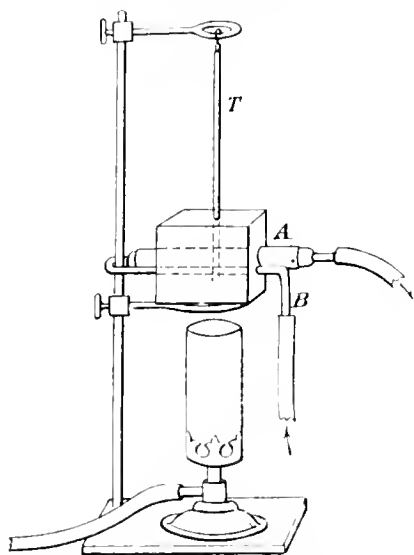
NOTES ON LABORATORY APPARATUS.

By J. H. COSTE.

An Air Bath.—This has been found useful for drying substances at temperatures above 100° C. It is usually difficult to obtain a temperature much above, say, 120° in the ordinary air-oven without using a large burner, which is generally difficult to regulate. The temperature also varies considerably at different heights in the oven. If the substance is attacked by air at high temperatures or gives off other substances than water, an estimation of the water is difficult.

The apparatus figured—which is made from a square "tin" or copper box, with a lid perforated at the top to take a thermometer (T), the bulb of which is level with the tubes (A and B) passing through the sides of the box—is heated by an Argand burner and supported on a retort stand. Dry air (or other gas) passes through the tube B, where it undergoes a preliminary heating, and then through the drying tube A. The substance to be dried is placed in a porcelain boat, or in a tube passing through the cork of A (by the latter means precipitates on filter tubes can be dried). It is usually sufficient to estimate the loss in

weight of the substance in the boat; but, if necessary, drying tubes can be used to collect the water, or special absorbing apparatus for other volatile substances.



A temperature of over 200° C. can be easily obtained with an ordinary Argand flame and maintained fairly constant. When a thermometer was placed *inside* as well as one *outside* the drying tube, it was found that the temperatures only differed by a few degrees when a water-pump was drawing air through the system at the rate of about 8 litres per hour. If this bath is protected from draught any temperature can be maintained within a few degrees easily.

A Glass Rod for Decantation.—It is often in quantitative operations desirable to wash a precipitate by decantation in a beaker or flask. If a long rod is used to pour the liquid down in transferring, it usually disturbs the settled precipitate in the beaker, and is inconvenient to place in a flask. A short rod, kept when not in use in a little beaker afterwards washed out into the main quantity, is liable to be neglected. A little rod bent at one end into a hook can be hung on the side of the beaker or flask when not in use, and thus cannot be overlooked in final washing, and at the same time serves for decantation purposes.

Nottingham Section.

UNIVERSITY COLLEGE, NOTTINGHAM.

Chairman: F. J. R. Carulla.

Vice-Chairman: J. M. C. Paton.

Committee:

L. Archbutt.

F. Clowes.

J. B. Coleman.

H. Forth.

W. G. Johnston.

J. F. Kempson.

T. Mason.

J. O'Sullivan.

C. Taylor.

G. J. Ward.

R. Lloyd Whiteley.

Treasurer: S. J. Pentecost.

Hon. Local Secretary:

J. T. Wood, 29, Musters Road, West Bridgeford, Nottingham.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—*Committee:* R. M. Caven, F. E. Lott, and J. J. Sudborough.

Meeting held at University College, June 17th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

ACETYLENE: LIMITS OF EXPLOSIBILITY OF MIXTURES WITH AIR, AND DETECTION OF SMALL PROPORTIONS IN AIR.

BY FRANK CLOWES, D.S.C.

(Summary.)

THE ease with which acetylene can now be prepared from calcium carbide has enabled the writer to determine the proportion of this gas which must be present in air to produce an explosive mixture. It was found that air containing any percentage proportions between 3 and 82, gained the power of burning throughout independently of the external atmosphere. This is a far wider range than that shown by any combustible gas yet experimented with, and it appears probable that the wideness of the range of explosibility, due to true combustion, is, in the case of acetylene, increased by its known power of undergoing endothermic decomposition.

The detection and measurement of proportions of acetylene in air which are less than 3 per cent., by the observation of the flame cap over a standard hydrogen flame, was found to be entirely satisfactory; and this method of detecting and measuring small proportions of inflammable gas in air seems to be one which is likely to be of use in certain laboratory processes of gas analysis.

Dr. Clowes showed comparative flames of coal-gas and acetylene, and also exploded definite quantities of acetylene and air, and showed the flame caps produced by smaller quantities than were required to form an explosive mixture.

DISCUSSION.

Mr. F. J. R. CARULLA said that in connection with the subject of acetylene explosions, Prof. Vivian B. Lewes had pointed out (*Journal of Gas Lighting*, May 12, 1896) that one of recent occurrence, originally involved in some mystery, was due to the presence of phosphide of calcium in the carbide obtained from the Continent, which contained this impurity owing to the use of phosphatic lime in its manufacture. Such carbide evolved phosphuretted hydrogen on contact with water, which doubtless fired an explosive mixture of acetylene and air. Prof. Lewes concluded his letter with the following caution, which was well worth quoting:—

"The present manufacture of acetylene from impure carbide, and the sale and use of automatic acetylene generators utterly unfitted for the purpose for which they are intended, is fraught with very grave danger; and I fear that in the next few months you will have to record many such accidents. This is the more to be deplored, as the undue haste to employ this most beautiful illuminant will only result in unjustly discrediting it."

Had Dr. Clowes any experience of this impurity in the carbide that he employed?

Mr. J. T. WOOD said that, when on the Continent, he had seen several acetylene lamps, and in Paris there was actually a little paper which was called *L'Acétylène*, which pushed the thing in an extremely vigorous way. There were articles in it about the gas every week—some of them good ones—and it appeared that they were shipping the carbide in large quantities from America. It was produced there by water-power from Niagara, and to compete with them under such circumstances in this country was quite hopeless, as they must inevitably produce it in America at a much cheaper rate. A friend of the speaker's had called his attention to an article in the *Figaro* of June 1st by a French chemist, M. Emile Gautier, in which he wrote about the "Domestic Uses of Acetylene." He made in the course of it some remarks about the gas being a paradoxical

body, and he said that if one tried experiments with it in small quantities by grammes and drops the risks in using acetylene were negligible, but when it came to using it in large quantities it was quite another problem. He went on to say: "To put water on to a mass of carbide equal to a dozen kilogrammes would be like lighting a cigar in a powder magazine!" He said: "On the other hand, acetylene can only be used when chemically pure, and that purity so far is only a myth." The object seemed to be to point out that the only way to use acetylene was in its liquid form. M. Raoul Pietet had been able to solve the problem in a very practical manner, and had devised a chemical means of purifying the gas and delivering it in a liquid form for use. He had also devised, though it would be too lengthy to explain in detail, a better means of using the solid form of carbide without danger of explosion. A company was being formed, or had been formed, to deliver pure liquid acetylene in the way that compressed gases were now delivered in this country. M. Gautier said that the problem was solved, and that acetylene in the future would put all other gas flames in the shade! Mr. Wood, in conclusion, said he would like to ask Dr. Clowes one question, and that was, that acetylene being such a curious body, and being able to explode without any oxygen, whether there was not some danger of its lighting back when burnt without a special jet?

Mr. R. M. CAVEN said there was one question he would like to ask with regard to the flame caps. Was not a flame cap a kind of local explosion? He supposed the lower explosion, from a standpoint of theory, was really a flame cap of infinite length.

Dr. CLOWES, in reply, said that there was no doubt that many of the accidents which had arisen from the use of acetylene had been due to the impurity in the carbide. The early reports, which came generally from the Continent, that when acetylene came into the air the gas would explode spontaneously, undoubtedly owed their origin to the presence of phosphuretted hydrogen. Phosphide had been found in the carbide and phosphuretted hydrogen in the gas, but they were now making the carbide sufficiently free from phosphide to be free from danger. The carbide they had been using that evening had been tested very carefully, and was certainly free from phosphorus. He was afraid that acetylene lamps on the Continent had, so far, not been very successful. A friend of his in Switzerland informed him recently that he had a lamp which would burn sometimes an hour and sometimes an hour and a half, and then would not burn again until it had been recharged; and that it generated the gas much faster than it could be burnt, thus leading to offensive pollution of the air. He had never found acetylene burning back in a cool tube. As they had seen in an experiment, they could get it to burn back when the tube was hot, but even then the store of cold gas was not fired or exploded. There was no doubt, as had been suggested, that the flame cap was simply the area of combustion maintained by the heat of the flame. If they gradually increased their quantity of combustible gas, the flame cap gradually merged into a mass of flame, and so became an infinite flame cap, but this was not permanent as an ordinary flame cap was.

THE AMOUNT OF AIR CONTAINED IN WATER.

BY J. M. C. PATON.

CONDENSING steam engines are in common use wherever supplies of water are plentiful. The water always contains some air and other gases, but about the quantity of the air and gases there appears to be some uncertainty.

Most writers on the steam engine content themselves by saying that "the water used for steam-engine purposes invariably contains more or less air, and if this were allowed to accumulate in the condenser the vacuum would gradually become destroyed," and they then give some empirical rule for size or proportion of air pumps.

If the water contained no air or gas, the function of the pump emptying the condenser would be simply to remove water, the volume of which is known; but this pump has also to remove an unknown quantity of air, and consequently in practice the sizes of the pumps are found to vary very much.

It is usual to define the size of the air pump as having a proportion or ratio compared with the volume swept by the piston of the steam engine.

At a recent trial of an American man-of-war with triple screw engines and independent air pumps, the pumps were found to have a volume ratio of 88·9, 75·7, and 61·6, or an average of 72 taken over the three engines. This ratio of 88·9 is the best of which I have a record. In this case, with a surface condenser, the air pump is removing all the water fed into the boilers, and also the air which leaks into the vacuum sections of the engine, but it is not dealing with the actual condensing water. In these pumps, with a ratio of 72 to 1, the feed water would only be about one-eighth of the volume swept by the pump pistons. The water entering the pumps from the hot well would be very free from air, and if it be assumed that this air occupied three-eighths of the pump capacity, then we have one-half of the pump capacity left to deal with the air due to leakage. In the present case this means that a pump having a capacity equal to 72 by 2, or $\frac{1}{144}$ th part of the volume swept by the piston of the low-pressure cylinder, is sufficient for the removal of air due to leakage. The efficiency of such a pump being, say, about 50 per cent., it follows that $\frac{1}{72}$ th represents the real volume of this air *in vacuo*. If this is divided by, say, 12, we find the volume of air at atmospheric pressure is about $\frac{1}{864}$ th part of the volume swept by the low-pressure piston. In the present case this means less than 10 cb. ft. per minute, or the total leakage area, is represented by a hole, say, about $\frac{1}{16}$ th of a square inch in cross section; this, with engines developing over 21,000 h.p. and including the leakage from about 20 auxiliary engines with their pipes and connections, must certainly be looked on as a satisfactory result.

Having now considered a favourable case where the condensing water does not give up its air to the pump, and having seen within what small compass leakages of air may be brought, we may now proceed to look into an ordinary case where the condensing water with the air it contains have also to pass through the air pump.

In ordinary horizontal condensing engines it is a very common practice to make the diameter of the air pump one-third of the diameter of the steam cylinder when both have the same stroke; in other words, the ratio of volumes is 9 to 1. (In special cases—for instance, in the tropics—the ratio may be even one-sixth instead of one-ninth.) Compare this with the 88·9 ratio found in actual practice under different conditions. The difference is caused by the presence of the condensing water and its air, combined with the need for a general design of such a character as to be able to deal with any ordinary or average conditions of working.

Speaking broadly, it may be said the air leakages are so small as to be almost negligible in good practice, and the air pump has to be designed to deal with the condensing water only; the usual margin for contingencies will cover all else.

The volume of condensing water is arrived at with practical accuracy by a very simple calculation when the working conditions are known, but for the present purpose we may say that in this country the quantity will usually be from 25 to 35 times the boiler feed water.

The question now arises, what quantity of air will enter the condenser with every 100 cb. ft. of water?

One authority on water analysis says: "Water is capable of absorbing, in a greater or less degree, every gas and every vapour which is placed in contact with it." All water which has been kept in open vessels is necessarily charged with nitrogen and oxygen gases, inasmuch as these gases form the chief constituents of the atmosphere. And if any sample of water be freely shaken up with large volumes of air, it will presently become charged with nitrogen and oxygen in certain well-ascertained proportions, depending on a physical law. A litre of water, freely shaken up with

large volumes of air at 15° C., will absorb 17.95 c.c. of air, the composition of which is:—

	Vols.
Nitrogen	65.1
Oxygen	34.9
	100.0

These figures agree with the theoretical amounts calculated on the coefficient of absorption of each gas, as given by Bunsen, viz., 0.0118 for nitrogen and 0.0299 for oxygen. $0.0118 \times 79 = 65.1$, and $0.0299 \times 21 = 34.9$.

The figures given deal with saturated waters, but in their natural condition many waters may be far from being saturated.

An old examination of Thames water at Woolwich showed carbonic acid 48.3 c.c., nitrogen 14.5 c.c., and oxygen 0.25 c.c.; total 63.05 c.c. Here the volume of oxygen is very small, owing to the presence of sewage.

Another examination of Thames water at Kingston showed total gases 52.7 c.c., formed of carbonic acid 30.3, nitrogen 15.0, and oxygen 7.4 c.c., thus indicating nitrogen and oxygen in about the theoretical proportions for fully aerated water.

The power of water to absorb gases increases with increase of pressure, but at present we are dealing with atmospheric or normal pressures only.

It will be noticed that the proportions of nitrogen and oxygen in the water are not the same as in ordinary air, but the amount of oxygen is greater. This point suggests that when these gases are given off *in vacuo*, the larger proportion of oxygen may to some extent account for the well-known rapid rusting away of wrought-iron bolts and nuts, &c. in the interiors of both condensers and air pumps.

I now repeat the question—What quantity of air will enter the condenser with every 100 cb. ft. of water?

Is water from ordinary sources usually fully saturated with air?

At the temperature found in a condenser, does the water give off carbonic or other gases in greater quantity than existed in a free state in the water before it entered the condenser?

The usual test for air seems to involve boiling the water. Does this give a correct report of the amount of gas in the cold water?

After water has given off its air in a vacuum, how much air does it take up during its passage through a tower of fascines, or other cooling apparatus, such as is used when the water is at once cooled and re-used?

DISCUSSION.

The CHAIRMAN said the question had been put in such a form that it really opened up a very big discussion. He would like to ask if there was anyone present who was prepared to answer the main question. If there was not, they must not think he desired to apply the closure, but he thought it would be desirable first to have the note printed, and then discuss it at the next meeting.

Mr. R. M. CAVEN gave some particulars and a table from Thorpe's Dictionary as to the gases dissolved in water. (See Thorpe's Dict. Appl. Chem., Vol. III., 964.) He said it had been thought that the small proportion of oxygen present in waters was due to the absorption of this constituent by oxidisable organic matter, but this could only apply to surface waters. The small quantity present in deep well waters which were free from organic pollution was a remarkable fact for which no explanation could at present be given. The large proportion of CO₂ in Thames and deep well water is due to calcium bicarbonate.

Volumetric percentage (or cb. ins. per 100 cb. ins.) of air dissolved in distilled water to saturation at 0° C. and 760 mm. pressure was as follows:—

N	1.580
O	0.824
CO ₂	0.716
	3.120

Soft waters were probably about saturated with N and O at their respective temperatures, though not with CO₂.

The discussion was then adjourned until the next meeting.

ERRATUM.

This Journal, May 1896, 325.—In date of meeting, for "April 15th" read "May 13th."

Yorkshire Section.

Chairman: C. F. Tittley.

Vice-Chairman: J. J. Hammel.

Committee:

H. E. Aykroyd.	W. Leach.
J. E. Bedford.	W. Mc'D. Mackay.
F. W. Branson.	A. G. Perkin.
T. Fairley.	C. Rawson.
N. Farrant.	Geo. Ward.
A. Hess.	Thorp Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, Yorkshire College, Leeds.

The names in italics are those of Members of Committee who retire at the end of the current session.

The following have been elected to fill the vacancies, and will take office in July next:—Chairman: Thos. Fairley. Vice-Chairman: Christopher Rawson. Committee: J. Cohen, J. R. Denison, T. Glendinning, F. W. Richardson, and A. Santhells.

Meeting held at the Queen's Hotel, Leeds, on Monday,
June 1st, 1896.

MR. C. RAWSON IN THE CHAIR.

TITANIUM OXIDE AS A MORDANT FOR WOOL. TOGETHER WITH A NOTE ON ZIRCONIUM AND CERIUM OXIDES.

BY JOSEPH BARNES, F.I.C.

MORE than 11 years ago I discovered the property which oxide of titanium has of combining with polygenetic colouring matters, and showed that it could be applied as a mordant to cotton in the same manner as alumina and would produce shades somewhat resembling those yielded by the latter substance (this Journal, 4, 310). In 1887 I dyed samples of cotton yarn by means of titanic oxide mordant, and these were exhibited at the Manchester Exhibition in the show case of Messrs. Kearns, Allan, and Co. No notice of these appeared in any of the English publications, but they were reviewed by Dr. O. N. Witt, in *Dingler's Polyt. Journal and Die Chem. Industrie*. Beyond this no mention has been made in any journal or text-book with reference to this property of titanic oxide. The reason why the matter has not attracted any attention is probably owing to the fact that the colours obtained on cotton presented no striking characteristics, and that they were no more than could be easily obtained by the use of commoner materials, and also owing to the generally prevailing idea that titanium was a rare element and one not likely ever to enter into serious competition with the common and easily obtained oxides of chromium, aluminium, and iron. Quite recently it occurred to me to try the effect of a titanium mordant on wool. The reason why this substance had been tried on cotton only was because I was at that time interested in the dyeing solely of vegetable fibres. I found upon making preliminary trials on wool that the oxide of titanium was really an excellent mordant for animal fibre, and was just as easy of application as those which are usually made use of, and further that it appeared to possess properties which would make it possible to produce shades which could not be obtained by any mordants hitherto employed. Then, again, there is the fact that the element titanium is much more abundant than is generally supposed, and that during recent years it has been found in very large quantities, and is now thrown away as a waste product. Having made a few more experiments with this substance, and having convinced myself that apart from the scientific interest which the question merits, that there is a probability of a commercial development in the use of oxide of titanium as a mordant, I thought it worth while to again bring the

subject before this Society, and to lay before it a few results which I have obtained in its application to animal fibre.

Oxide of titanium is said to be used in the manufacture of artificial teeth, and to enter into the composition of a certain glaze for earthenware; further than this I am not aware of any practical application to which it has been put, and seeing that this substance is one which has hitherto never entered into questions of practical interest to the dyer, I may be excused for occupying a little of your time in giving a brief description of its more important properties.

The element titanium has an atomic weight of 48. In the periodic classification it comes between carbon and zirconium, which form, together with cerium and thorium, the even series family of Group IV.—the odd series of the same group being silicon, germanium, tin, and lead. Its richest ores are rutile, or titanium dioxide, and titanate of iron, or ilmenite. Brookite and anatase are rarer forms of titanium dioxide. It is a very widely distributed element, and exists in much greater quantities than was formerly supposed. The number of minerals in which it is found is very great, and it has been shown to exist in the sun's atmosphere. Bauxite, a mineral which has of late years been obtained in large quantities in Ireland for the manufacture of sulphate of alumina, contains considerable quantities of oxide of titanium, varying from 2 per cent. to 10 per cent. A sample which I have here contains 6.42 per cent., the bulk of which, viz., 5.37 per cent., enters into solution along with the alumina when the ore is treated with vitriol, and is then reprecipitated as meta-titanic acid upon boiling the clear solution. Titanium exists, in more or less quantities, in most clays, and in some samples the amount is considerable. New Zealand magnetic iron sand, of which there are immense deposits, contains from 7 per cent. to 10 per cent. of oxide of titanium. According to recent investigations it appears that this element exists in notable quantities in the ash of many plants (C. E. Wait, Journ. Amer. Chem. Soc. 1896, 18, 402).

Of the better known elements, tin and silicon are most closely allied to it in the general habitude of their compounds, and titanium may be considered to hold an intermediate position. It may be obtained in the metallic condition as a dark powder by heating sodium in the vapour of titanium chloride. This powder burns, when heated in the air, with great brilliancy, and dissolves in hydrochloric acid, forming a violet solution of titanous chloride. This is a higher chloride than the tin chloride which would be formed under similar circumstances, and may be termed a sesqui-chloride (Ti_2Cl_3). Titanous chloride and, indeed, all titanous salts, are more prone to oxidation even than the stannous compounds. The anhydrous tetrachloride is produced by heating the oxide, mixed with carbon, in a current of chlorine. It is formed at a lower temperature than the corresponding silicon chloride. It may also be produced by heating the oxide in a mixture of chlorine and carbon monoxide. It is a heavy, strongly-fuming liquid, boiling at $136^\circ C.$, and may easily be obtained free from iron by distillation. When mixed with a small quantity of water it forms a solid oxychloride, which is soluble in a further addition of water. Alkalis throw down from this solution a hydrated oxide, which, unlike the hydrated oxides of tin and silicon, is insoluble in caustic soda or potash. It may be dissolved in cold mineral acids and in alkaline oxalates, fluorides, and tartrates. When its solution in hydrochloric or sulphuric acid is boiled, the oxide is reprecipitated in a different condition—as meta-titanic oxide. It is now no longer soluble in hydrochloric or dilute sulphuric acids, and has only a feeble attraction for colouring matters. It may be easily dissolved by means of hydrofluoric acid or by moderately strong sulphuric acid, e.g., by mixing with dilute sulphuric acid and concentrating on the water-bath.

A solution containing titanium gives, with tannic acid, an orange precipitate, with gallic and pyrogallie acids orange or brownish-yellow solutions, and with salicylic acid a pale yellow coloration. The action of hydrogen peroxide upon a solution of titanium is very characteristic

—a yellow to deep orange coloration is produced, which is destroyed by alkalis and restored by the addition of acid. The yellow and orange colours produced by salicylic and gallic acids and by hydrogen peroxide are imparted to wool when the latter is steeped in their hot solutions. The colour produced by hydrogen peroxide is supposed to be owing to a peroxide of titanium (TiO_2): it is destroyed after boiling some time.

Now with regard to the most suitable compound for the mordanting of wool, it is very obvious that solutions of the oxide in mineral acids could not be used without some addition to prevent the precipitation of meta-titanic oxide upon boiling. Oxalates, fluorides, and tartrates may be used for this purpose, and with all three I have been successful in the mordanting of wool. It is impossible for me to say, from the small number of mordanting experiments that I have made, what is the best material or the best proportion, or what are the best conditions generally, but I may say that so far I have met with most success in the use of the "tartrate." With the "oxalate" I found that the duration of heating and the temperature were most important things to attend to, and that, after heating for a certain time, the wool either lost the titanic oxide, or, what appears more likely, the latter became transformed into the meta or inert condition. Wool, when mordanted with the "oxalate," assumes a bright but pale yellow colour, and if taken out at this stage will dye up satisfactorily; if the heating be continued, the yellow colour disappears, and the wool will then give a poor result in the dye bath.

With the "tartrate" the wool may be boiled for an hour or two without this degenerative action taking place, at least to any serious degree, though I am inclined to think that even in this case there is a period of maximum efficiency and then a falling away. Wool mordanted with the "tartrate" mordant has a decided cream colour.

The question as to the best method of mordanting is, however, one that can only be settled by a long series of comparative experiments. The "tartrate" mordant that has been used for the patterns exhibited was prepared as follows:—

20 grms. of anhydrous titanium chloride were mixed with 80 grms. of cream of tartar and 50 c.c. of water. The mixture was then evaporated on the water-bath to a clear viscid residue, which, upon cooling, weighed 113 grms. From 20 to 25 grms. of this mordant were used for each 100 grms. of wool, and the mordanting bath was kept at the boil for about two hours. The dyeings were generally done with an addition of 3 c.c. of acetic per litre of dye bath.

The following is a list of colours thus obtained on wool:—

Alizarin gives a deep maroon.

Alizarin orange gives a bright scarlet.

Ceruleum gives a dark green, yellower than with a chromium mordant.

Alizarin blue gives a blue, redder than with a chromium mordant.

Logwood gives a deep black.

Tannic acid gives a deep yellow.

Salicylic acid gives a sulphur yellow.

All these colours except the last one withstand the action of dilute mineral acids and soaping. Even the logwood black and tannic acid yellow after soaking in dilute hydrochloric acid at $3^\circ Tw.$ for one hour, and then rinsed and soaped, suffered to a scarcely perceptible degree.

The behaviour of the mordanted cloth in the alizarin dye-bath is very remarkable; before the final maroon shade is developed, the cloth assumes a brilliant red colour, and if it is taken out at this stage and dried, it will be found to be nearly the same colour as that produced by alizarin orange. It is in this condition sensitive to acids, which turn it to a dull brown colour; washing and heating with water turn the brown colour to a maroon. The red colour withstands the action of the soap bath, and after this treatment it is much less sensitive to acids. When the red colour before soaping is heated with distilled water it gradually assumes a maroon shade. At first it occurred to me that this difference in colour was owing to a difference in ratio between the colouring matter and mordant, but dye tests made with varying amounts

of colouring matter and the same amount of mordant gave gradations in depth with little variation in tone.

With regard to the fastness of these colours to light, I may say that there has been no time to make thorough tests. Samples of the logwood black and tannin yellow have been exposed in a window facing the south from March 4th until the end of May and show no signs of fading. The colours which were dyed on cotton yarn and exposed in the Manchester Exhibition during the exceptionally sunny summer of 1887 showed no more tendency to fade than the corresponding colours on an alumina mordant, and the tannin yellow did not appear to suffer in the least, whereas the wood yellows were nearly bleached.

Oxide of zirconium, which comes next to titanium in the even series family of Group IV., has also an attraction for colouring matters, and when wool is boiled in a solution of zirconium sulphate it becomes mordanted with the oxide, and will yield with alizarin a colour very like the one produced on a chromium mordant. I have also prepared small pieces of cotton with a zirconium mordant, and obtained colours with alizarin and alizarin orange, the former yielding a reddish violet, and the latter a red.

Cerium does not appear capable of yielding a mordant to wool; when wool is boiled in a solution of a cerium salt, it will not take up any colour in the dye bath. I have produced colours on cotton with a cerium mordant, but they are quite worthless, being entirely destroyed by the weakest acid, and resembling in this respect the lakes produced by the alkaline earth metals.

DISCUSSION.

The CHAIRMAN said that these rare earths had not been much experimented with, and might turn out to be of importance. He suggested that if long-continued boiling deteriorated the mordanting, a better result might be obtained by "stuffing and saddening." He also remarked that the cloth had a somewhat harsh feel, and asked whether this was due to the mordanting.

Prof. J. J. HUMMEL remarked on the fact that oxalates, fluorides, and tartrates could be used as assistants, as in the case of the commoner mordants, and although the percentage of mordant used (25 per cent.) was rather large, it might prove possible to reduce it. The mordant seemed to be unique in being able to give such a brilliant colour as that produced with alizarin orange, and also one of such depth and fastness as that with logwood. The brilliancy of the colours with tannic and salicylic acids was certainly remarkable, and further experiments with titanium mordant in wool dyeing might be well worth carrying out. He pointed out that tannic acid might be considered as closely related to the yellow colouring matters, and the bright colour here given with tannic acid seemed to give distinct evidence of this relationship.

Mr. A. G. PERKIN suggested that the tannin might possibly be decomposed into gallic acid, which was known to give yellow colours with most mordants.

Mr. H. R. PROCTER inquired whether the tannin-yellow could be produced in the cold, as in that case it might probably find an application in leather-dyeing.

Mr. J. BARNES stated that cotton could be mordanted cold, and that probably this could be done with leather also. The attraction of the titanium mordant for tannia was so great that on boiling with tannin a sample of titanium-mordanted wool dyed with logwood, the logwood was partially discharged, its place being taken by tannin.

In reply to Mr. Rawson, he said that he had not tried the "stuffing and saddening" method. He had compared the fastness of titanium and chromium logwood blacks to acids, and found them nearly equal. Gallic acid produced a similar shade to tannin, but was not so fast. It could be dyed in a single bath, since no precipitate was formed by gallic acid with titanium, as was the case with tannin. He admitted that the titanium-mordanted cloth was somewhat harsh to the feel.

THE DYEING PROPERTIES OF CATECHIN AND CATECHU-TANNIC ACID.

BY J. J. HUMMEL AND REGINALD B. BROWN.

ANYONE who has studied the literature having reference to the application of catechu, must have been struck by the fact that very contradictory statements appear in text-books as to which of the two chief constituents of this dyestuff plays the more important part in the dyeing process. This uncertainty led us to make experiments on the subject, especially as we had at command a sufficient quantity of pure catechu, which had been prepared in the research laboratory of the dyeing department, by Mr. A. G. Perkin and Dr. Setzer. Moreover, a number of samples of various Indian cateches had been received for examination from the Imperial Institute, and it was thought that the investigation of the dyeing properties of these samples and of the constituents of catechu in their pure condition might suitably be undertaken at the same time.

The authors of many text-books appear to have derived their information from an earlier source, for we find the same statements couched in identical language in several works, while in no case are the actual experiments described on which the conclusions are based. All agree in describing catechu as containing (1) a colourless crystallisable body, insoluble in cold water, which is called catechin or catechuic acid; (2) a substance of the nature of tannin, perfectly soluble in cold water, and known as catechu-tannic, or mimotannic acid; and (3) other substances possessing a brown colour, and probably formed by the oxidation of one or both the preceding bodies, e.g., rubinic and japonic acids. Here agreement ends, and as regards the usefulness of these substances in dyeing, a variety of views are expressed. Kurrer (1848) states that the portion of catechu possessing dyeing properties is the catechin which, on oxidation, forms japonic acid, and that the catechu-tannic acid is without any influence on the production of the colour, since catechu from which all the catechu-tannic acid has been removed retains its dyeing properties unimpaired. The same statement, that catechin plays the chief part when catechu is employed in dyeing, is also made by Schützenberger (1867), Föl (1872), Crookes (1874), Singer (1875), and others. On the other hand, the claims of catechu-tannic acid to be the useful constituent for the dyer are upheld by Sacc (1861) and V. Joëlét (1879), while Napier (2nd Ed. 1875), Girardin, and Crace Calvert (1878) ascribe the dyeing properties of catechu to both constituents.

In view of these contradictions, we decided to make dyeing experiments with the pure substances, having regard only to the application of catechu in the dyeing of cotton. The crystallised and colourless catechin prepared in the research laboratory was considered to be absolutely pure, and the catechu-tannic acid employed, obtained from the firm of E. Merck, of Darmstadt, though not absolutely pure, having a pale yellowish-brown colour, seemed to be sufficiently pure for the present purpose. In the first instance we merely compared the dyeing properties of these two products with each other, and at the same time with those of commercial Gambier and "Bull-cuteh," as representing two widely different varieties of catechu. In the course of the experiments, however, further points of interest arose, notably the function of copper sulphate in the dyeing process.

In the ordinary method of dyeing catechu-brown on cotton, the material is steeped in a hot solution of catechu containing a small addition of copper sulphate, and subsequently allowed to remain in the bath as it cools. Without washing it is then treated in a boiling bath containing potassium bichromate, and for deep shades the dyeing and chroming operations are repeated. Our first experiments were carried out according to this process, and were conducted as follows:—0.5 gram. of each substance was dissolved in distilled water, and the solution, with or without the addition of copper sulphate, diluted to 50 c.c. In this solution a piece of cotton cloth $3\frac{1}{4} \times 2\frac{1}{4}$ in. in size, and weighing 0.5 grms., was boiled for one hour, and allowed to steep for one hour in the cooling liquor, then squeezed, and "saddened" in a bath containing 2 grms. $K_2Cr_2O_7$ per litre for 10 minutes at the boil. During these operations

the boiling liquors were maintained at a constant level. With half of each pattern the dyeing and saddening processes were repeated.

Experiment 1.—Catechin, catechu-tannic acid, Gambier and Bull-cutch were dyed simultaneously, according to the above method, with the addition of 0.05 gm. CuSO_4 to each solution. On comparing the results it was seen that the shades given by catechin and Gambier were similar, and much paler than those obtained from catechu-tannic acid and Bull-cutch, which were also similar to each other. The inferences to be drawn from this experiment are, (1), that both catechu-tannic acid and catechin possess dyeing properties, but the former to a much greater degree than the latter; (2), that Gambier behaves in dyeing exactly like catechin, while Bull-cutch behaves like catechu-tannic acid. The repetition of the dyeing and saddening operations very greatly increases the depth of colour; in fact, only in this way is it possible, according to our experiments, to obtain very full brown shades, an increase in the concentration of the cutch bath not sufficing for this purpose. It may be noted in passing that catechin dyed twice gives a very similar shade to catechu-tannic acid dyed once.

Experiment 2.—A repetition of Experiment 1 was made, omitting the addition of copper sulphate to the dye-baths. A similar comparative result was obtained, but all the shades were much lighter than in the first experiment. In this trial Bull-cutch dyed a deeper colour than an equal weight of catechu-tannic acid, and since it is of course impossible that the commercial product can be stronger in actual colouring power, so far as this is due to catechu-tannic acid, than the pure substance itself, this greater depth of shade might seem to be due to the presence in the cutch of small quantities of other colouring matters. The varying tones of brown obtained from different cutches might also be accounted for in this way. Having regard, however, to the fact that when dyeing with the addition of CuSO_4 (in Experiment 1), the depth of colour produced by catechu-tannic acid is slightly greater than that given by cutch, it is possible, and appears to us more probably correct, that the greater colouring power of the cutch in this experiment is due to its containing certain soluble-oxidation products intermediate between catechu-tannic acid and the insoluble brown colouring matter as fixed on the fibre.

It was noticed that catechin with copper sulphate produced a colour equal in depth to that given by catechu-tannic acid without this addition. It is therefore possible as suggested by Neubauer (1856) that under the oxidising influence of copper sulphate catechin is converted into catechu-tannic acid, and since the experiments show that the latter when dyed with the addition of copper sulphate yields a darker colour than without, it would appear as if catechu-tannic acid formed an intermediate product between catechin and the ultimate brown substance fixed upon the dyed cotton.

Experiments 3 to 6 were made with the object of ascertaining to what extent each step in the process contributes to the final depth of colour when dyeing with the pure colouring principles with and without copper sulphate. In each case one pattern was dyed for an hour at the boil, a second was allowed to cool in the bath, and with the third and fourth patterns the operations were repeated twice and thrice respectively. The patterns showed that the increase in depth due to steeping in the cooling liquor is very marked in the case of catechu-tannic acid but very slight with catechin; the latter is at once precipitated on cooling, and further absorption of it by the fibre is thus prevented. Catechin dyed without copper sulphate yields only a very pale brown, even after three times dyeing and saddening; after the first saddening the cotton has merely acquired a dull yellow tint, and it is possible that the colour resulting from repetition of the dyeing process may be due to catechin becoming partially changed in the dye-bath to catechu-tannic acid by atmospheric oxidation. In the case of catechin it is also noticed that the effect of chroming at each stage of the process is to make the colour much yellower and only very slightly deeper, the increased depth of colour due to repetition of the operations is therefore acquired during dyeing and not in the

saddening bath. With catechu-tannic acid the exact contrary is the case, an added dyeing operation merely makes the brown yellower in tone and very little fuller, while on saddening a great increase in depth results. It would seem therefore that the colouring matter in the form of catechu-tannic acid, which may provisionally be regarded as the more highly oxidised condition, is more sensitive to the further influence of oxidising agents, e.g., $\text{K}_2\text{Cr}_2\text{O}_7$, than when it is in the form of catechin.

It may be further noted that the results of these trials corroborate those of Experiments 1 and 2, the shades obtained by the use of catechin with the addition of copper sulphate, and catechu-tannic acid without this addition, are similar in depth, but the browns from catechin are redder before saddening and yellower after saddening than those from catechu-tannic acid.

Experiment 7.—Catechu-tannic acid and commercial Bull-cutch were dyed in the cold for periods of 1 and 16 hours without the addition of CuSO_4 ; it was here sought indeed to apply catechu-tannic acid to cotton under the conditions found most favourable in the case of tannic acid. On comparing the patterns with those of Experiment 2, which were dyed at the boil, it was seen that the shades differed little from each other. This result was by no means unlooked for, since in the absence of CuSO_4 one would naturally expect that only the soluble catechu-tannic acid would be utilised. By allowing the patterns to steep in the dye-bath overnight, instead of for one hour only, a slight increase in depth results, and here again it is possible that atmospheric oxygen during the prolonged operation acts like the copper sulphate of the ordinary process.

Experiment 8.—Patterns were dyed under exactly the same conditions as in Experiment 7, but with the addition of CuSO_4 to each dye-bath. Here no improvement is shown on prolonging the dyeing operation beyond one hour, all possible oxidation in the dye-bath being apparently effected by the CuSO_4 during the first hour. On comparing the dyed patterns with those obtained in Experiment 1, dyeing at the boil, very little difference in depth of colour was noticed in the case of catechu-tannic acid, but with Bull-cutch, which, of course, contains both catechin and catechu-tannic acid, the patterns dyed at the boil were considerably the deeper. This fact again indicates that in the presence of CuSO_4 both constituents of the cutch take part in the dyeing process.

Experiment 9.—It was thought possible that the greatly increased depth of colour caused by a repetition of the dyeing process was due to the attraction of further colouring matter by the chromic oxide fixed upon the cotton along with the colouring matter after once dyeing. In order to ascertain whether cotton mordanted with chromic oxide attracts the colouring matters of catechu, a piece of cotton was mordanted with chromium and divided into portions of the same size as those used in previous trials. These were dyed with catechin and catechu-tannic acid, and saddened with $\text{K}_2\text{Cr}_2\text{O}_7$; the colours obtained in this trial were in both cases considerably deeper than those dyed on unmordanted cotton; the explanation suggested may therefore be the true one. With regard to the use of mordants in conjunction with catechu, it was found that with aluminium mordants pure catechin dyes a dull light brown, and with iron mordants a more purplish brown, both colours becoming much yellower on subsequent treatment with $\text{K}_2\text{Cr}_2\text{O}_7$. Catechu-tannic acid yields with aluminium a brownish-yellow, with iron a dull light brown, and these shades are made much deeper by saddening with $\text{K}_2\text{Cr}_2\text{O}_7$, the former changing to a full red-brown, the latter to a yellowish-brown of medium depth.

There still remained to be considered the action of the copper sulphate in the dye-bath. If the idea is correct that it brings about the conversion of catechin into catechu-tannic acid, the question naturally arises: Is this change effected by virtue of the oxidising properties of copper sulphate, or is the presence of a metallic mordant in the dye-bath an essential feature of the operation? To solve this question, as far as it can be solved by dyeing experiments, it was necessary to dye with the addition of various substitutes for copper sulphate, some of which resembled this salt in containing a metal, others in possessing oxidising

properties, and to compare the patterns so dyed with those dyed without addition, and with the addition of copper sulphate. In choosing oxidising agents for this purpose, $K_2Cr_2O_7$ and ferric salts were necessarily excluded, since they precipitate catechin in the dye-bath. According to the result of the experiments, which were made with Gambier, the substitutes employed may be divided into three groups:

(1.) Substitutes which yield no useful result, the resulting colour being little or no deeper than when dyed without addition. In this group are comprised chrome alum, aluminium sulphate, zinc sulphate, sulphuric acid, and sodium carbonate.

(2.) Substitutes causing an increased depth of shade, but giving a duller and yellower shade of brown than that obtained with the use of copper sulphate. These additions were ferrous sulphate and potassium permanganate with sulphuric acid.

(3.) The colour is somewhat similar in depth and tone to that given by dyeing with the addition of copper sulphate. This was the case with hydrogen peroxide only.

We may therefore conclude from these results that copper sulphate is mainly useful on account of its oxidising properties, which, however, are not active enough under the conditions of the dye-bath to precipitate the solution. Non-oxidising metallic salts have little or no influence upon the shade, with the exception of ferrous sulphate, which resembles potassium permanganate in causing the production of a deep dull brown of a yellowish tone, a result probably due to a mordanting action of the iron and manganese respectively. Since, however, the pattern dyed with the addition of ferrous sulphate is lighter than the one obtained by the use of permanganate, the oxidising property of the latter is apparently not without influence on the depth of colour. The change in the dye-bath to which the increased depth is due is not brought about by either acid or alkali, and the only useful substitute for copper sulphate among those we have tried is peroxide of hydrogen, which, however, gives a shade somewhat lighter and redder in tone than is obtained by the use of copper sulphate. It has already been conjectured that in certain cases the oxygen of the air may act in the same way as the $CuSO_4$, although by reason of the slow action of the air the use of $CuSO_4$ could never be superseded in practice by atmospheric oxidation, at any rate, so far as dyeing with catechu is concerned.

A final experiment was now made to compare the effects of applying the copper sulphate and catechu *simultaneously* and *successively*, and for this purpose one piece of cotton was treated successively in separate baths with $CuSO_4$ and catechu, with a second pattern this order of operations was reversed, while two others were dyed at the same time with catechu alone, and catechu + $CuSO_4$ respectively; half of each pattern being afterwards saddened with $K_2Cr_2O_7$. On examining the patterns it was seen that the cotton treated with $CuSO_4$ and then with catechu was similar before and after saddening to that dyed without addition. As we expected, the preliminary boiling with $CuSO_4$ had no effect. On now comparing the results of applying the copper sulphate in the same bath as the catechu and subsequently to it, the former pattern was found to be much the deeper, and hence we conclude that the function of copper sulphate is to convert the colouring matter into some form in which it is most readily attracted by the cotton, and for this purpose it must be added to the actual dye-bath.

The conclusions to be drawn from our experiments may now be briefly summarised as follows:—In dyeing cotton with catechu the catechin and catechu-tannic acid both contribute to the production of the colour, the tinctorial power of catechu-tannic acid exceeding that of catechin. It is very probable that in the dye-bath catechin is converted into catechu-tannic acid by the action of $CuSO_4$, and it is therefore clear that a twofold oxidation is necessary, the addition to the dye-bath of a small quantity of some oxidising agent, e.g., $CuSO_4$, which does not cause precipitation of the colouring matter, and a subsequent oxidation in a separate bath with potassium bichromate. Having regard to these facts, our experiments show that the practical method of dyeing with catechu, viz., at the boil,

and with the addition of $CuSO_4$, is perfectly justified, for although the final product of the oxidation of catechin is the insoluble brown substance provisionally termed japonic acid, it does not appear that the oxidising action of the copper sulphate is energetic enough to produce this substance already in the dye-bath. Had this been the case, the use of copper sulphate in the dye-bath would have been injurious. The final and complete oxidation to insoluble japonic acid is reserved for the subsequent action of the bichromate of potash.

In examining the dyeing properties of the 29 samples of Indian catechu received from the Imperial Institute, it became evident that the differences observed in the dyed patterns corresponded to a certain extent to the differences shown by catechin and catechu-tannic acid in the foregoing experiments. The catechu samples were compared in the following manner:—10 grms. of each sample were extracted with water at $80-90^\circ C.$ for one hour, 1 gram. $CuSO_4$ added, and a piece of cotton cloth weighing 10 grms. entered into the bath. The above temperature was maintained with constant level for one hour, and the cotton allowed to cool for four hours in the liquor; at the end of this period one-third of the pattern was retained without further treatment, the remainder saddened for 10 minutes at the boil in a bath containing 2 grms. $K_2Cr_2O_7$ per litre. At this stage another portion of the pattern was retained, and the remaining third of the original piece was subjected to a repetition of the dyeing and saddening operations.

Judged according to their dyeing properties, the various samples of catechu examined naturally divide themselves into the following three groups:—

I. Cateches which, by the simple treatment of cotton in their decoctions at a high temperature, with the addition of copper sulphate, impart a more or less yellowish-brown and somewhat pale colour to the cotton, *not materially affected or darkened by subsequent boiling with bichromate of potash*, thus showing that little of the colouring principle of the catechu has been attracted by the cotton. If the two operations are repeated, these cateches give yellowish-brown possessing only a moderate depth of colour.

II. Cateches which in the first process stain the cotton a reddish- or orange-brown colour much fuller than that given by the members of Group I., and which by chroming are rendered distinctly redder and darker, an indication that the cotton has taken up a much larger quantity of the colouring principle than in the case of cateches belonging to Group I. By repeating the operations of "studding" and "saddening," the cateches of this group give a full rich reddish-brown dye much deeper than that given by the members of Group I. These cateches are apparently of the best quality for the purpose of cotton dyeing.

III. Cateches which in the first process give a comparatively pale yellowish-cinnamon colour, which is reddened by chroming. By repeating the operations of "studding" and "saddening" these cateches give reddish-browns, having little depth or body of colour.

On examination it would appear that the first group includes cateches Nos. 1-8 (see table below) all of which are of a somewhat pale brownish-grey internally, and show an earthy fracture. Nos. 9-12 may be reckoned as belonging to the same group, although they are dark brown in colour, show a lustrous fracture, and dye a somewhat redder shade of brown than the foregoing. From their appearance these cateches consist very largely of catechin.

The second group comprises Nos. 14-25, all of which are dark brown in colour, and have a lustrous fracture. These cateches being much more soluble in cold water than those of Group I., and giving darker colours, no doubt consist very largely of catechu-tannic acid. The third group includes the Gambier catechus, Nos. 26-28, which have a pale colour and earthy fracture, appearing to consist essentially of catechin.

In the table below, cateches Nos. 1-12 are arranged according to the shade given in dyeing cotton, No. 1 giving the yellowest brown, No. 12 the reddest shade.

Cateches Nos. 14-25 are arranged in order of depth of colour, No. 14 being the darkest and No. 25 the palest, though still a good colour.

Of cutches Nos. 26—28, the first mentioned gives the deepest colour.

Sample No. 13 gives only a grey stain and is evidently not catechu but, as stated on the label, an imitation, and appears to consist chiefly of mineral matter.

No. 29, which is not intended for dyeing, has similar properties to Nos. 26—28, but gives a much paler colour of comparatively little value.

For the purpose of comparison, cotton patterns were also dyed with the two following samples of catechu at present in the market:—

1. Bull-catechu.—This quality, which is said to represent the best in the market, has the form of large irregular blocks of a dark-brown colour and lustrous fracture.

2. Mangrove catechu.—This variety of catechu, which is probably derived from *Ceriops candolleana*, forms a very dark reddish-brown resinous mass, having considerable lustre, and being almost entirely soluble in cold water.

When dyeing with Bull-catechu the cotton is stained in the first operation a pale yellowish-brown, somewhat similar to that given by the members of Group I., but by chroming it became much darker and redder, behaving, therefore, like those of Group II. By repeating the staining and saddening operations a very full reddish-brown dye is obtained. The Mangrove catechu behaved during the dyeing

process very similarly to the Bull-catechu, the chief difference being that in the first operation the cotton is stained a very much redder shade than that given by any other catechu examined. These dyeing experiments show that the Bull and Mangrove catechus may be considered as belonging to Group II., indeed, they may be placed at the head of this class, since after twice dyeing they give much darker colours than any of the rest.

On comparing the results obtained from the various catechus with those given by catechin and catechu-tannic acid it was seen that those catechus which are brown in colour, lustrous, and more soluble in water behave in dyeing like catechu-tannic acid, while those which are paler in colour, with earthy fracture and less soluble, behave like catechin, of which they probably largely consist. Since catechu-tannic acid possesses greater colouring power than catechin, it is evident that the catechus which are more lustrous, more soluble, and richer in catechu-tannic acid are the most valuable for the purpose of dyeing cotton.

These notes must be regarded as a very partial inquiry into the application of catechu in dyeing, since we have entirely omitted any reference to the details connected with the use of potassium bichromate as the saddening agent, but this, and other points of interest concerning the use of catechu, we may possibly refer to in a future communication to this Society.

No.	Commercial Name.	Source.	Form.	Colour.	Fracture, &c.
1	Cuteh Extract	Forest Department, Bombay.	Small paste-like pieces, flat on one side.	Dull pinkish-fawn ...	Brittle, with dull earthy fracture showing numerous minute white spots.
2	Cuteh	Kanau, N.W.P.	Small irregular or rectangular blocks.	Inside, dull pinkish-fawn; outside, dark brown.	Tough, with earthy fracture showing laminated structure.
3	Cuteh, superior quality. "Swat Catechu."	Chamber of Commerce, Bombay.	Similar to No. 1	Similar to No. 1	Similar to No. 1, but showing fewer white spots or none.
4	Cuteh, Cawnpore catechu (superior quality).	Bombay	Similar to No. 2	Similar to No. 2	Similar to No. 2.
5	Catechu Extract ...	Surat, Bombay...	Similar to No. 1	Similar to No. 1	Similar to No. 1, but showing no white spots.
6	Cuteh, For. Janak-puri, No. 3.	Calcutta Market.	Small pieces, like coarse gravel.	Dark brown or fawn.	Lustrous fracture in dark portions; laminated structure.
7	Cuteh, For. Janak-puri, No. 2.	" "	Irregular lumps, as if portions of slabs.	Outside dark brown; inside paler.	Brown parts lustrous fracture, the pale portions earthy; laminated.
8	Cuteh, For. Janak-puri, No. 1.	" "	Similar to No. 7	Similar to No. 7	Similar to No. 7.
9	Cuteh, called Val Pegu (Salpatawala).	" "	Rectangular slabs 6 x 3 ins., wrapped in leaves.	Reddish-brown throughout, with here and there darker spots.	Fracture only slightly lustrous, showing minute air spaces.
10	Cuteh, Telengar, No. 1.	" "	Irregular lumps....	Outside light earthy brown; inside very dark brown.	Fracture lustrous, showing numerous air spaces.
11	Cuteh, For. Beluti Kalogazin.	" "	Rounded lumps, flat on one side.	Very dark brown, almost black.	Fracture irregularly dull and lustrous, showing here and there bits of lighter coloured vegetable matter.
12	Cuteh, called imitation soft Burmah. Cuteh, Salpatawala, No. 3.	" "	Similar to No. 11 ..	Similar to No. 11	Similar to No. 11.
13	Cuteh, Imitation Rajapore catechu.	Bombay	Somewhat similar to No. 11.	Dull earthy drab	Dull earthy fracture (evidently consists chiefly of mineral matter).
14	Cuteh (hard)	Iharawaddy Div., Pegu Circle, Burma.	Large irregular blocks wrapped in leaves.	Very dark brown	Brittle, lustrous, with numerous air spaces.
15	Cuteh (soft)	" "	Similar to No. 14	Similar to No. 14	Similar to No. 14.
16	Cuteh (black)	Minbu Div., Pegu Circle, Burma.	Large flat slabs wrapped in leaves.	" "	" "
17	Cuteh (soft)	Yaw Div., Pegu Circle, Burma.	Small pieces like coarse gravel.	Very dark brown	" "
18	Cuteh, called Pegu, No. 1.	Calcutta Market; imported from Burma.	Large flat slabs wrapped in leaves.	Dark brown	" "
19	Cuteh (yellow)	Pegu Circle, Burma	Small lumps, flat on one side, with leaf adhering.	Externally, light reddish-brown; internally, darker.	Very brittle. Lustrous fracture, somewhat porous.
20	Cuteh (yellow)	Minbu Div., Pegu Circle, Burma.	Small rectangular slabs wrapped in leaves.	Dark reddish-brown.	Brittle. Lustrous fracture, numerous air spaces.
21	Cuteh (red)	" "	Similar to No. 20 ...	Similar to No. 20	Similar to No. 20.
22	Cuteh (manufactured in iron pots).	Benghari, Barrang Div., Nampur, Assam.	Large slabs, wrapped in paper.	Dark reddish-brown.	Similar to No. 20, but without air spaces. Dense and compact in structure.
23	Cuteh (manufactured in brass pots).	" "	Similar to No. 22...	Similar to No. 22	Fracture earthy, except in the outer portions, which are darker in colour and lustrous; dense and compact in structure.

Note.—Nos. 1 to 25 are derived from the *Acacia Catechu*, and 26 to 29 from the *Uncaria Gambier*.

No.	Commercial Name.	Source.	Form.	Colour.	Fracture, &c.
24	Cutch (black).....	Pegu Circle, Burma	Small blunt cones wrapped in leaves, irregular lumps...	Very dark brown, almost black.	Fracture highly lustrous, with numerous air spaces; brittle.
25	Cutch (hard).....	Yaw Dye, Pegu Circle, Burma.	Irregular lumps...	Very dark brown....	Very brittle, fracture lustrous, very numerous air spaces; almost eindery.
26	Cube Gambier (No. 1 best form).	Singapore.....	Small cubes.....	Externally, pale brown; internally, buff.	Brittle, fracture earthy.
27	Cube Gambier (No. 2 best form).	".....	Similar to No. 26...	Similar to No. 26....	Similar to No. 26.
28	Block Gambier....	".....	Irregular lumps....	Outside, dark brown; inside, paler.	Fracture of outer portion of blocks, lustrous; of inner portion, earthy and powdery.
29	Gambier Papan (used for chewing).	Negri Sembilan..	Thin square cakes.	Externally pale brown, internally buff.	Very brittle, fracture earthy, showing brownish specks as if mixed with foreign matter.

Note.—Nos. 1 to 25 are derived from the *Acacia Catechu*, and 26 to 29 from the *Uncaria Gambier*.

DISCUSSION.

The Chairman, Mr. C. RAWSON, agreed with the authors that it was very hard to find definite information on this subject in books, and that the statements which were published conflicted. Some years ago he estimated the percentage of catechu-tannic acid in various samples of cutch, but found this no guide to their comparative value for dyeing purposes; this fact is evidently explained by the varying quantities of catechin and catechu-tannic acid contained in them. It was very difficult to compare cutch samples, owing to the different shades of brown given by different qualities. A further difficulty was, he had found, that in making dye-tests with certain samples of cutch the comparative value appeared to be different when different amounts of CuSO_4 were used. He would like to know if the authors had determined the amount of colouring matter in exhausted dye-baths by means of dyeing trials, and whether they had tried salts of vanadium in place of cupric sulphate; also whether copper and chromium were considered by the authors to form an integral part of the coloured body? It was well known that both oxide of copper and oxide of chromium were present in the dyed cotton. Had any experiments been made on wool dyeing with cutch? It had been suggested to use catechulin for wool dyeing and catechu-tannic acid for cotton dyeing, after separating the two by treating cutch with cold water.

Mr. T. FAIRLEY asked whether hydrogen peroxide was used in acid or in alkaline solution? Hydrogen peroxide would not act on certain substances except in presence of a third body; for example, if a solution of lead acetate were added to one of H_2O_2 and H_2S , lead sulphide was precipitated and immediately oxidised to PbSO_4 , showing that the H_2O_2 had no action on the H_2S prior to the addition of lead acetate. He asked also whether catechu might not be advantageously employed in wool dyeing to a greater extent than at present?

Mr. A. G. PERKIN said that in conjunction with Dr. Setzer he had been engaged for some time past upon an investigation of catechin. The results obtained by an examination of three samples of Gambier catechin and various specimens of *Acacia catechu*, which were among those experimented upon by Prof. Hummel and Mr. Brown, were that all these contained an identical catechin, melting at $171^\circ\text{--}172^\circ$ with decomposition. Schützenberger and Ruck (Bull. Soc. Chim. 4, 5) gave the melting point of catechin as 217° ; Etti (Monatshfte, 2, 547), 140° ; Gautier (Bull. Soc. Chim. 30, 568), $164^\circ\text{--}165^\circ$, and a second variety at $188^\circ\text{--}190^\circ$; and although those of low melting point were evidently impure specimens of that described above, the higher melting products were difficult to understand. The molecular weight of catechin appeared to be considerably lower than that usually given, and it was probably closely related to maclurin from old fustic, kinoïn from gum-kino, and cyanomaclurin which existed in jackwood. Results had been obtained by them, shortly to be described, which would give some insight into the constitution of catechin. He considered that the so-called japonic acid was probably distinct from katechuratin, and would like to know if any experiments with the dyed material had been made in this direction. Both catechu-tannic acid and katechuratin could be obtained from catechin without

apparent oxidation. Had the samples of mordanted cloth dyed with catechu been boiled for a long time? for by dyeing a short time he had obtained yellow shades somewhat resembling those given by kinoïn.

Prof. J. J. HUMMEL said that this paper had been brought forward in a somewhat immature condition, and that there were many other experiments which would have been performed had time permitted. Possibly the use of catechu in wool dyeing might be extended, but its use was limited by the facts that it made the wool harsh and prevented milling. The idea had occurred to him, before making the experiments just described, that the cutch might be separated into crude catechin and catechu-tannic acid in India, the former to be used by the colour manufacturer (since with certain azo compounds it yields useful colouring matters), and the catechu-tannic acid to be employed for dyeing. In consequence of these experiments he had abandoned the view which he formerly held, that the use of copper sulphate in the dye-bath was useless and irrational. It was further an interesting fact that the calico printer employed Gambier in preference to other varieties of catechu, although it was weaker in colouring power, the probable explanation being that gambier was of more definite strength and composition.

Mr. R. B. BROWN said that they hoped to make many of the experiments suggested by Mr. Rawson and others, and to embody them in a future paper. Hydrogen peroxide was used in neutral solution as a substitute for CuSO_4 . It had been frequently shown by analysis that cotton dyed with catechu contained both copper and chromium. Schlumberger held the opinion that the dye was a lake of chromium and oxidised catechu, while Heckmann considered that the chromium oxide was mechanically mixed with the oxidised brown substance. The cotton mordanted with aluminium and iron was dyed, like the other patterns, one hour at the boil and one hour cooling, and the shades were much browner than when dyed for a few minutes only.

THE HIDE-POWDER FILTER.

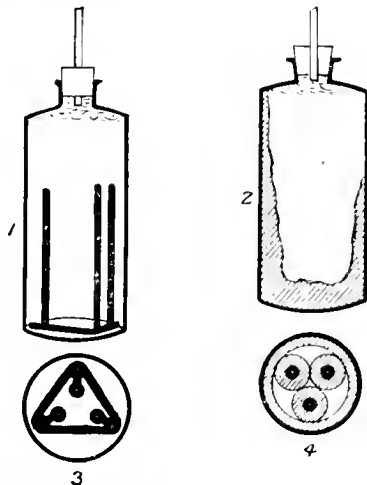
BY R. L. JENKS.

AFTER working for some time with the bottle form of hide-powder filter described by Mr. Procter in this Journal, April 1892, I have made a slight addition to the apparatus which it may interest other workers to make trial with. This still further diminishes the risk of loss of result caused by the tannin infusion creeping up the sides of the bottle instead of passing through the powder itself, and also economises the rather expensive hide powder. The improvement consists of a triangular tripod of small glass rod, which is made to fit inside the bottle. It is buried in the hide powder and acts as a conductor of the infusion up the middle of the filter.

The base fits the bottle loosely as an inscribed triangle, powder being pushed in between each point and the wall. The legs reach up about two-thirds of the distance to the shoulder of the bottle, but are so drawn in towards the centre as to divide the cross sectional area fairly equally into three parts. The infusion then travels up the glass legs as well as on the inside of the bottle, so that a cross section of the swollen plug of hide powder (easily expelled *en masse*)

from the bottle after use by blowing down the neck) exhibits three coloured rings in an outer zone. Some excellent patterns have been thus obtained. With 5 grms. of hide powder per 100 c.c. of infusion, containing 0.6—0.8 gm. of dry extract, the top half-inch or so is perfectly free from colour, showing that absorption is complete before reaching that point. About 1 gm. of powder is saved in each estimation, absorption is made regular, and the extra trouble involved is practically nil. For plugging the siphon tube I prefer glass wool to cotton wool.

The filter should be packed very lightly, and it is highly important that the liquor be added in small quantities, so that the powder is first moistened by capillarity, otherwise it is nearly sure to choke. Various other shapes of the "conductor" have been tried and considered (such as a spiral or helix, &c.), but the tripod pattern excels all others in strength, simplicity, and effectiveness.



1. Tripod in bottle.
2. Showing irregular creeping.
3. Plan of No. 1.
4. Cross section, showing regular absorption when tripod is used.

New York Section.

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The following have been elected to fill the vacancies, and will take office in July next:—*Chairman: Prof. C. F. Chandler. Committee: M. Alsborg, W. F. Fuerst, A. H. Mason, W. Jay Schnefflin, and R. C. Schupphaus.*

*Meeting held at the College of Pharmacy,
Monday, May 18th, 1896.*

MR. A. H. MASON IN THE CHAIR.

THE EDUCATION OF CHEMISTS.

BY C. DUISBERG, OF ELBERFELD.

I do not wish to leave America, replete with new impressions and experiences which I have gathered here in the

interest of my business, without expressing, be it in only a small way, my gratitude for the abundant hospitality which has been offered me.

Chemical industry in America is yet in its infancy. It has not reached that height which we observe in England, France, and, above all, in my own country, Germany. What is chiefly wanted here is the organic chemical industry which in Germany is so highly developed. The foundation, however, of coal-tar distillation products has been laid here in powerful inorganic industries, and the time cannot be far off when there will be American competition in the organic chemical field, as is already the case with the special organic products of wood-spirit, acetic acid, acetone, &c.

I regret that I am not in a position to give you to-day a special report on one of the technological industries of my own knowledge. Since, however, the first condition for the growth and development of each industry is the education of capable men, due development can only advance step by step if clever, well-educated chemists can be found; and since chemistry, as an international science, is not limited by frontiers, the chemical industry of America can obtain capable Germans and the German industry capable American chemists and engineers. I can, therefore, without damaging our interests or those of our country, explain to you, as representatives of the chemical industry of the United States, my experience in the education of chemists.

I have at my command extensive experience regarding the education of chemists in all branches, for I am technical manager of one of the largest chemical manufactories in Germany—The Farbenfabriken, vormals Friedr. Bayer and Co., of Elberfeld, or rather of Leverkusen, near Cologne, whither now the whole works are being transferred in order to reduce expenses and to reduce the costs of manufacturing. We not only try to make use of all the derivatives of the tar from wood and coal for the production of aniline and alizarin dyestuffs of all possible descriptions, and also of very diverse pharmaceutical products, such as phenacetin, sulphonal, trional, salicylic acid, somatose (a new alimentary product), saccharine, &c., but we produce also the inorganic products necessary for their manufacture, such as sulphuric, hydrochloric and nitric acids, chlorine, &c., and a large number of intermediate organic products.

In our works there are at present about 100 chemists having a university education and about 25 engineers who have been trained at a technical high school. They are recruited from almost all the universities and technical high schools of Germany, and the greater number have been engaged by me personally during the last 10 years.

As member of the Commission formed last year by the German Society of Applied Chemistry for the introduction of a States examination for German technical chemists, I have often had the opportunity to exchange views regarding the education of chemists with numerous professors of the German universities and high schools, and also with a great number of gentlemen interested in chemical industry. I had a statistical table drawn up concerning the present education of chemists employed in the German chemical manufactories; this will be found later on in this paper.

No industry is so closely allied to science as the chemical, in which, it is true, one can arrive, though at a snail's pace, at new results without the use of scientific means; but in which definite results can only be obtained when the practitioners thereof are in close relation with the science, or, better still, when they are authorities in the special field chosen for their labours. He who in technical chemistry relies, without scientific support, on empiricism, is like the blind, who gropes his way along known thoroughfares, but cannot advance on unknown roads, and even if he succeeds after innumerable difficulties, passes along without noticing the points of interest.

Chemical reactions cannot be compared to an engine, in which every action is shown by the movement of the wheels, in which any irregularity is immediately visible, and can be observed at once by the engineer. In technical chemistry the sharp eye of a scientifically trained man is wanted in order to recognise the individual developments of the re-

actions in progress, which will only be seen through the accompanying indications.

Technical chemists find even in simple chemical reactions most remarkable complications, the prevention of which can only be accomplished in a prompt and sure manner by a chemist who is intimately acquainted with all the details of his science. For instance, it is generally thought that the production of an azo-colour is technically the most simple thing imaginable. It is only necessary to mix a certain quantity of diazo compound with a certain quantity of an amine or phenol, and the formation of the azo dye at once takes place quantitatively. But this is far from being the case. Certainly, if the right components be mixed, a dyestuff can be obtained, but since the struggle for economic production demands that quantitative yields of pure products shall be produced, it requires the concentrated work of a research chemist to determine all of the conditions that bring about the combination. In this case, the manner and form of the diazo compound, the manner and quantity of the solvent, the temperature and rapidity with which the two bodies come together and become chemically combined, the purity of the two components, are of the greatest importance. In the colour industry, even at the present time, in the manufacture of the simplest colours, the most important results are matured by constant observation, experimenting, and control during the process of fabrication.

In the other branches of chemistry the same conditions prevail. As an instance I may cite the manufacture of sulphuric anhydride and of fuming sulphuric acid; for, although the method of producing the latter substance has been known for years, it has been possible by constant observation and experiment to perfect the manufacture, so that the formerly expensive product is now sold at a much lower price. Ten years ago it cost about 20 times as much as concentrated sulphuric acid, but now it is so cheap that a fuming sulphuric acid of high percentage can be made by mixing the weak acid with sulphuric anhydride.

It is scarcely necessary to point out that for such an industry the education of its operators is of the greatest importance.

Chemistry, as a science as well as an industry, is, like electro-technology, a child of the 19th century. Technical chemistry, with its powerful influence on public life, only dates from the middle of this century, and started on its course of victory much later. It is therefore clear that the proprietors of chemical works, the representatives of chemical industry, are often not convinced of the necessity of employing in their works thoroughly well trained men of general scientific education. The consequences will, however, teach that all those who occupy the old standpoint and allow their chemists only a consultative branch in their laboratories must go back, or at least remain on the same spot, whilst others, who give qualified chemists the responsibilities of practical management and take advantage of the above lessons, go forward. In no other field is the saying "inactivity is retrogression" so applicable as in that of chemistry, where constantly new inventions replace the older, and where not only technology but science progress so quickly. Not only technical chemistry, but the other fields of practical chemistry, such as the chemistry of foods and analytical chemistry, require the best chemically educated powers in order to solve all problems quickly and exactly. This is specially important in all legal difficulties when the opinion of a technical chemist—an expert—is required. In these cases the judge has to rely on what the expert places before him, because chemical science and practice is too special a subject for the lawyer to penetrate thoroughly into the points.

A nation that will not stand back in the race must therefore pay the greatest attention to the training of chemists. How many young men lose their way in this respect, and never reach the aim of their ambitions? If they had had the proper training, success probably would be assured, but they are often directed into the wrong path.

The question is, how is it possible, according to our present ideas, to complete the education of a chemist, apart from the special field which, later on, he may make his own—whether he will devote himself to a scientific

career, or whether he will become a technical expert or an "alimentary" chemist?

I share the opinion of the majority of university professors and manufacturers who properly understand chemical science: in the first place, a thorough schooling, a general all-embracing education, is required. The justifiable reproach often made against young chemists is that they are one-sided, and that before they have acquired sufficient general knowledge they devote themselves to a special branch. It is, of course, not impossible to become a capable chemist without going through the usual schools, as has been shown by numerous living examples. This was especially feasible in olden times, when our science was still in its infancy, but now it is different. The almost incomprehensible advance that chemistry has taken of late years, the necessity for the right understanding of the influence of other sciences, such as mathematics and physics, physiology, pharmacology, &c., which all contribute to the attainment of the best results, necessitate a larger, more general, and extensive preparatory education. When the youth, after having gone through the best schools, where he has acquired a knowledge in general education, such as mathematics, natural philosophy, languages, literature, &c., goes to the university, he commits a grave blunder if he devotes himself immediately to chemistry to the exclusion of other sciences. Even at this stage he must not omit to enlarge his knowledge in other fields. He must keep himself informed of the general scientific progress in other departments at the university. He must study theoretical and practical physics in order to learn to understand the principles of physical chemistry. To that he must add mineralogy and crystallography, so that he may succeed in mastering inorganic chemistry, and train himself to understand the relation of substances to space. He should also know the foundation of botany and zoology to be able to follow the developments of organic life. His principal occupation must, of course, be theoretical and practical chemistry.

Chemical technology demands from every practical chemist a perfect knowledge of analytical chemistry, because it produces the best results, and is even of the most importance in organic technical chemistry. The young chemist, therefore, must become perfect in quantitative and qualitative analysis, without neglecting practical chemical work, and prepare for the field of inorganic chemistry. Inorganic chemistry is, scientifically and technically, the foundation of the whole structure of applied chemistry, and if the foundation is weak the whole edifice will surely suffer.

When analytical chemistry has been mastered, and the student is at home in physics, mineralogy, &c., he can safely study organic chemistry. Here the centre of gravity is in preparation work. The organic chemical student must make himself acquainted with all important methods from one, or, better still, several classical examples, which he learns from the great chemical classics. Here the young chemist is often wrongly advised, for he allows himself to be tied down to a special field, in order to assist his professor scientifically, before he has acquired an exact knowledge of organic chemical methods. We organic experts, as is well known, put the greatest value on this point, that, after a student has learned chemistry, theoretically and practically, he shall acquire the ability to independently work in scientific fields, so that he may find the way in unknown or unexplored chemical fields. The teacher must at this stage assist; he must keep the student from going astray, and should not interfere by his own action with the independence of the student's work. This is the best preparation for his profession as a technical chemist, because, later on, he will have to rely upon himself in chemical research and its developments, and also principally in devising new technical methods and products. The chemist, however, should not work independently until he has mastered methods, and when he has done so he should proceed alone, or he will only imitate, and not originate.

In theoretical chemistry the chemist should be thoroughly acquainted with chemical reactions, which form the basis of analytical methods, so that he can meet all the difficulties of technical analysis. Although inorganic

analysis has been much perfected, it still leaves much to be desired in technical questions, and is remarkably deficient in organic chemical industry. The young chemist must therefore learn also to find new analytical methods for technical practice. But, above all, he should be thoroughly acquainted with the chemical reactions that take place in the operation of technical chemical industry. I am an enemy of specialisation at universities, in whatever direction; for the young chemist, when beginning to study, seldom knows to what branch he will finally devote himself. The special field almost always depends upon accidental circumstances. For that reason we do not wish that the chemical technologist be taught, as often is the case, that the smallest detail of the apparatus is taken into account, and all the tricks, so to speak, that are wanted in some technical work are explained. We only wish that chemical technological sciences explain to the student practical inorganic and organic syntheses, for which they are—as, for instance, colour-technology—remarkably well adapted. We wish, of course, that the technical chemist should be acquainted with the great processes, such as those of *Le Blanc*, *Solvay*, *Deacon*, *Weldon*, &c., but only in broad principles, not in details of apparatus. Nor should he neglect physical chemistry, especially electrical. In the laboratories of all universities the young chemist should find electro-chemical appliances, not in special apartments, but in different places in the general working room, so that every student may be in a position to produce inorganic and organic preparations by electro-chemistry. The young chemist must learn to handle electric currents and know the principles of electrolysis. He will thus be placed in a position, if his way should lead him in an electro-chemical direction, to easily master that science.

In Germany the chemist generally finishes his studies with his promotion, based on his performance of a chemical experimental research, and after passing a verbal examination in the general field of chemistry, and in physics and mineralogic or another related science. He then obtains the title of Doctor of Philosophy or of Doctor *Rerum Naturalium*. This examination can be passed in Germany only at the university, and not at the technical high schools. These also serve for the education of chemists, although in a more technical direction, and the students generally finish their studies by passing the so-called "diploma examination." The young chemist is now ready to go into practice wherever a suitable situation is offered, and it will be easy for him to perfect himself in any special branch by studying the literature on that subject. If, however, he should have the necessary means and should not be compelled to work for his livelihood, he would do well, although his university study has cost him from four to five years already, to become assistant at the laboratory of a high school. He will strengthen in that way the knowledge that has very often been superficially acquired for the examination, and, before all and above all, he will exercise himself in independent practical laboratory work, but under the superintendence of the professor.

In our works in Elberfeld and Leverkusen, in which, for our special object, we choose almost exclusively young chemists from the high schools, we always give the preference to those who, after passing their examination, have worked one or two years with one of the professors with whom we are associated. When such a chemist joins our service we do not expect—if, for instance, he should enter the department of colours—that he should even know what a colour is. We have found it most satisfactory if we ourselves introduce the young chemist to our special field. For that purpose every chemist must first pass through our experimental dye and print laboratory, so that he learns dyeing and printing and becomes aware of the requirements of the dyers' industry as regards dyeing properties and the fastness of colours. When the chemist has finished in this laboratory he is introduced to the scientific laboratory, the function of which is to keep us and our chemists informed of everything new that appears in the field of our manufactures in literature, patents, &c., and it is at the same time principally the laboratory of inventions. In this our scientific laboratory alone at the present time more than 20 chemists are occupied.

Here the young technical chemist must produce a few of the well-known dyestuffs of the greatest variety of groups. He must experiment with those colours of our competitors that we find in the market, and only then will he slowly and gradually be directed into one special branch of colour chemistry. This scientific laboratory, similar to the general staff of the army, serves at the same time to supply us with substitutes for the leading chemists for special departments in our works, where only such chemists are admitted who have shown their value in the scientific laboratory.

In the same manner as we form our chemists for the colour department, we do it for other departments in our works—inorganic, pharmaceutical, analytical, &c.

We do not expect from any of the chemists during the first year of their appointment striking results. It will be satisfactory if he perfects himself as much as possible in the branch that has been allotted to him, and tries to master it. Capable, generally educated, active, and especially energetic men become almost always in the course of their first contract productive, and give the service that is expected from them.

I hear it said, however, that chemical industry works with numerous machines and apparatus. Innovations and improvements, especially in the field of inorganic industry, have been produced only by alterations and new constructions of furnaces and machinery. Is it not right, therefore, that the chemist, especially the leader of a department, should be educated in construction, in the knowledge of the machinery? Should he not be able to make drawings, and be capable, the same as an engineer, to construct the apparatus for his purpose? In many branches of chemical industry the knowledge of machinery may be necessary for the practical chemist, especially when the works are small and there are no engineers. In opposition to many of my friends I place myself, however, on the standpoint—although I myself have acquired this branch of technical knowledge—that the chemist does not require it as a necessity. Nothing, in my opinion, is worse than to make of a chemist an *ingenieur-chimiste*, as is done in France, or chemical engineer, as is very often done in England. The field of chemistry which the chemist has to master is at the present so enormous that it is practically impossible for him to study at the same time mechanics, which is the special field of the engineer. Division of labour is here absolutely necessary. I leave to the engineer and to the chemist their respective sciences, but I desire that both work together. I deny decidedly that any one person can master at present all necessary sciences and combine them in himself. The chemical engineer has some knowledge of both sciences, but his knowledge of neither is complete. That at least is my opinion and my impression. I also state that a thoroughly well trained chemist who has never heard of even the elements of mechanics, can find his way nevertheless very easily among the apparatus of chemical industry, most of which are simple, if he should be compelled to look after that part of his department. I personally prefer in questions of technical mechanics one capable engineer to a dozen chemists with a knowledge of mechanics. He, however, who places extra value on the knowledge of machines, and desires that his chemist should be instructed in this part, should not be too exacting in that direction, but be satisfied with a knowledge of the elements of this science, and take chemists that, as is the case with us in Germany, have been educated, not at the university, where those branches are not taught, but at technical high schools, where they must be learnt during the first years.

In order to see now whether those who conduct the chemical industry agree generally with the principles here laid down regarding the education of chemists, namely, that the knowledge of mechanics and construction is not required, I have issued statistical inquiries to 83 of the more important chemical works in Germany, in which more than one chemist is occupied, with the following results:—

Of 633 chemists, who find occupation in these 83 works (amongst which are 13 inorganic industries, 14 which manufacture organic intermediate products, 10 wood- and coal-tar distilleries, and 9 tin-colour works, as also 10 works for the manufacture of pharmaceutical products and 1

perfumes), there were 70 per cent. that had passed their examination at a higher German school—the gymnasium or other preparatory school, 45 per cent. that had received their education exclusively at the university, 17 per cent. exclusively at a technical high school, 35 per cent. both at the university and at the technical high school; so that when we divide the two last into equal parts, 65 per cent. had studied at universities and 35 per cent. at technical high schools. Of all these chemists, 68 per cent. had graduated as doctors of philosophy, and only 15 per cent. had passed the diploma examination of the technical high schools, whilst 15 per cent. had passed no examination whatever.

With reference to the different industrial branches, I found that the metal industries, the inorganic industries, the coal-tar distilleries, and the blasting-powder works, place those chemists who had been educated exclusively at the technical high schools on the same level as university chemists, but do not, as has been often thought, prefer them.

The other works, especially those that produce inorganic and organic products, the tar-colours, the pharmaceutical and perfumery works, seem, on the contrary, to prefer the university chemists, who know nothing about mechanics.

I am not sufficiently acquainted with the conditions of the United States to judge, but I am firmly convinced that the requirements I have described for the education of chemists in Germany are also applicable, and perhaps still more so than with us, considering that there the principle of division of labour is more accentuated, and where also chemical industry is beginning to develop itself in various ways.

In so highly developed an industry as modern technical chemistry is now in Germany, in which at present chemists, physical experts, physiologists, physicians, apothecaries, engineers, architects, and even jurists—as, for instance, in our works in Elberfeld—are combined, one can only expect good results by reasonable division of labour and concerted action when all concerned are first-rate powers; when, above all, the chemists, who of course form the majority, are energetic, active men; when everyone in his special branch is an authority. This applies not only to Germany, but must apply equally to all other competing countries.

Chemists who have to spend from five to six years in their education naturally ask high salaries, but it will be found that the capital so invested will produce good interest.

Although our great master and poet Goethe says:—"All theories are grey, but the golden tree of life is green," it is necessary in chemical industry that all who take part in it should study both theory and practice. The search after the philosopher's stone, which occupies the modern chemists now just as much as in the times of our forefathers, the alchemists—with this difference, however, that the definition of what is meant by the philosopher's stone has been altered,—is in the present time scarcely possible by empiricism. Only he will find this philosopher's stone who provides for himself and his co-operators the highest qualifications in general and special, theoretical and practical education—activity and energy.

DISCUSSION.

The CHAIRMAN said the meeting was indebted to Dr. Duisberg for telling them in forcible language the secret of Germany's success in chemical industries. In some countries better provision was now being made for that education which alone can bring about these results.

Dr. SCHIEFFELIN said he had experience for three semesters in a German university studying chemistry, and could testify to the tremendous importance which was attached to thoroughness in chemical work as a preparative for entrance into technology. The mere fact that the larger manufacturers of coal-tar colours employed as many as 100 doctors (graduates of the university were all doctors, which meant that they had studied at least two or three years longer than the graduates of American colleges) was convincing. A man in America who got the degree of Bachelor of Philosophy from the Columbia School of Mines, or from Yale, the Sheffield Scientific School, or from any of the numerous and excellent schools of techno-

logy, was about two years behind the man who had really earned his degree of Doctor in the Germany university; and, as Dr. Duisberg had pointed out, after they had obtained this degree they were expected to work two or three years as assistants in the laboratories of the technical high schools. Nearly every important city had a technical high school, which corresponded pretty closely to schools of technology, such as were found in Hoboken, the Stevens Institute, the School of Mines, the Troy Polytechnic, and the Massachusetts Institute of Technology, &c. There were also a number in the West. These young men went as assistants to the professors in these schools of technology, and learnt practically a great deal about making reagents and directing the students how to study elementary chemistry there; and he supposed it was evident that a man learned a great deal more by teaching another than in superficially learning to recite to another. Prof. Chandler told him that in the new laboratory in Columbia College (about to be built by the generosity of the Havemeyers) there would be arrangements whereby all the students would prepare their own reagents, so that they would have some technical and practical education as well as theoretical. When he (Dr. Schieffelin) was in the School of Mines, from 1883 to 1887, reagents were made by the laboratory servants, under the direction of the assistants and professors in the private laboratory, and students did not really know very much except what could be picked up, yet they were supposed to know theoretically how to prepare them. But the boys who went there in the next few years would learn a great deal more than he did, and it was a very significant and pleasant fact that the American schools were overtaking the foreign ones in this respect, and he was sure that the necessity of thorough education in chemistry was being more and more appreciated by all of our manufacturers here. He thought that the testimony of them all would be that they saw the value of employing the most highly educated men in chemistry they could get. It was only to-day he cut out from the *New York Times* about a third of a column testifying to the value of the investment of chemical research for the purpose of showing it to his partners, in order to persuade them that some of the outlays, which are theoretical, that were being made at our laboratory (for electrolytic application) are really very good investments for the future. If one bought machinery purely for experimental purposes, it seemed to the men with old-fashioned ideas as rather extravagant; but it was not extravagant in the end, for in a few years not only would the interest on the investment be saved, but the whole cost.

Prof. COBLENTZ said this paper of Dr. Duisberg's impressed him very much, coming from such an authority, who had had experience in selecting and training so many chemists at such a large factory. It must be acknowledged that the Germans were exceedingly thorough; that before they took up any speciality in chemistry, the chemists got a foundation in all the allied branches; but the difficulty that Americans laboured under, in his experience so far as it goes in teaching, was that if Americans wanted to be chemists, they wanted to be so quickly, and they did not want to bother about learning the theory of chemistry. They would even go to work and take young men before they have passed out of the schools, and say, "I want a chemist made of my son." The young man was sent into a college, which harried him through, and he came out an analytical, an organic chemist, able to get on fairly well in that one speciality, but always labouring under the disadvantage of inadequate training; and Americans would never be able to compare with Europe until the requirements of the institutions were stricter. Another point that struck him as true, and which came within his own experience, was that German professors had their own hobbies, and liked to get the students on these hobbies as soon as possible. He was often taken from the preparation of organic compounds and set to work on one of these hobbies, and never knew what he was doing or in what direction he was tending, but he had to work on that hobby nevertheless. He thought that one disadvantage some of their German brethren laboured under was that students often had to work on these hobbies without being allowed

to complete their necessary preliminary educational training in that line. On the whole, this paper was a valuable contribution to their knowledge, and he thought the schools throughout the country should apply this lesson, and have students thoroughly trained in theoretical education in all necessary branches, and then let them take up specialties.

Dr. ECCLES was reminded of a speech of a professor in England not long ago, in which he pointed out one important feature of the difference between England and Germany. The professor said an Englishman first discovered the aniline dyes in England. The Germans had built upon the foundation laid by England, and had beaten England in their own field. Inquiry into the cause of this resulted in the declaration that it was the thoroughness with which Germany was educating its chemists. Dr. Duisberg's paper forcibly reminded him that the general tenor of educationalists throughout America to-day was in the same direction. They insisted upon students in every field being thoroughly posted in the fields undertaken by them. They pointed out the fact that it was habit that made the man; that if a habit of careful thorough work was established in him, he would not break away from it. Slovenliness of thought or manipulation once established becomes habitual and detrimental. The strength of a chain was gauged by that of its weakest link. So with mental links. When strain was put upon the student the weakest point of his education was that which determined his success. If he had been well trained and had paid due regard he would become a true chemist, if chemistry was the lot he had chosen.

There was, however, a danger to be considered lest the field should be made too wide and the thoroughness too intense in everything in which they wanted to train them. One consequence would be that before the foundation was laid manhood would have come, and possibly old age, and before the structure was erected their opportunity might have passed. That might be avoided by limiting the amount of preliminary study in such a way that the things studied should be preparatory to those likely to be required in the future. The Doctor emphasised this in his paper. The simple lesson was that all could take in chemistry by this method of division of labour. This was the lesson of the future for the teacher. A century or more ago every professor was expected to be a professor of astronomy, physics, languages, mathematics, of everything. He was supposed to fill the whole field of science and know it all. That had passed away. They now left out things that were no longer necessary for study, and the consequence would be that in these new fields they would have to do precisely as with the sciences: find what could be discarded. It was just as necessary to do this as to be thorough in what they undertook.

Dr. McKENNA said all felt the need of more thoroughness in their educational methods, and the paper and subsequent remarks that thoroughness must begin lower down was a most useful warning to educators. The fact that their science was so beautiful, its principles so broad, so all-embracing in their nature, proved the necessity for "broad" study in preparation; studies of languages, literature, the "humanities" as they were called, and students who had spent sufficient time at this "broadening" study would certainly absorb the so-called strictly scientific knowledge with greater ease and produce better men. He agreed with Dr. Coblenz about the great hurry in which characterised the American student. That perhaps was the greatest fault with the young men, an overweening desire to rapidly get over the ground, to reach success very early, but without due preparation success would be deferred.

Mr. KENT thought they had scarcely made the most of chemical industry. Their industries had so far been in the cruder materials. They had taken the agricultural, the soil, the forest, the mines in their primeval conditions, and had hardly been prepared to establish chemical industries. That was one phase of the case, another was the commercial conditions met with, such as the tariff. That alone had been an obstacle, in his opinion, in chemical industry, also the expense of labour. Labour was expensive, and the man pursuing chemical industry needed the assistance; that and the development of literature and of our institutions, the classes, however, advanced had then energies

occupied in laying the foundations, in getting in materials to work with, and they had scarcely time to give to chemical industry the attention which the subject demanded.

Dr. HORN observed that one point which struck him very forcibly was the generosity of spirit displayed by Dr. Duisberg and the Company in taking the trouble to complete the education of these young men whom he was testing, so to speak, and it was an example which might be followed very advantageously by those employing chemists, to teach not only those, but the workmen, the reasons for the work which they do. A number of striking instances of this were brought to his notice, where it might have redounded to the advantage of the employer if he had been careful to be somewhat generous in the instruction of his workmen as well as of his chemists. He thought also that the younger teachers who have not always had the advantage of instructing the graduated chemist, or the advantage of so many men in their employ, should do all that possibly can be to encourage those who work in our laboratories to follow out the studies that pertain to their daily work. He had found always that even the youngest boys in the laboratories, who do the most elementary work, were generally enthusiastic, and if once pointed out they very quickly profit by the instruction. A case came to his notice not long since of a man in a sugar refinery who let a large tank of sugar solution become quite acid through fermentation, and on asking him why he had not put lime in it, he replied that "he knew they put lime in the tanks up stairs when they got acid, but he did not know they put it in down there." It had never been explained to that man that the lime was put in to counteract the progress of the fermentation. Workmen are not instructed why certain things are done, when very frequently no possible harm would result from such instruction. Dr. Duisberg had given good examples of the good results which flow from a generous view of this matter.

Dr. PROCHAZKA fully endorsed the policy of Dr. Duisberg, though the adherence to such policy had not been emphasised in that country, because no chemical works of that magnitude existed. Personally he was engaged in a kindred industry, and in engaging a new chemist his policy was the same. He cared far less for what the chemist claimed to know in the particular industry than for his possibilities.

Mr. PLATT said the best testimony to the value of Dr. Duisberg's paper was the fact that it struck everyone present differently. He was not a scientific man, but an employer of labour, skilled and unskilled; he agreed that they did not make enough of their chemists. It had been his aim to obviate the misapplication of the chemist's possibilities; and because a man was scientific and had a university degree it was no reason why he could not be a practical business man also. They had good evidence of that in Dr. Duisberg himself.

The CHAIRMAN: Dr. Duisberg referred to the possibilities of the chemical industries of this country in the future. One of the great advantages which America had to-day was that it could begin where Germany now stood; but it was necessary to have the institutions of education to enable them to do the work, so that if some of the merchant princes could have been present to hear this address they would have seen that to be generous in this matter would be a good investment for the welfare of the country and therefore for themselves. One of the charms of this paper to him had been the strong point the author made of their having no secrets among the employes in Elberfeld. Now if they went into any chemical works in other parts of the world they would find there were some departments to which they could not gain entrance, and in days gone by they were told that certain secrets had died with certain men. Now in Elberfeld they heard there was nothing of that kind.

One would like to ask Dr. Duisberg how much it costs in Germany to obtain this education? What fees had a man to pay before he becomes a doctor of science, and also what inducement there was for him afterwards in the way of salary, besides the possibilities of glory that might arise from original research; and to ask this because they found so many German chemists coming to America. It might

be a great advantage to have them, that they might carry on the work which they left behind in Germany in branch establishments in America, when the time for such development arrived.

Dr. DIETBERG said he never heard a discussion in English before. He was very interested in hearing the different points on education in America, and was very surprised to hear, especially from Prof. Coblentz (and it seemed to him the principal point), that young chemists hurry in learning chemistry. They in Germany had no difficulties in quite the same manner. He had stated in a German paper that when about 17 years ago he went to the university, he had to work in organic chemistry even the second semester; then he preferred to go to another university, and six semesters afterwards (three years) he took his degree. He did not enter in the technical department, but went to Munich and Strasburg and studied further, and only after finishing the theoretical systems perfectly he went into technical chemistry. American students appeared to be anxious to become perfect chemists quickly and to get money. It was the opposite in Germany. There were a great many chemists, and not three, but perhaps five, six, seven years were necessary to perfect the students and enable them to become doctors now. But their educational system was still being perfected, and the aim would be that no student should be allowed to study chemistry until he had passed an examination in the school to show his general education; and even then he would not be allowed to go from the university to take a degree until he had accomplished some original research, which was the point of greatest importance. Dr. Horne was right in telling them that German works trained their chemists themselves; that was the best way, they thought, and they had to do it, not only with young chemists, but with occasionally older ones. It was necessary, because every man when he had to do technical work became tired. He had to work from morning till evening, when his domestic duties claimed his attention, and it was impossible for him to read novelties in patents, in literature, &c. Therefore all these novelties were brought to the chemists in the works. There was every two weeks an assembly of all the chemists of the works, where the chemists of the scientific laboratory and special departments had to tell the other chemists what they had read in their several branches, what they had found in common, and in this way they were enabled to give perhaps in three or four hours a perfect review of every new thing that had happened in the fortnight.

In answer to the question, how long they spent in training a young chemist, he had already stated that it was perhaps one year. They did not educate the chemist, but he had to educate himself by working in the laboratory necessary for his branch. They did not expect success the first year, but they got success in following years. A student in Germany had to study, say, five to six years now, and the cost of this was perhaps 10,000 to 15,000 marks, for which a student could educate himself in the university, and live very well. 10,000 to 15,000 marks was necessary because the study of chemistry was not very cheap. Large sums for experimental work, fees for the lectures, &c. had to be spent.

The point which he understood Mr. Plant to make was that Americans did not place sufficient confidence in their chemists. That was a very bad feature. Earlier, in Germany especially, the foremen of the works occupied the first place, and the chemists the second. The chemists had to work in the laboratory, and the foremen and workmen had to manufacture the colours; but that was now changed. Now the foremen had nothing to say about chemistry work and manufacturing colours. The chemist alone had to decide in all these cases, and that was of the greatest importance.

But if their Chairman told them that there were many secrets in other countries and that there were no secrets in the works in Germany, he was entirely mistaken. There were a great many secrets in German works, but in the circle of the factory there were only a small number. Still, no person was allowed to tell the secrets he knew and heard. He had to keep them to himself. Naturally in the

special departments of the works there were secrets which were known to special chemists, because in some ways it was necessary—when impossible to protect a process by patent—to keep it secret.

Dr. SCHIEFFELIN desired, before closing the discussion, to refer to the Chairman's remarks upon the necessity of endowments for research in chemistry in America. It would be ungrateful to the late Peter Cooper if he did not testify to the value and great importance of the Cooper Institute in New York. Some of the best men in his factory, when they were boys and young men, and up to within a few years, and on showing interest in chemistry, were advised to attend the night school in chemistry for three years in Cooper Union. His firm were very glad to pay the slight expense of 15 dols. or 20 dols. for apparatus (the tuition being free), and they got a most excellent foundation in chemistry,—as good as a great many graduates of the technical schools, chiefly because they had an interest in the work. That led him to point out that the graduates of the German universities were on a rather different footing from the graduates of American technical schools. The great number of students in the German universities who studied chemistry never graduated and never got the degree of Doctor. They went out and had a good time, and did not work in the laboratory or take trouble to experiment, and as they did not try they did not get their degree. The men who did graduate in America had a pretty thorough foundation. For instance, the class of 1887 of the School of Mines were 95 freshmen; of that number only 33 graduated, but the class that graduated numbered 45 because they had some 12 who had fallen from the class above into that class. And so in Germany the weeding-out process went on, and probably only those of best ability went into the colour works; and as for secrets, he had always understood that workers at neighbouring desks did not even know what their neighbours were working at. They were partitioned off. Probably in the happy family of the works, they were told about it. As for Peter Cooper and his work they could not be too thankful for New York having such an institution.

ON THE ANALYSIS OF WHITE PAINTS.

BY G. W. THOMPSON.

THERE are upon the market, as is well known, numerous brands of white paint, ground stiff in oil, and sold as "strictly pure white lead," which are mixtures of various materials, more or less inferior to, and selling at prices much below pure white lead. The analysis of these mixed paints is not ordinarily considered difficult, and with certain mixtures this is true; but there are mixtures on the market on which chemists have obtained very materially divergent results. To speak of these peculiar mixtures was our primary intention, but on further thought we have considered it advisable to take up the whole subject of mixed white paints. It is not our purpose to consider the examination of the oil, or the vehicle in such paints, but only the pigment or solid constituents. The solid proximate constituents used are as follows:—White lead, so called sublimed white lead, consisting of varying proportions of lead sulphate, lead oxide, and zinc oxide, lead sulphate, zinc oxide, barytes, sulphate of lime, carbonate of lime, china clay, silica, sulphide of zinc, sulphite of lead.

There may be other constituents used in this class of paints, but so far as we know, the above list is practically complete. The steps in their analysis are as follows:—

- 1st. Extraction of oil.
- 2nd. Preparation of extracted sample for analysis.
- 3rd. Qualitative examination.
- 4th. Ultimate quantitative analysis, showing elements present.
- 5th. Proximate quantitative analysis, showing the forms in which these elements are combined.

The extraction of the oil may be performed by using any solvent for oil, which is completely volatile at 212° F. We prefer to use C.P. benzol, as it may all be distilled off, and nearly all recovered, and because its solvent action is superior to that of turpentine, benzene, or petroleum ether. We perform the extraction by treating about 20 grms. of

the paint in a small beaker, decanting four times. In the presence of much zinc oxide, a small and insignificant portion of this substance will fail to settle, and will be carried over with the solvent. The extracted paint is dried at 212° F.

The dry paint so obtained is ground in a porcelain mortar, and passed through a 50-mesh screen so as to obtain a uniform sample from which to weigh out.

The qualitative examination for the elements present may be performed as follows:—Effervescence with concentrated hydrochloric acid indicates carbonic acid, sulphuretted hydrogen if zinc sulphide be present, or sulphurous acid if lead sulphide be present. These latter two may be recognised by their odours. Boil a portion of the paint with a solution of acid ammonium acetate, filter, and test portion of filtrate for sulphuric acid with barium chloride. Test another portion of the same solution with sulphuric acid in excess for lead, and if precipitate of lead sulphate be obtained, filter off, and test filtrate for zinc by making alkaline with ammonia, and adding ammonium sulphide. Test another portion of ammonium acetate solution for lime by making alkaline with ammonia, adding ammonium sulphide, filtering, and adding ammonium oxalate to filtrate. The portion insoluble in ammonium acetate, in the absence of sulphide of zinc and sulphate of lead, may be barytes, china clay, or silica. The qualitative examination of this residue is best combined with quantitative examination given further on.

The oxides and elements the presence of which is usually possible in a white paint are:—Carbonic acid, water (combined), sulphuric acid, sulphurous acid, sulphur (combined as sulphide), silica, barium oxide, calcium oxide, zinc oxide, and zinc combined as sulphide, lead oxide, aluminium oxide.

The actual determination of these constituents is not in all cases necessary, and many short steps may be taken; thus, in the absence of sulphuric acid, the lead soluble in acetic acid may be directly calculated to white lead. We think it best, however, to give here suggestions for the determination of the separate constituents given above. We would determine carbonic acid by any accurate absorption method. Water cannot be determined accurately in samples from which the oil has been extracted, as a small amount of organic matter will remain which vitiates the results. In the absence of sulphites and sulphides, it may be approximately determined by obtaining the loss on ignition, and deducting the carbonic acid from it; the remainder is water, but the results so obtained are always high. In some cases it may become necessary to take the water by difference. The method of obtaining the water by absorption, used by some, is inaccurate because of the empyreumatic substances given off on heating and absorbed with the water. Sulphuric acid may exist in two conditions, in one it is soluble in ammonium acetate and in the other, as in barytes, it is insoluble in ammonium acetate. That soluble in ammonium acetate may be determined by precipitating with barium chloride in that solution. Sulphuric acid in barytes is best calculated from the barium present determined as described later. Sulphurous acid may be determined by oxidation to sulphuric acid, or its determination may be based on the insolubility of lead sulphite in ammonium acetate. For instance, one portion of the sample is oxidised with nitric acid and the total lead determined. Another portion is treated directly with ammonium acetate and the lead soluble in that menstruum determined. The difference between the two determinations is the lead present as sulphite, from which we may calculate the sulphurous acid present. Sulphur as sulphide is always present as zinc sulphide, which is never used in the presence of lead compounds. It may be determined by oxidation with bromine water and precipitation with barium chloride, or by determining the zinc insoluble in ammonium acetate. Silica may be determined by treating matter insoluble in ammonium acetate with hydrofluoric acid and sulphuric acids. The loss on ignition is silica, or it may be determined by fusing the residue in the regular way. Barium oxide is determined by precipitation with sulphuric acid from hydrochloric acid solution of that part of fused residue insoluble in water. Calcium oxide by precipitating in alkaline or acetic acid solutions with ammonium oxalate,

weighing as oxide or sulphate. Zinc oxide is precipitated as carbonate in the usual way. To secure a uniformly fine granular precipitate, we have found it useful to finish the precipitation with bicarbonate of soda, and then boiling to expel excess of carbonic acid. Lead may be determined as chromate in acetic acid solution by precipitating with bichromate of potash and weighing in Gooch crucible. Alumina from fusion of insoluble residue is determined in the usual manner. Schemes for the separation of these constituents from each other and into their proximate combinations depends on the constituents present, and we can treat this subject in no better way than by taking typical cases, which we now do.

Sample 1 is a mixture of barytes, white lead, and zinc oxide.

Two 1-grm. portions are weighed out. One is dissolved in acetic acid and filtered, the insoluble matter ignited and weighed as barytes, the lead in the soluble portion precipitated with bichromate of potash, weighed in Gooch crucible as chromate, and calculated to white lead.

The other portion is dissolved in dilute nitric acid, sulphuric acid added in excess, evaporation carried to fumes, water added, the zinc sulphate solution filtered from barytes and lead sulphate and precipitated directly as carbonate, filtered, ignited, and weighed as oxide.

Sample 2 is a mixture of barytes and so-called sublimed white lead.

Weigh out three 1-grm. portions. In one determine zinc oxide as in case 1. Treat a second portion with boiling acetic acid, filter, determine lead in filtrate, and calculate to lead oxide. Treat third portion by boiling with ammonium acetate, filter, ignite, and weigh residue as barytes, determine total lead in filtrate, deduct from it the lead as oxide, and calculate the remainder to sulphate. Sublimed lead contains no hydrate of lead, and its relative whiteness is probably due to the oxide of lead being combined with the sulphate as basic sulphate. Its analysis should be reported in terms of sulphate of lead, oxide of lead, and oxide of zinc.

Sample 3 is a mixture of barytes, sublimed lead, and white lead.

Determine barytes, zinc oxide, lead soluble in acetic acid and in ammonium acetate, as in case 2; also determine carbonic acid, which calculate to white lead, deduct lead in white lead from the lead soluble in acetic acid, and calculate the remainder to lead oxide.

Sample 4 is a mixture of barytes, white lead, and carbonate of lime.

Determine barytes and lead soluble in acetic acid (white lead) as in case 1. In filtrate from lead chromate precipitate lime as oxalate, weigh as sulphate, and calculate to carbonate. Chromic acid does not interfere with the precipitation of lime as oxalate from acetic acid solution.

Sample 5 is a mixture of barytes, white lead, zinc oxide, and carbonate of lime.

Determine barytes and white lead as in case 1. Dissolve another portion in acetic acid, filter, and pass sulphuretted hydrogen through the boiling solution, filter, and precipitate lime in filtrate as oxalate; dissolve mixed sulphides of lead and zinc in dilute nitric acid, evaporate to fumes with sulphuric acid, separate, and determine zinc oxide as in case 1.

Sample 6 is a mixture of barytes, white lead, sublimed lead, carbonate of lime.

Determine barytes, lead soluble in acetic acid and in ammonium acetate, as in case 2, lime and zinc oxide, as in case 5, and carbonic acid. Calculate lime to carbonate of lime, deduct carbonic acid in it from total carbonic acid, calculate the remainder of it to white lead, deduct lead in white lead from lead soluble in acetic acid, and calculate the remainder to oxide of lead.

Sample 7 contains sulphate of lime.

Analysis of paints containing sulphate of lime present peculiar difficulties, from its proneness to give up sulphuric acid to lead oxide or white lead if present. Sulphate of lime and white lead boiled in water are more or less mutually decomposed with the formation of sulphate of lead and carbonate of lime. A method for the determination of sulphate of lime is by prolonged washing with water with

slight suction in a weighed Gooch crucible. This is exceedingly tedious, but thoroughly accurate. A reservoir containing water may be placed above the crucible, and the water allowed to drop slowly into it. This may take one or two days to bring the sample to constant weight, during which time several litres of water will have passed through the crucible. Another method for separating the sulphate of lime is by treatment in a weighed Gooch crucible with a mixture of 9 parts of 95 per cent. alcohol and 1 part of glacial acetic acid. Acetates of lead, zinc, and lime being soluble in this mixture, the residue contains all the sulphate of lime and any sulphate of lead and barytes which may be present. Determine the lead and lime as in sample 4, and calculate to sulphates. Sulphate of lime should be fully hydrated in paints. To determine this, obtain loss on ignition; deduct carbonic acid and water in other constituents; the remainder should agree fairly well with the calculated water in the hydrated sulphate of lime, if it is fully hydrated. If, after washing a small portion of the sample with water, the residue shows no sulphuric acid soluble in ammonium acetate, the sulphate of lime may be obtained by determining the sulphuric acid soluble in ammonium acetate and calculating to sulphate of lime. The difficulty is in determining the sulphate of lime in the presence, or possible presence, of sulphate of lead. To illustrate the analysis of samples of white paint containing sulphate of lime, and the difficulty attending thereon, we would mention a sample containing sublimed lead, white lead, carbonate of lime, and sulphate of lime. In such a sample we would determine the lead, lime, sulphuric acid, carbonic acid, loss on ignition, the portion soluble in water, and the lime or sulphuric acid in that portion, calculating to sulphate of lime. Deduct the lime in the sulphate of lime from the total lime, and calculate the remainder to carbonate of lime; deduct the carbonic acid in the carbonate of lime from the total carbonic acid, and calculate the remainder to white lead; deduct the sulphuric acid in the sulphate of lime from the total sulphuric acid, and calculate the remainder to sulphate of lead. The lead unaccounted for as sulphate or white lead is present as oxide of lead. Deduct the carbonic acid and water in the carbonate of lime and white lead from the loss on ignition, the remainder being the water of hydration of the sulphate of lime.

Sample 8 contains as insoluble matter, barytes, china clay, silica.

After igniting and weighing the insoluble matter, carbonate of soda is added to it and the mixture fused. The fused mass is treated with water, and the insoluble portion filtered off and washed. This insoluble portion is dissolved in dilute hydrochloric acid, and the barium present precipitated with sulphuric acid in excess. The barium sulphate is filtered out, ignited, weighed, and if this weight does not differ materially—say by 2 per cent.—from the weight of the total insoluble matter, the total insoluble matter is reported as barytes. If the difference is greater than this, add the filtrate from the barium sulphate precipitate to the water-soluble portion of fusion. Evaporate and determine the silica and the alumina in the regular way. Calculate the alumina to China clay on the arbitrary formula $2\text{SiO}_2, \text{Al}_2\text{O}_3, 2\text{H}_2\text{O}$, and deduct the silica in it from the total silica, reporting the latter in a free state. It is to be borne in mind that China clay gives a loss of about 13 per cent. on ignition, which must be allowed for. China clay is but slightly used in white paints as compared with barytes and silica.

Sample 9 contains sulphide of zinc.

Samples of this character are usually mixtures in varying proportions of barium sulphate, sulphide of zinc, and oxide of zinc. Determine barytes as matter insoluble in nitric acid, the total zinc as in case 1, and the zinc soluble in acetic acid, which is oxide of zinc. Calculate the zinc insoluble in acetic acid to sulphide.

Sample 10 contains sulphate of lead.

This is of rare occurrence. Sulphate of lead is insoluble in ammonium acetate, and may be filtered out and weighed as such. It is apt on exposure to the air in the moist state to become oxidised to sulphate of lead.

There are certain arbitrary positions which the chemist must take in reporting analyses of white paints:—

1st. White lead is not uniformly of the composition usually given as theoretical (2PbCO_3), (PbH_2O_2), but in reporting we must accept this as the basis of calculating results, unless it is demonstrated that the composition of the white lead is very abnormal.

2nd. In reporting oxide of lead present this should not be done except in the presence of sulphate of lead, and if white lead is present, then only where the oxide is more than 1 per cent.; otherwise calculate all the lead soluble in acetic acid to white lead.

3rd. China clay is to be calculated to the arbitrary formula given.

In outlining the above methods we have in mind many samples that we have analysed, and the combinations we have chosen are those we have actually found present.

ACCURACY IN SILVER ASSAYS.

BY FREDERIC P. DEWEY.

I wish to call attention mainly to one source of inaccuracy in assaying, which, though well known and easily corrected for, has until recently been largely neglected. I refer to the absorption of the precious metals by the slag and cupel.

Mason and Bowman have published a table giving the average loss of silver in the entire process of scorification and cupellation as 2.54 per cent., 0.55 per cent. in scorification, and 1.99 per cent. in cupellation.

For gold the average for the entire process was 0.87 per cent.—0.574 per cent. in scorification and 0.296 per cent. in cupellation. But the meagre description of the results impairs their value.

At the April, 1894, meeting of the Washington Chemical Society I presented a paper on "The Accuracy of the Commercial Assay for Silver," in which I called particular attention to this matter.

In this paper are given many results on various materials ranging from tailings from silver mills carrying from 1.8 to 18.5 oz. of silver per ton through various ores, both raw and roasted, from 12.5 to 45.5 oz. per ton, lead carbonate precipitates from 1 to 500 oz. per ton, base sulphide precipitates from 100 to 5,000 oz. per ton, regular sulphide precipitates from 100 to 16,000 oz. per ton, base bullion from 300 to 500 fine, and lastly, fine bullion averaging 999.3 fine.

The following table summarises some of the results:—

Material Assayed.	Grade of Value.	Range of Inaccuracy.	Average Inaccuracy.
		Per Cent.	Per Cent.
Tailings	1-20	18.0-18.6	13.7
Washed ore	15-35	13.0-10.0	10.4
Raw ore	20-50	16.0-5.0	9.7
Roasted ore	20-45	12.0-6.0	9.1
Lead carbonate	50-100	5.1-2.6	3.8
Base sulphides	1,000-5,500	5.0-1.8	3.0
Regular sulphides	2,000-16,000	2.8-1.2	1.7
Copper-silver bullion, 300 "fine" ..	..	2.0	2.0
Fine bullion, 999.3 "fine" ..	..	1.1	1.1

In general the percentage of the inaccuracy of the ordinary commercial assay from slag and cupel absorption varies inversely with the value of the material assayed, when figured upon that value.

In order to see this most clearly it is necessary to compare results of the same class of material, and, preferably, made by the same assayer under practically constant conditions. Sometimes, when a series of individual results differs irregularly, if the results are grouped considerable regularity may appear. For instance, on looking at a series of miscellaneous results on ores running from 15 to 40 oz. per ton, no irregularity may appear, but if the results are grouped in periods differing by 5 oz. per ton they may become very regular in the variation. While different assayers working on the same material may show some regularity they may also vary greatly.

When, however, high-grade material, such as sulphide precipitates running from 8,000 to 16,000 oz. per ton, particularly if they contain much copper, are assayed, the results are not always so regular in their variation.

When we come to consider the percentage of inaccuracy when figured upon the total material assayed, we find that it generally follows the silver contents of the material, and in the case of rich products, becomes very large. Thus, in 2.3 oz. tailings, the silver equals 0.0079 per cent. of the total, and a 21.8 per cent. loss on this equals only 0.0017 per cent. of the total. On the other hand, in a 17,500 oz. sulphide, the silver equals 60 per cent. of the total, but the comparatively small loss of 1.25 on this equals 0.756 per cent. of the total.

The following table gives a few results upon this point:—

Material.	Grade.	Silver Inaccuracy Per Cent.		
		Per Cent.	Of Total.	Of Silver.
	Oz.			
Tailings.....	2.3	0.0079	21.8	1.0017
Ore.....	20.3	0.0305	8.9	0.0062
".....	30.5	0.1011	5.0	0.0051
".....	31.0	0.1063	13.0	0.0138
".....	19.0	0.1680	8.8	0.0148
Base sulphides.....	431.0	1.477	8.6	0.1202
".....	507.5	1.741	2.2	0.3802
Regular sulphides.....	5538.0	18.98	8.4	1.5943
".....	10028.0	33.33	1.5	0.5495
".....	15046.0	51.58	1.2	0.6180
".....	17500.0	60.00	1.26	0.756

While the amount of silver recovered from the slag and cupel in the case of ordinary ores is small, when stated per ton of ore; yet when a year's operations, involving 10, 20, 30 or more thousands of tons, are considered, the difference between an ordinary and a corrected assay amounts to quite a respectable sum, and becomes well worthy of consideration in these times of low prices for silver.

When we consider rich materials, such as high-grade ore and the products of the Russell process, for instance, the slag and cupel loss on a single ton becomes considerable; and with very rich products, such as lixiviation sulphides, particularly when they carry a large percentage of copper, as in the regular Russell sulphides, this loss may amount to several hundred ounces per ton.

The assay of Russell sulphides presents unusual difficulties.

They are precipitates obtained in the lixiviation process of treating silver ores. In general they carry 8,000 to 14,000 oz. of silver per ton, 20 per cent. to 33 per cent. of copper, a little lead, some free sulphur, and the balance various impurities in small amounts. The variety that I am most familiar with carries about 1 oz. of gold for each 1,000 oz. of silver. They are very disagreeable to handle; they are light and dusty; they soil everything they touch, and yet they are sometimes semi-malleable. On account of their richness, but small weights can be taken for assay, and even then large buttons of silver are obtained which are given to spitting, and the presence of so much copper requires the use of large amounts of lead.

After much work, the following method has been elaborated as the most suitable for their assay, and is used in settling contracts for handling the sulphides:—

"Weigh out one-twentieth of an assay ton of sulphides, 55 grms. of granulated test lead, and 2 to 3 grms. of fused borax. One half of the lead is put in the bottom of the scorifier and hollowed out; the sulphides are put into the hollow and the rest of the lead poured over them; the borax is then placed on top. The assay is then conducted in the usual way. The slag and cupel should be ground up and assayed, and the result added to the main assay."

In the following table are given: 1st, the results of plain scorification assay by this method; 2nd, the ounces per ton found in the slag and cupel; 3rd, the percentage in slag and cupel; and 4th, the total silver found by adding the slag and cupel silver to the scorification silver by one assayer; 5th, the total silver as found by another assayer

upon the same samples; and finally, the difference between the two assayers.

Ozs. per Ton by Commercial Assay. First Assayer.	Ozs. per Ton in Slag and Cupel. First Assayer.	Per Cent in Slag and Cupel. First Assayer.	Total Ozs. per Ton.		Differences.	
			First Assayer.	Second Assayer.	Plus.	Minus.
8675.20	144.11	1.622	8819.31	8782	57.31	..
10074.25	189.35	1.844	10263.60	10119	144.60	..
10783.35	189.00	1.720	10972.35	10938	34.35	..
10902.30	194.38	1.752	11096.68	11220	..	123.62
11015.73	191.69	1.710	11207.42	11090	117.42	..
11238.40	175.22	1.535	11413.62	11548	..	134.38
11828.75	176.72	1.471	12005.47	12046	..	40.53
12566.55	169.21	1.560	12735.76	12821	..	57.24
12665.85	169.87	1.553	12835.72	12841	24.72	..
13001.65	229.84	1.737	13231.49	13187	44.49	..
13625.50	226.52	1.635	13852.02	13919	..	66.98

On comparing results on individual lots considerable variation will be found between the two assayers, but on considering the total amount of silver involved the difference becomes quite small. By the first assayer these eleven lots contain 236,118.99 oz. of silver, while by the second they contain 235,483.88 oz., the difference between the two being only 54.89 oz. This amount is 0.0232 per cent. of the smallest total of ounces found and 0.0095 per cent. of the weight of sulphides involved, and shows that when carefully and properly executed the method gives concordant results on averaging a sufficient number of assays.

As showing the difference which may occur by this method of assaying, besides noting the individual difference above between the two assayers, it may be added that one of these found the following difference on assaying the same sample at different times:—

	Oz per Ton.
No. 1.....	141
No. 2.....	90
No. 3.....	112

Again, in using this method we usually start four assays of each sample. As we have found the charge rather destructive to scorifiers it is not unusual to lose an assay. In two sets of four results the differences between the highest and lowest individual results were 49.6 and 55 oz. per ton. In five sets of three results the differences were 36, 54, 94, 98, and 152.2 oz. per ton. As each one of a set of assays was carried through under practically the same conditions as the others, these differences may seem rather high, but the total ounces represented by these seven assays was 121,346.53 oz., while another, very expert assayer by this method, working upon the same samples, found 121,416.56 oz., showing a difference of only 99.93 oz. on the total number of ounces involved.

Mr. Russell has stated to the writer that in his opinion the very best assay of Russell sulphides, that can be made is still about $\frac{2}{3}$ of one per cent. below the actual amount of silver present. That there is a considerable loss of silver in assaying these sulphides, even by the above corrected method, we know by practical experience.

In the 1894 run of the Marsac refinery 116,519.5 lb. of sulphides, carrying 572,541.45 oz. of silver by the corrected assay, were refined by the sulphuric acid process invented by the writer.

Now in practical operations there must necessarily be some losses, but in this case the losses were less than the difference between the corrected assay and the amount of silver actually present, for we recovered 2,073.81 oz., or 0.36 per cent. more silver than the corrected assays called for.

In a number of cases the slag and cupel have been assayed separately, but there does not seem to be any uniformity of results, except that the cupel silver is generally much greater than the slag silver, although in one case they were both the same—0.8 oz. In a set of 29 assays running from tailings at 6.2 oz. per ton to ore at 44.7, the cupel silver varied from 0.8 to 5.4 oz per ton, and the slag silver from

0.1 to 1.8 oz. per ton; the lowest cupel silver was on 18-oz. ore and the highest on 24.1-oz. ore; the lowest slag silver was on 26-oz. ore and the highest on 32.4-oz. ore, and both these assays were made by the crucible method. In only two cases was the cupel silver less than 1 oz. per ton, and one of these was on the 6.2 oz. per ton tailings, and in only two cases was the slag silver over 1 oz. per ton.

In a recent paper on "Assays of Copper and Copper Mattes" reported to the American Institute of Mining Engineers, some interesting figures are given on this point. In assaying copper matte carrying about 55 per cent. copper and 129 oz. of silver per ton, one assayer reported 0.3 to 1.0 oz., another none to 0.35, and another none in the slag, while in the cupel the first reported 3.2 to 4.0, the second 1.0 to 2.1, and the third did not report. Again, on copper bearings carrying about 98 per cent. copper and 160 oz. of silver per ton, the same three assayers reported 0.8 to 0.35 to 1.5, and none in the slag, and the first two 4.8 to 8.7 and 2.0 to 5.5 in the cupel.

While the correction for slag and cupel loss is easily made and ought always to be made when accurate statistics are kept, there is yet the volatilisation loss to correct, and some means of doing this is desirable. While a check assay answers very well for bullion, it would hardly be possible to construct check material for the varying characters of ores and products ordinarily met with.

The question is sometimes asked if some wet method would not be better than fire assaying, but at present no such method is available for general assaying.

In the absence of copper the Volhard method of titration with sulphocyanide is highly recommended, and it has been proposed to dissolve cupriferous materials, separate the silver as bromide, reduce it to metallic silver by zinc, dissolve and titrate; but this method recovers only about 90 per cent. of the silver, and finally various scraps have to be gathered up and assayed to make up the total.

Again, it has been proposed to dissolve and precipitate the silver as AgCl , with or without a collector, generally sulphate of lead, to gather up and envelope the AgCl and then assay. While these methods may be more accurate than the uncorrected assay of such material, yet they consume much more time and finally depend upon an assay in which the slag and cupel must also be assayed if any considerable accuracy is required.

While the straight assay of any ordinary material, and especially if cupriferous or zinciferous, tends to losses by the slag and cupel, yet the removal of the foreign substances and the assaying of pure or nearly pure silver or its compounds does not avoid these losses altogether. In assaying fine silver produced at the Marsac refinery, which showed by check assays an average of 999.3 fine, the absorption by the slag and cupel was 11 oz. per thousand or 1.1 per cent. In the symposium on copper above referred to, three chemists reported slag and cupel losses in such methods ranging from nothing to 3.38 oz. per ton, while another who used a special collector reported from 4.63 to 15.0 oz. per ton of silver and 0.059 to 0.19 oz. per ton of gold.

A few words as to a common fallacy which this paper may tend to support. I think that it is pretty generally believed, particularly in the West, that the highest normal result found in any set of assays must necessarily be the best and nearest to the actual content of the material assayed, but this is by no means the case. In avoiding Seylla we may easily fall into Charybdis.

In cupelling at a low heat in order to avoid loss of silver by volatilisation we may easily leave foreign metals in our silver beads and get too high results. In the copper symposium one chemist reported from 0.3 to 1.0 oz. silver per ton in the slag, and 3.2 to 4.0 oz. silver per ton absorbed by the cupel, but at the same time he reported from 2.3 to 3.33 oz. per ton of copper left in his silver bead. Another chemist reported from 5.7 to 6.3 oz. silver per ton in his slag and cupel, but also 5.6 oz. per ton of copper in his silver button.

In the assay of Russell sulphides by the above method, notwithstanding the enormous excess of lead used—36 times the weight of sulphides taken—the final silver beads often if not always carry some copper. In six cases the amount varied from 6 to 13 oz. per ton, and averaged 9.16 oz. per ton.

ANALYSIS OF CHROME ORES.

BY ELWYN WALLER, PH.D.

RECENTLY, in examining some chrome ores, use was made of a method essentially that of Clark (J. Chem. Soc. LXIII., 1079) decomposition by sodium peroxide, &c. The recent discussion between Kidal and Rosenblum on the one side (this Journal, 1895, 1017) and Saniter on the other (*ibid.* 1896, 155) has induced me to present my own experiences.

The plan pursued may be described as follows:—

About 0.5 gm. of the finely pulverised ore was accurately weighed out in a small nickel crucible (about 3.5 cm. diameter at the top, and 3 cm. high; weight, 9 to 12 grms.). On top of this was weighed approximately 2 grms. of dry powdered sodium peroxide. The powders were mixed by means of a stout platinum wire, any material adhering to the wire being shaken or brushed back into the crucible by the aid of a feather.

The crucible was then supported on a nickel-wire triangle and a low flame applied, which, in the course of about two minutes, brought the mass into a state of quiet fusion. This heat was maintained for eight to ten minutes, and then, grasping the crucible with the tongs, and raising the flame, the mass was brought to a visible red heat, the crucible being moved about so as to give a rotary motion to its contents. This condition was kept up for a full minute, when the crucible was allowed to cool.

When the crucible was cool enough to be handled it was laid on its side in a small casserole, and 50 to 80 c.c. of boiling water added. By turning the crucible about with a glass rod the mass was soon dissolved, complete solution being marked by the cessation of effervescence. The crucible was then rinsed off with more boiling water and removed. Boiling the solution for about five minutes to decompose any remaining peroxide was the next step.

The solution was then filtered into a half-litre flask, and the black insoluble residue washed with cold water until the washings ran absolutely colourless. The contents of the flask were acidified with dilute sulphuric acid, cooled, if not already so, and the flask filled with cold water to the mark. After mixing by pouring back and forth into a beaker, the solution was titrated (in two lots of 250 c.c. each), preferably, after dilution, by use of standard hyposulphite solution containing 30 grms. of the crystals per litre—of course after adding potassium (or sodium) iodide, 15 to 20 c.c. of a 10 per cent. solution, finishing with starch in the usual manner.

Comments.—The analyses were conducted on ores ground to an impalpable powder. A side test on a portion of one ore, which was only fine enough to pass a 60-mesh sieve, made it seem probable that the method described might serve with ores coarse enough to pass a sieve of that size.

The size and shape of the crucible were found to make an appreciable difference. On using a broad dish for the fusion, imperfect decomposition of the ore was attained with the same proportions of ore and flux.

The temperature used appeared to be somewhat higher than that prescribed by Clark, since he designates a "pasty" condition, but (except at the end) was lower than that recommended by Saniter. Raising the temperature but little above that necessary to give a liquid melt, caused "spitting," resulting in loss, unless the melt was kept constantly moving as described. A higher temperature during the fusion also caused a more decided attack of the crucible.

Using a crucible of the size specified, and working as described, it was found that 2 grms. of sodium peroxide sufficed to decompose readily 0.7 to 0.75 gm. of ore when containing 35 to 50 per cent. or over of Cr_2O_3 . With lower grade ores, especially when much silica was present, the proportion of flux needed to be larger, the higher grade of ores usually decomposing the more readily. In general terms it seemed that the larger the amount of flux used over and above that necessary to decompose the ore, the more decided the attack of the crucible. A crucible weighing originally 9.7593 grms. after 18 fusions weighed 8.3149 grms., an average loss for each fusion of about 80 mgrms. The maximum loss for any one fusion was 268 mgrms., the minimum, 7 mgrms.

The usual loss in fusing at a low temperature was 20 to 50 mgrms. Some heavier crucibles lost proportionately more.

The black residue, insoluble in water, was digested warm (paper and all) with dilute sulphuric acid (1:9) for 15 or 20 minutes, when it dissolved to a clear solution, showing no black grains of undecomposed ore. It was found that when silica was to be determined, the black coating which adhered to the inside of the crucible contained some silica, and required to be dissolved off in the same manner. In any case, this treatment was applied in order to clear the crucible for subsequent use. Hydrochloric acid acted in the same way, but more rapidly than sulphuric acid.

The water solution of the melt always showed indications of the presence of some peroxide, which was apparently smaller in amount the hotter the water,—that is to say,—acidification without previous boiling afforded a coloration attributable to the formation of perchloric acid, and neutralisation with ammonia then afforded a precipitate coloured greenish by chromium hydrate. This phenomenon was more marked on acidifying with sulphuric acid than with hydrochloric. Indeed, when the melt was dissolved in cold water and sulphuric acid was added, the colour of the solution passed rapidly through dirty blue-green to the green of chromium sulphate. No intermediate colourless stage noticed by Rideal and Rosenblum was observed.

The iron method, as well as the hyposulphite titration, was tried in several cases, and concordant results were obtained. The latter method was found to be much the more convenient, and eventually was used exclusively. Dilution to at least 600 or 700 c.c. is desirable, in order to render the end reaction with starch easily discerned. This, however, is to a considerable extent a question of accustoming the eye to the tints.

The hyposulphite solution was standardised by weighing out some pure potassium dichromate which had been pulverised and then thoroughly dried in the air-bath, dissolving it in the proportion of 1 gm. (= 0.517 Cr₂O₇) in 100 c.c., and testing on four or five lots of 10 c.c. each.

For this and for many other purposes, a Müller's starch solution is the most satisfactory, in which the starch is moistened with a few drops of caustic potash (or soda) solution and then dissolved in warm water. The few drops of the starch solution were in no case added until the coloration due to free iodine had been nearly destroyed by addition of the standard hyposulphite.

The iron titration, if applied as described by Sutton (Volumetric Analysis, 6th edition, p. 154), involving as it does the weighing out of some ferrous ammonium sulphate for each titration, has obvious inconveniences, and the use of a solution of the salt, which will require frequent re-standardisation, is also much more troublesome than the hyposulphite method.

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I.—PLANT, APPARATUS, AND MACHINERY.

The Concentration of Liquids [Injection of Hot Air].

R. Wirth. Chem. Zeit. 1896, 20, 306.

THE author remarks that although the process of blowing hot air through the liquid which has to be evaporated is very little used, it is extremely efficient. The pan should be set in connection with a condenser and a vacuum pump. Whilst the boiling point of the substance under treatment is lowered considerably by the partial vacuum and the rapid evaporation, the vessel does not require to be directly heated, and so wear and tear of plant are considerably reduced. The air should be broken up into a number of fine streams. When concentrating saline liquids by this arrangement, "creeping" is much reduced.—F. H. L.

PATENTS.

[*Safety Appliance*], *An Improved Method of and Apparatus for Counteracting, Deflecting, and Distributing Gases and Flames in Chemical Works, Furnaces, or the like.* F. E. Gäteke, Altona-Bahrenfeld, Germany. Eng. Pat. 2717, Feb. 7, 1895.

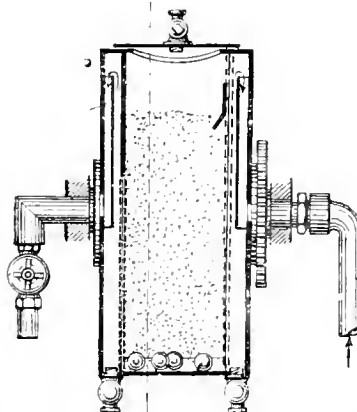
IN many forms of furnaces, &c., used for industrial purposes, inconvenience or danger attends the opening of charging and other doors, for the purpose of working, charging, or discharging material, through the liability of hot or noxious gases to shoot out. The object of this invention is to counteract this by arranging a perforated pipe in front of such opening, by means of which a flat curtain or screen of steam, air, &c., is formed, which deflects the issuing gases in a direction in which they will be harmless.—R. B. P.

Filtering Liquids, Improvements in and relating to Apparatus for. J. B. C. Kröhnke, Hamburg, Germany. Eng. Pat. 5865, March 20, 1895.

THIS apparatus is designed to enable the filtering medium to be periodically cleaned without removal from the filter.

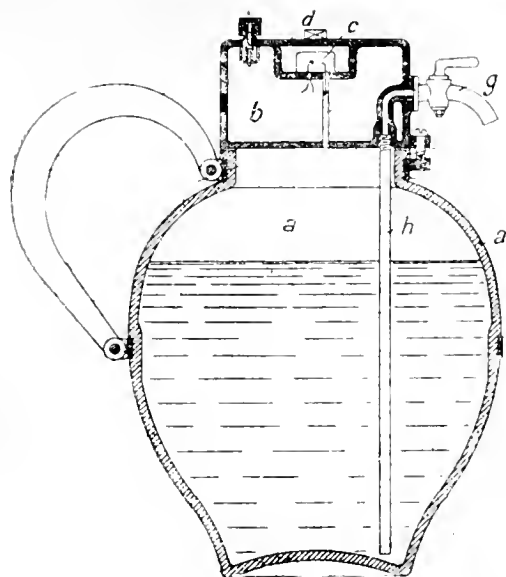
Figs. 1 and 2 show its construction. The liquid enters at the right-hand side (Fig. 1), follows the course of the arrows, and leaves on the opposite side.

Fig. 1.



The in- and outlets form trunnions upon which the filter can be rotated by suitable gearing. For the purpose of cleansing, the filter is filled with water and the valve on

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Luck, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.



—A. S.

Vegetable and Animal Matter, Improvements in Apparatus for Drying. A. Ludwig, London. From S. Moser, Frankfurt-on-Main, Germany. Eng. Pat. 3859, Feb. 20, 1896.

This invention relates to improvements in Ryder's apparatus for drying fruit, &c. (this Journal, 1886, 39). The furnace is enclosed in a double casing, and the air supply is drawn through an asbestos filter placed between the inner and outer casings, which both cleanses the air from dust and at the same time warms it and economises heat. Further economy is effected, and a more even temperature in the drying flues secured, by causing the hot gases from the furnace to pass into the lowest flue through a compartment filled with sand fixed along the bottom of the flue.—L. A.

II.—FUEL, GAS, AND LIGHT.

Carbon; The Combustion of, in Air. A. Naumann. Zeits. angew. Chem. 1896, 200.

ACCORDING to a series of experiments carried out by the author in conjunction with R. Ernst, the relation between the amounts of monoxide and dioxide produced during the burning of carbon in air, is strictly dependent on the temperature of combustion. The formation of dioxide begins at 400° C., and is accompanied only by small quantities of monoxide. The former rapidly increases to a maximum of 20 per cent. of the evolved gases by volume at 500°, remaining almost constant up to 700°. At 700° the production of monoxide is very small, but rises quickly at and above 800°; while at 1,000°, 34.3 per cent. is to be found in the waste gases, the highest amount theoretically possible. Provided that the air is not caused to pass too rapidly over the heated carbon, oxygen entirely disappears between 500° and 700° C., carbon dioxide being formed along with only small quantities of CO. At about 900° C. the formation of CO increases rapidly, and at 1,000° C. and over, exclusively carbon monoxide is produced, all oxygen being completely consumed.

J. Lang (Zeits. phys. Chem. 1888, 2, 178) has shown that CO₂ already formed cannot be again completely reduced by carbon to CO between 1,000° and 1,100° C. Now, since absolutely no CO₂ could be detected in the combustion products of carbon at 1,000°, above referred to, it follows that the production of that carbon monoxide must have been a direct production, and not in any wise due to reduction of CO₂.—F. H. L.

Petroleum Lamps, Diminution of the Flame in. A. G. Chem. Rev. u. d. Fett- u. Harz-Ind. 1896, [38], 73—76.

THE apparatus used in these experiments is designed by Lenoir and Forster, and consists of a glass cylinder and flat burner, the former graduated in millimetres (0—155), and provided with a tapped outlet near the base. 250 c.c. of oil are placed in the cylinder, and the wick, 20 cm. long by 24 mm. in width, having been trimmed, is lighted, the flame being adjusted to a height of 3 cm., and enough oil removed by the outlet tube to bring the level down to the mark 10.

The progressive diminution of the height of the flame can be measured by a cathetometer, or by tracing the inverted image projected on the focussing plate of a camera. The prevalence of red and yellow rays in the flame militates against the production of a good photographic image, but this difficulty is probably surmountable. Krüss's flame-measuring apparatus (Dingler's polyt. J. 283, 207) is also suitable, and the percentage of decrease may be easily calculated.

Applied to several varieties of petroleum, the method recorded considerable variation in the rates of decrease in illuminating power exhibited. The presence of acid bodies appears to be prejudicial in this respect, for at the stage when the neutral oils gave a decrease of from 25 to 34 per cent. (which may be classed as "very good" to "normal"), the light from those with an acid reaction declined to 50—64 per cent., one even falling off to the extent of 90 per cent. This latter was an oil originally of very good quality, which had been exposed to light for four months, the result being that it turned dark yellow in colour, and deposited brown resinous matter on the sides and bottom of the storage flask. Shaken up with sulphuric acid of sp. gr. 1.53, this oil turned dark red, and became black with concentrated acid. Sodium hydroxide solution (34° B.) was turned brown on being added, and the mixture separated into three layers, the central one containing the compounds of lye and acid, which, when decomposed by acids, gave an odour of petroleum acids.

The author, from personal experience, confirms the results published by Ostrejko (this Journal, 1896, 26) on the effect of the absorption of air by petroleum.—C. S.

Naphthalene in Coal-Gas, Diminution of. V. O. Keller. Gastechniker, 23, 268.

AS light petroleum has such a great power of liquefying and dissolving naphthalene, the author experimented on the introduction of crude petroleum into the carbonising retorts.

But the author concludes that the introduction of petroleum into the retorts will not obviate the stoppage of pipes by crystallised naphthalene.

Experiments were then tried with various purifiers for the same purpose. A special purifier with a glass side was employed and the gas issuing from it was led through a glass tube immersed in a freezing mixture. The following results were obtained:—

1. With the purifier empty, crystals of naphthalene appeared in the cooled tube in a few hours.
2. With the purifier partly filled with gasoline, no trace of naphthalene could be found in the cooled tube after 36 hours. The illuminating power of the gas was increased, but the flame was made smoky.
3. With lime in the purifier, a small quantity of naphthalene was found in the tube in 24 hours.
4. With Laming's mixture, no trace of naphthalene was present in the tube after 24 hours.
5. With a mixture obtained from a gasworks little troubled with deposition of naphthalene, and which consisted mainly of oxide of iron, the tube remained entirely free from naphthalene for 48 hours.
6. With a mixture of silica, 17 per cent.; alumina, 28 per cent.; oxide of iron, 35 per cent.; and soda, 20 per cent.; the tube was completely blocked with naphthalene in 6 hours.

The author concludes that the material used in the purifiers exerts a much greater influence on the amount of naphthalene in the purified gas than has been hitherto supposed.

—J. T. T

PATENTS.

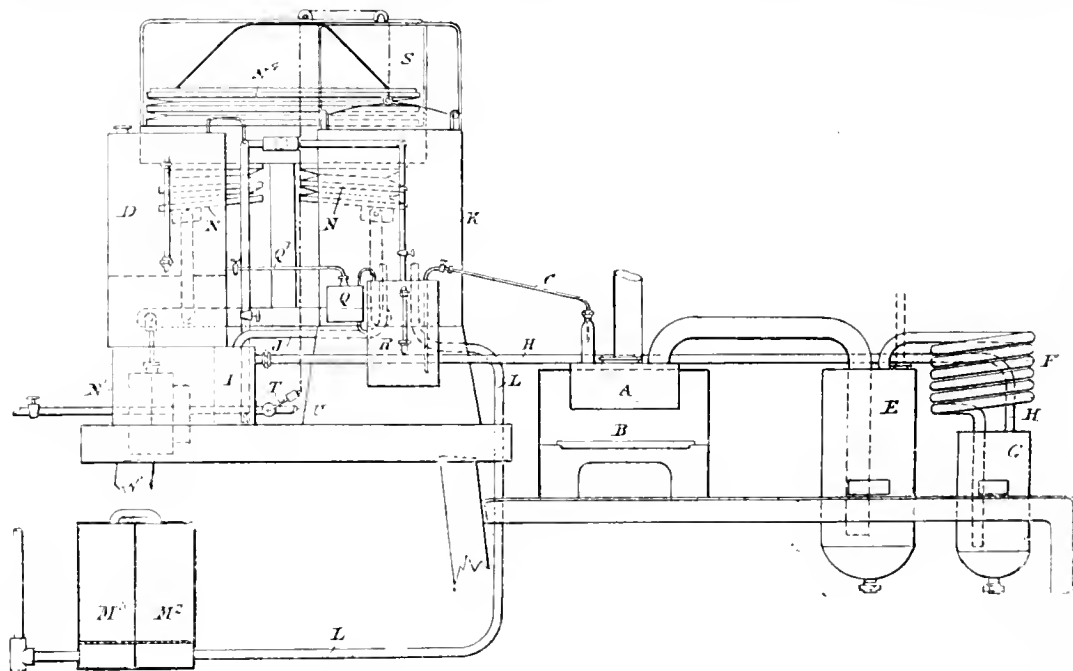
Gas [Liquid Hydrocarbon] for Lighting and Heating Purposes, New or Improved Process and Apparatus for the Manufacture of. P. Brentini, Earl's-field, London. Eng. Pat. 3354, Feb. 15, 1895.

This inventor proposes to manufacture gas, for lighting and heating purposes, by gas-ifying liquid hydrocarbons in a special manner; subsequently mixing the gas so produced with air, also in a special manner; with the result that he

obtains a gas of so permanent a character that it does not condense at comparatively low temperatures.

The apparatus described, is intended for domestic use, though the principle of the process is applicable to large installations as well; it is represented in the figure.

Hydrocarbon gas, manufactured by allowing liquid hydrocarbon (petroleum, kerosene, or benzoline, &c.) to fall drop by drop into the cast-iron retort, A, which is heated by coke or gas, in the furnace B, passes success-



sively through E (a water-washer), F (a surface condenser), and G (a tar collector), and arrives by H in a vessel, I, where it is mixed with a regulated quantity of air, and thence, by J, it passes to the bell gas-holder, K.

Hence, by L, the gas may pass, either direct to the burners or, traversing M² and M³ (layers respectively of granulated charcoal and of caustic lime placed upon coke), may be still further purified and dried, before consumption.

The supply of hydrocarbon to the retort, and that of air to the mixing chamber, are adjusted to one another and to the consumption of gas at the burners, and are regulated automatically.

The air supplied to I, is obtained from the collapsible chamber, N¹, into which it has been previously forced by the bellows, N N, themselves actuated by the small water-motor N¹, through the interposition of a lever and a pair of links, shown in the figure by dotted lines.

The speed of the water-motor depends upon the amount of water passing through its exhaust, U, and this is controlled by the tap, T, which, in turn, is opened or shut, according as the bell of K (to which it is attached by the cord, S) rises or falls, in consequence of the consumption at the burners being greater or less than the manufacture of gas by the apparatus.

The hydrocarbon is contained in the closed reservoir, D, which is connected by Q¹ to Q, a chamber containing a float valve which closes as soon as the desired level of hydrocarbon in the next vessel, R, has been attained. From R, hydrocarbon passes by C to the retort A.

The gas spaces of Q and R are in communication; and those of D and R are in connection with N¹. The faster the water-motor works, and the greater the pressures produced in N¹, D, and R, the larger will be the quantity of hydrocarbon supplied to the retort, and the larger also the quantity of air to the now greater quantity of gas manufactured; the ratio of gas to air remaining, however, constant.

The object of the constant level of hydrocarbon in R, is to secure the sole dependence of the supply to the retort, upon the amount of gas pressure existing, from time to time, without influence from the height of liquid in R.

By slight additions to the apparatus, the supplies of water to the condensers, and of gas for heating the retort, may be similarly controlled automatically, so as to accord with the consumption of gas at the burners.—E. R. B.

Illuminating Gas [Oil], Improvements in the Manufacture of. A. R. Newman, London, and J. M. Somerville, Grove Park, Kent. Eng. Pat. 8746, May 2, 1895.

The apparatus proposed by these inventors comprises, (1) a retort, made up of inclined metal cylinders, arranged in zig-zag order, and set across a chamber, through which pass the waste blast gases, from a water-gas producer, and (2) a fixing-retort, which is a vertical metal cylinder, of elliptical section, and made up of three lengths, suitably jointed together. The interior of the fixing-retort is largely occupied by a considerable number of gratings, placed one above the other, at a short distance apart; the bars of the gratings being arranged at different angles, so that the gases, in ascending the retort, traverse a spiral path, and acquire a gyratory motion; the action of heat upon the gases is thus greatly increased, by reason of the increased heating surface to which they are exposed. The plant also includes (3) a pair of water-gas producers, worked alternately in the usual way.

In working the apparatus, oil descends from a suitably placed tank, through a pipe placed in the heated wall of the retort chamber. The oil, the temperature of which is now raised nearly to the boiling point, flows into the uppermost part of the zig-zag retort and traverses it, in company with the water-gas; the mixed gases subsequently ascending the fixing-retort, and such reactions ensuing from the heating, that a permanent gas is obtained.

The oil which is to be employed with the apparatus, is not specified by the patentees.

The steam employed is superheated by passing it through a coil, placed in the path of the waste blast gases; and the air, made use of to effect the complete combustion of the blast gases, and which is admitted on two successive occasions in the cycle of manufacture, is highly heated, by virtue of traversing channels in the heated walls.

The fixing-retort is also heated by the waste blast gases; for it is enclosed in a jacket, through which the waste gases pass on their way to the chimney.—E. R. B.

Incandescence Gas Lights, Improved Illuminating Appliances for. J. Moeller, London. Eng. Pat. 2224, Jan. 31, 1895.

IN place of the ordinary fabric forming the groundwork for the deposition of the earthy oxides, used in the preparation of incandescent mantles, which is liable to unequal shrinkage, thus constituting a source of weakness in the finished mantle, the inventor proposes to substitute a material composed of independent rings, linking one into the other, but not otherwise attached, and therefore not subject to the strains arising from unequal contraction. The links may be made of pieces of suitable thread, knotted after being looped together.—C. S.

Incandescent Carburetted Air or Gas Lighting, Improvements in, and Apparatus therefor or connected therewith. D. Hancock, J. B. Craig, and A. H. Hancock, all of Stratford, London. Eng. Pat. 3424, Feb. 16, 1895.

THIS patent relates, more especially, to the various modes of burning a certain carburetted air or gas, the manufacture of which is described in the specification in application for Patent 3425 of 1895 (see following abstract). The burners now described are "non-atmospheric," in the sense that the mixture of gases consumed at them contains already sufficient oxygen for complete combustion.

All the forms described are *pendent* burners, and, in all of them, the gaseous mixture is conducted into a box or chamber, which is attached to the downwardly directed gas tube; and, in two of the modifications of the burners, the gas escapes from the box into the interior of a mass of material (not otherwise specified), and, by its flame, renders it incandescent. In a third modification, the flame externally heats a conical mass of incandescing material, enclosed in a wire cage.—E. R. B.

Carburetted [Air] Apparatus, Improvements in. D. Hancock, J. Bell, and A. H. Hancock, all of London. Eng. Pat. 3425, Feb. 16, 1895.

THIS invention consists of an apparatus for forcing warmed air through mineral oils or spirits in order to produce an inflammable gas.—R. B. P.

Incandescent Lighting, Improved Method of combining Air and Gas. H. Gardner, London. From La Société Française de l'Héliogène, Paris. Eng. Pat. 11,820, June 18, 1895.

IT is proposed in this invention, in order to increase the illuminating power of ordinary flat-flame gas-burners, to force air by a blower (or other means) into the gas pipe in such a manner as to produce a mixture of 3 parts of air to 1 of gas at a pressure of 15 to 20 mm. water gauge. The jet, which burns with a blue oxidising flame, impinges on a fringe of radiant material suspended above the burner, and heats the said fringe to incandescence, producing thereby a brilliant light.—C. S.

Incandescence Spirit Lamps, New or Improved Gasifying Apparatus for. G. Tresseureuter, Berlin. Eng. Pat. 1162, Jan. 16, 1896.

THE apparatus described, which is intended for domestic use, is intended solely for the production of spirit vapour.

The apparatus comprises a vertical axially disposed tube, containing a wick, and leading, at its lower end, into a reservoir filled with spirit, and at its upper end to the burner. Around this upper end is another chamber, into which spirit may be introduced by means of a small pump;

the latter being a part of the apparatus which, though concealed within the reservoir, is operated from the outside by a small lever handle.

In working the apparatus, the spirit in the upper chamber is lit, whereupon the axial tube is warmed, and the spirit brought up by the wick, vaporised. Some of the spirit vapour so produced, passes direct to the burner, and some to a small injector; the latter supply, mixed with air, which is sucked in at the injector, is conveyed by a tube, to a perforated annular tube encircling the wick tube in the upper chamber. Through the apertures of the annulus, the spirit and air mixture escapes, inflames, and carries on the warming of the wick tube which was commenced by the spirit pumped into the upper chamber.

The injector and its principal parts, except the air-holes, are enclosed within the upper chamber.

The apparatus is so constructed that air-spaces are provided between the wick tube and the contents of the lower chamber, and also between the upper and lower vessels, so as to minimise, as far as possible, the effects of radiated or conducted heat upon the contents of the lower chamber.—E. R. B.

Water-Gas from Coke, Coal, or other Fuel, Improved Process of, and Apparatus for the Generation of. H. Strache, Vienna. Eng. Pat. 3487, Feb. 18, 1895.

TO generate water-gas from coal, &c., the air required for combustion during the admission period is heated by means of the hot combustible gases from the regenerator, aided by a "recuperator."

During the gasifying period, steam is superheated in the regenerator, and utilised for coking the fuel. The resulting gas and vapours pass, along with steam, through a highly heated column of coked fuel, and are converted into water-gas.

The generator consists of a vertical cylindrical chamber, the top part of which is occupied by the fuel to be coked, whilst in the lower part is the hot coked fuel.

The regenerator is filled with refractory blocks exposing a large surface, and is surrounded by an annular chamber forming the recuperator. In this there are a series of hollow, ribbed, cast-steel bodies, which form a continuous passage, surrounded outside by the hot gases from the regenerator. The air to be heated is passed through this passage.—R. B. P.

Gas [Air Gas], Improvements relating to the Manufacture of, and to Apparatus therefor. J. H. Ladd, London. Eng. Pat. 10,477, May 27, 1895.

(IMPROVEMENTS ON Stringfellow's patent. This Journal, 1891, 453.) Stringfellow obtained a combustible gas by passing air over screens impregnated with liquid hydrocarbons and subsequently over screens moistened with water, so that moisture might be taken up. The patentee proposes, when necessary, to employ heat either by previously heating the air, the hydrocarbon, or the water, or any two of them or all three.—L. T. T.

Smoke, Purification of; and the Recovery of Soot from the Products of Furnaces, Improvements in or relating to. G. Mugna, Budrio, Italy. Eng. Pat. 5834, March 20, 1895.

See under XVIII. B., page 466.

Acetylene Generating and Storing Apparatus, Improvements in. E. Gearing, Harrogate. Eng. Pat. 6777, April 2, 1895.

THE metallic carbide is contained in a generating vessel closed by a water-luted cover. The carbide is placed in a perforated vessel which can be lifted in and out of the generator, thus facilitating charging and discharging.

Water is admitted as a spray on the top of the carbide. The acetylene generated, passes through an intermediate chamber, forming a water lute, into a gas-holder of ordinary construction, the rising and falling of which regulates the amount of water admitted into the generator.

—R. B. P.

Acetylene, Improvements in Apparatus for Use in the Production and Utilisation of. E. Ducretet and L. Lajeune, both of Paris. Eng. Pat. 16,502, Sept. 3, 1895.

APPARATUS for the production of acetylene, by the decomposition of calcium carbide with water, is described by the inventors, who state that their apparatus differs entirely from those heretofore known, "in which the pressure of the acetylene gas removes the liquid from the carbide of calcium, but does not prevent its contact with water vapour, whereby slow, but continuous, decomposition can take place, with consequent danger and loss of the acetylene gas, apparatus of this kind not being capable of storing it at the high pressure which is produced by its evolution."

In the apparatus of the inventors the gas is produced, and if necessary stored, at any ordinary pressure which may have been previously agreed upon.

The apparatus consists of two stoutly constructed vessels, fitted to withstand considerable pressure, the upper one (which contains water) being in communication with the lower one (which holds the calcium carbide) by two tubes, one of which puts the gas spaces of the vessels into communication, while the other allows water to flow from the upper vessel into the lower one.

In the upper part of the lower vessel there is a valve-like structure, the piston of which is expelled by such pressures as may overcome a spring on the other side of this piston; the spring may be tightened up by a screw workable from the exterior of the apparatus, and, as the lower vessel is also provided with a pressure gauge, the valve may be adjusted so as to operate at any pressure which the acetylene, accumulating in the lower vessel, may have set up.

In retreating, the piston permits another spring to bring a plug against the aperture by which water is entering the lower vessel.

A portable lamp, and several other modifications, are also described.—E. R. B.

Acetylene Gas, for Acetylene Gas Lighting, Improved Process and Apparatus for the Production of. F. Rossbach-Rousset, Tempelhof, near Berlin. Eng. Pat. 1116, Jan. 16, 1896.

This inventor obtains acetylene by the decomposition of calcium carbide with water, the present invention providing

means for the regulation of the water supplied to the carbide, such means being dependent upon the pressure of the gas produced by the reaction.

The vessel containing the calcium carbide is enclosed in a gas-tight chamber, and the water-supply pipe traverses this chamber, is bent into a U outside the chamber, and then re-enters it, ending immediately over the calcium carbide vessel, into which it can therefore discharge its contents.

When water flows into the calcium carbide, and, in consequence, acetylene is generated, the pressure of the gas tends to check the influx of water; on the other hand, owing to the heat of the reaction, water, in the limb of the water-supply pipe, which, as stated above, traverses the chamber, is converted into steam, and the pressure so set up tends to neutralise that set up by the gas.

In a further modification of the apparatus, gas flames are applied to heat the water-supply tube.—E. R. B.

Gases, Specific Gravity of; Apparatus for Ascertaining. A. Custodis, Düsseldorf, Germany. Eng. Pat. 7791, April 18, 1895.

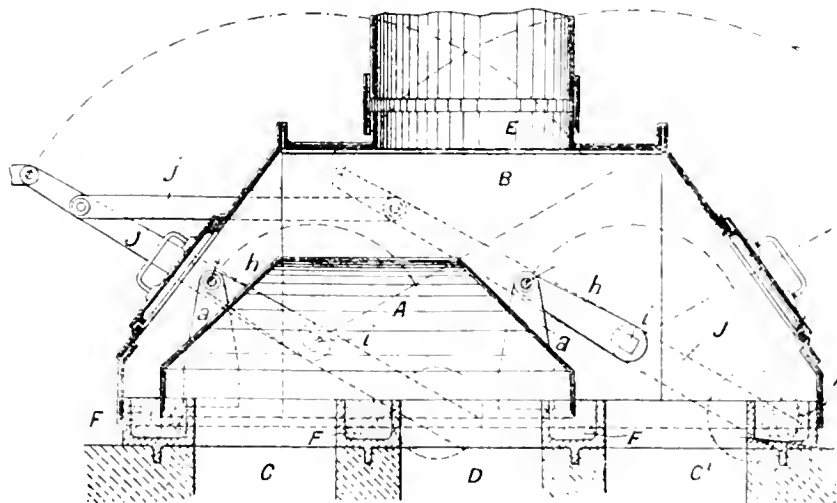
See under XXIII., page 472.

Gases, Weight of; Apparatus for Indicating and Registering. M. Arndt, Aix-la-Chapelle. Eng. Pat. 8615, May 1, 1895.

See under XXIII., page 472.

Gas Furnaces, Regenerative; Improvements in Devices for Reversing the Directions of Flow of Gas or Air in. J. R. Wright and W. Veitch, both of Gowerton. Eng. Pat. 9311, May 10, 1895.

The figure shows the apparatus of the inventors, in vertical section, and, in it, E is the inlet for gas or air, D communicates with the chimney, and C and C' with two regenerators. A is the valve proper, and it is represented as connecting C to D. It may, however, be moved so as to connect C' with D, the mechanism for this purpose being two weighted levers, J J, linked together by j, and attached to short shafts, i i. The shafts lie in bearings in the wall of the casing, B, and their inside ends are connected by cranks, h h, to the brackets, a u, of the valve, A.



The recesses, F F, contain luting material. Of the valve A, the inventors state that it "gives an opening through it of the full area of the flues, and is not injuriously affected by heat or flame, or its operation impeded by tar or soot." In the event of leakage, the valve proper need not be removed, but the leakage can be repaired, by unskilled persons, even when the furnace is in work.—E. R. B.

Gas, Sampling for Analysis; Improvements in Apparatus for. B. L. de Ridder, Amsterdam. Eng. Pat. 10,905, June 1, 1895.

See under XXIII., page 472.

Vaporizing Burner for Oil, Improved. J. Barany and J. Mücke, Berlin. Eng. Pat. 11,767, June 17, 1895.

THE main feature of this apparatus consists in a seal of fusible metal into which dips an inverted bell containing the liquid to be vaporised. The metal fuses at a higher temperature than is required to gasify the heaviest constituents of the liquid, and in its molten state allows the gas to escape from the bell into the surrounding chamber, whence it is conducted to a Bunsen or illuminating burner in the ordinary way. When the source of heat is removed, the metal solidifies and prevents the escape of any further amount of vapour. The supply to the burner is regulated by a screw valve attached to a diaphragm.—C. S.

Gases of Easily Inflammable Liquids, Gasifying and Increasing the Heating Power of the. E. Rohrbach, Berlin. Eng. Pat. 15,890, Aug. 23, 1895.

IN this apparatus the two ends of a bent horse-shoe-shaped pipe dip into the oil in the main reservoir. At the upper end of the horse-shoe pipe another pipe goes to the burner. From this latter pipe, a small metal pipe branches off, coils round the said pipe and rejoins it. From the coiled pipe, however, a capillary tube also leads downwards to below the coils, thus carrying some of the vapour, which, when ignited, heats the coiled and main tube and continues the gasification. The initial gasification must be effected by an external source of heat.—L. T. T.

Furnaces, Improvements in. A. M. Hewlett, Kewance, Ill., U.S.A. Eng. Pat. 16,297, Aug. 30, 1895.

See under X., page 458.

Gas Furnaces, Regenerative: Improvements in and connected with. A. Müller, Berlin. Eng. Pat. 19,355, Oct. 15, 1895.

THIS consists in using a coke fire, fed from the top, with flues for taking off the generator gases about one third or fourth of the height of the fuel chamber above the fire-bars. In this way the patentee claims a constant height of incandescent material, and, by properly arranging draughts, the obtaining of his generator gas as carbonic oxide and nitrogen, almost free from oxygen or carbonic acid. By using short flues and admitting previously heated air immediately at the end of these flues, the patentee claims perfect combustion with great saving of heat, and in the chimney gas almost solely carbonic anhydride and nitrogen, so that where carbonic anhydride is to be recovered there is still further economy.—L. T. T.

Coke Furnaces or Ovens, Improvements in. H. Stienes, Muhlheim-on-the-Ruhr, Germany. Eng. Pat. 24,823, Dec. 27, 1895.

THE heating of the furnace is effected either by the gases generated during the coking process, or, if it be desired to utilise these for other purposes, by gas from separate generators.

The furnace is constructed with two systems of heating flues, both being divided into halves at the middle of the length of the furnace by a wall, whilst the coking chamber runs the whole length.

The furnace is so built that those parts subject to most wear can be repaired without seriously disturbing the adjoining parts.—R. B. P.

Petroleum, Spirit, and Analogous Liquids, Improvements in Apparatus for Gasifying. D. Young, London. From F. H. Aschner, Berlin. Eng. Pat. 1648, Jan. 23, 1896.

THIS consists in a gasifying apparatus for combustible fluids, in which a collecting chamber is interposed between the gasifying chamber and the burning-nozzle, from which collecting chamber there is a passage controlled by a suitable valve, and provided with one branch leading to the burner-nozzle, and another branch, suitably controlled, terminating in a burner placed below the gasifying chamber. Below this latter is a small pan for the warming-up liquid. When the gasification is once started by burning combustible liquid in the above-mentioned pan, it is continued by means of a part of the gasified material passing down the

branch pipe to the heating burner below the gasifying chamber. The petroleum, spirit, or other combustible is drawn from the main receptacle to the gasifying chamber by means of a wick.—L. T. T.

Hydrocarbon Furnaces, Automatic Re-ignition Apparatus for. S. Pitt, Sutton, Surrey. From La Compagnie Internationale des Procédés Adolphe Scigle, Paris. Eng. Pat. 5409, March 10, 1895.

IN the path of the flame, between the sprayer or gasifier and the furnace, is interposed a hollow metal cylinder perforated with air-holes and lined with non-conducting material, and containing a second smaller cylinder or truncated cone which, heated by the flame, remains red hot for several moments after the latter has been extinguished, and automatically re-ignites the jet in case it is put out.—C. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum, Italian. C. Flaumet. *Moniteur des Produits Chimiques*, 1895, 25, [18].

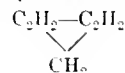
THE most important oil-bearing districts in Italy are Montanaro di Piacenza, Rivanozzano, near Voghera, Zocca-Casauria, and San-Giovanni-Incarico. Montanaro oil has a specific gravity of 0.7849 at 15° C., and yields 44.7 per cent. of light oil, 19.8 per cent. of a slightly heavier grade used for naphtha lamps, 22 per cent. of kerosene, and 14.4 per cent. of lubricating oil. The crude oil is free from H₂S. Rivanozzano oil has a specific gravity of 0.9132, and yields correspondingly heavier distillates. Zocca-Casauria oil is bituminous, having a specific gravity of 0.951. About 33 per cent. of burning oil and a good deal of black residuum suitable for varnish making is obtained from it. San-Giovanni-Incarico oil is a bitumen of sp. gr. 0.974, and containing much sulphur. A burning oil of sp. gr. 0.921 and flashing point of 85° C. can be obtained from it.—B. I.

Petroleum Products, Action of, on Aluminium. K. W. Charitschkow. *Trudy kak. otd. imp. russk. tekhn. obschutseh*, 1896, 11, I. 16.

STRIPS of pure aluminium were almost completely immersed in the distillates from petroleum, solar oil, and benzene, and in petroleum spent acids for four months at the ordinary temperatures. With the exception of that exposed to the action of benzene, which had increased in weight 0.08 per cent. and become slightly spotted, none of the strips were acted upon. The author suggests the lower molecular weight of benzene as the possible explanation of its greater energy. At temperatures of 75°–80° C. and 100°–120° C., the strips in the petroleum distillate and crude petroleum were intact after 48 hours, but after heating at 175°–180° C. for 38 hours under a reflux condenser, the aluminium in each case had increased in weight—in the petroleum distillate by 0.016 per cent. and in the petroleum by 0.017 per cent. From these results the author considers pure aluminium superior to copper and equal to iron, in its power of resisting the action of petroleum. It is specially suitable for vessels, such as cooling tanks, &c., in which the temperature of the petroleum does not exceed 120° C. Obviously the oil must be freed from any alkali, which would increase its solvent power.—C. A. M.

Cyclopentadiene in Coal Tar, the Indene of the Fatty Series. G. Kraemer and A. Spilker. *Ber.* 1896, 29, 552–561.

SOME time ago (this Journal, 1891, 38) the authors, in describing the isolation of Indene and Fluorene from coal tar, referred to a third hydrocarbon of the formula—

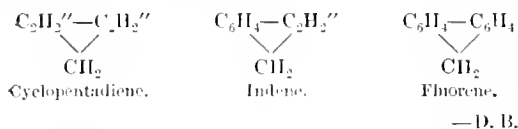


which they were hopeful of finding in the lowest boiling fractions of coal-tar oils. When subsequently Etard and Lambert extracted from compressed gas oils a product having the formula C₉H₈, named propetylene, the authors expressed the opinion that it must be the simplest form of

Indene. The first runnings from crude benzene or compressed gas oil formed the raw material for the present investigation. It was soon observed that prolonged standing affected the boiling points of these oils in an upward direction. Careful fractionation of the light oils thus changed, yielded a liquid boiling at 160° – 175° , from which the monomolecular hydrocarbon, named Cyclopentadiene by the authors, was isolated. It boils at 41° (corr.) under 760 mm. pressure, sp. gr. 0.815 at 15° – 15° ; it is insoluble in water, but miscible in every proportion with alcohol, ether, and benzene. Concentrated sulphuric acid and nitric acid cause it to explode; dilute acids and alkalis resinify it. It reduces an ammoniacal silver solution containing potash. Mono-, tri-, and tetrachloro compounds are described.

Dibromocyclopentene is obtained by combining Cyclopentadiene, suspended in twice its weight of light petroleum, with the theoretical quantity of bromine at -15° to -20° . It forms colourless crystals melting at 45° to 46° , is readily soluble in alcohol and chloroform, but decomposes *per se* or when treated with alcohol and water. Tetrabromocyclopentane is also described.

The authors maintain that the results they obtained on chlorination and bromination, confirm the correctness of the formula originally assigned by them to Cyclopentadiene, the discovery of which fills up a gap in the Indene series, thus:—

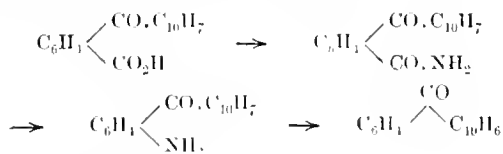


Trimethylbenzene, Consecutive, Accompanying Synthetical Mesitylene. A. Lucas. Ber. 1896, 29, 953–958.

THE author is in a position to assert that mesitylene, even when obtained from the purest acetone by synthesis, always contains hemellitrol (consecutive trimethylbenzene) in appreciable quantity, but the presence of pseudocumene could not be detected.—D. B.

Chrysoketone, Synthesis of, and Constitution of Chrysene. C. Graebe. Ber. 1896, 29, 826–828.

THE ready formation of fluorenone from ortho-amino-benzophenone induced the author to resume his studies on the constitution of chrysene. By reason of the pyrogenic synthesis of chrysfluorene from β -benzyl-naphthalene, the suggestion seemed probable that this hydrocarbon and consequently chrysene, is a 2,3-derivative of naphthalene. Commencing with oaphthylbenzoic acid, the author, in conjunction with Schestakow, attempted the synthesis of chrysoketone according to the following formula:—



The resulting compound was identical with the chrysoketone described by Bamberger and Kranzfeld. It is further shown that the acid obtained from naphthalene and phthalic anhydride is an α -derivative, namely, 1 naphthyl-phenylketone-2'-carboxylic acid.

From these results, the author concludes that chrysfluorene—or naphthofluorene, as he prefers to call it—and chrysene are 1-, 2-derivatives of naphthalene.—D. B.

Paraffin, Pine Resin in: Detection and Determination of. J. Klimont. Chem. Rev. u. d. Fett- u. Harzind. 1896, [38], 76–77.

See under XXIII., page 475.

IV.—COLOURING MATTERS AND DYES.

Luteolin. J. Herzig. Ber. 29, 1896, 1013–1014.

THE author calls attention to some points suggested by the work of A. G. Perkin on luteolin, the principle found in the yellow dyestuff *weld*. J. Chem. Soc. Trans. 1896, 206. With reference to the action of alkalis on luteolin, Perkin has confirmed the presence of pyrocatechuic acid in the decomposition products, but was unable to discover any trace of phloroglucol. The author, on the other hand, maintains that he has observed the phloroglucol reaction, and if this observation be proved to be correct, then the supposed close relationship of luteolin to fisetin will no longer hold good. See further, A. G. Perkin, Proc. Chem. Soc. 1896, [165], 105.—J. S.

Thio-Aldolaniline and Aldehyde Green. W. v. Miller and J. Plöchl. Ber. 29, 59–61.

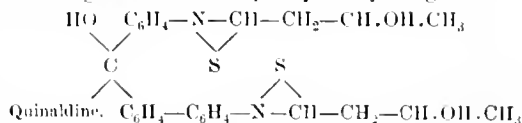
IN the formation of aldehyde green from *p*-rosaniline by the action of *p*-aldehyde and sulphuric acid, one amido group forms the quinoline ring, whilst the other two form aldol groups containing the group :C:N, and this readily forms additive compounds. When aldolaniline—



is warmed on the water-bath with crystallised ammonium sulphide in absolute alcohol, a condensation product is obtained having the formula—



This substance, which melts at 92° C., is white, but after some time turns yellow. It is very easily soluble in ether, alcohol, and benzene, but is almost insoluble in petroleum ether. It is probable that the sulphur in Aldehyde green has a somewhat similar position, the formula of that containing two atoms of sulphur probably being—



and the formula previously given should be modified.

—T. A. L.

Naphthazarin, New Process for the Preparation of.

Ch. Gassmann. Bull. Soc. Ind. de Mulhouse, 1896, 77.

TEN kilos. of 1,5-dinitronaphthalene are dissolved in 100 kilos. of monohydrated sulphuric acid, and to this solution 80 kilos. of fuming sulphuric acid (25 per cent. SO₃) and 5 kilos. of perfectly dry infusorial earth (Kieselguhr) are subsequently added. This mixture is allowed to stand for 12 hours, and is then heated for a short time on the water-bath to complete the reaction. The whole is now poured into 500 kilos. of water, boiled, and the precipitate obtained, filtered from the cooled solution. The residue on the filter is washed free from sulphuric acid, redissolved in a solution of 15 kilos. of caustic soda of 40° B. in 50 litres of water, and the solution is run into one of 8 kilos. of sulphurous acid in 100 litres of water. The naphthazarin is precipitated, filtered, and preserved in the state of a paste. This dyestuff (naphthazarin) is largely used in dyeing chromed wool, or in the state of bisulphite.—C. O. W.

Quinoline and Quinoline Derivatives, An Improvement in Skrap's Process for the Preparation of. C. A. Kneppel. Ber. 29, 1896, 703–709.

QUINOLINE and its derivatives are at present almost exclusively prepared by Skrap's well-known synthesis, in which the nitro compound (usually nitrobenzene) acts primarily as the oxidising agent. In the preparation of quinoline itself by this method a very good yield is obtained, but in the case of nitroquinolines the yield is often small, owing to the formation of resinous substances. Skrap himself has remarked that the yield is smaller the higher the molecular weight.

The author is of opinion that the formation of resin is due to the presence of the nitro compound, and he therefore recommends the use of an inorganic oxidising agent in the shape of arsenic acid (meta-arsenic acid or arsenic pentoxide) which gives in most cases a very good yield.

For the preparation of quinoline, 76 grms. of arsenic acid, 145 grms. of concentrated sulphuric acid, 155 grms. of glycerin, and 50 grms. of aniline are heated on a sand-bath in a flask, connected with a reflux condenser until the reaction sets in. After the reaction is over the contents are kept gently boiling for 2½ hours. The liquid is then diluted with water, excess of caustic soda added, and the quinoline, together with the unattacked aniline, is distilled off in a current of steam. Sodium nitrite is now added to the distillate, mixed with excess of hydrochloric acid until the smell of nitrous acid becomes permanent, even after shaking, when the liquid is boiled to destroy all the diazo-benzene hydrochloride. Finally, excess of caustic soda is added and the quinoline distilled over with steam and extracted from the distillate with ether. The yield is 46 grms. According to Skraup, 50 grms. of aniline and 32 grms. of nitrobenzene give 55 grms. of quinoline. 32 grms. of nitrobenzene thus only increase the yield by about 7 grms. The author further describes the preparation of orthotoluquinoline, orthonitroquinoline, paranitroquinoline, paradimethylamidoquinoline, metanitroquinoline, metadimethylamidoquinoline, paraquinoline sulphonic acid, β -naphthoquinoline, β -anthraquinoline, and 1-dioxy- β -anthraquinoline ("Alizarin blue").—J. S.

Morin. Part I. B. Bablich and A. G. Perkin.

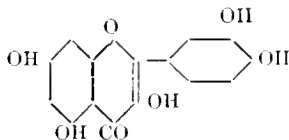
Proc. Chem. Soc. 1896, [165], 106–107.

THE yellow colouring matter, morin, exists, as has been known for some time, in old fustic (*Morus tinctoria*), and has lately been shown by one of the authors and F. Cope (this Journal, 1895, 1041) to be also contained in the Indian dyestuff, jackwood (*Artocarpus integrifolia*). By means of its compounds with mineral acids the true formula of morin was established by one of the authors and L. Pate (this Journal, 1895, 745) to be $C_{15}H_{10}O_7$.

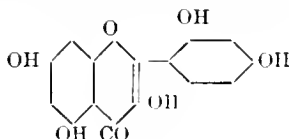
The principal reactions of morin described by previous workers are its behaviour towards alkaline reducing agents (Hlasiwetz and Pfandler, *Jahresb.* 1864, 527), by which means it yields phloroglucol and β -resorcylic acid, and towards fused alkali, when it gives phloroglucol and resorcinol.

The results of the authors demonstrate a close similarity between quercetin and morin. Quercetin yields with fused alkali phloroglucol and protocathecinic acid, morin, phloroglucol and β -resorcylic acid.

The formula of quercetin appears to be (Herzig, *Ber.* 1895, 28, 293)—



and it seems most probable that the formula of morin is represented by that of quercetin, in which the catechol nucleus has been displaced by a resorcinol group, thus—



PATENTS.

Colouring Matters [Reds and Violets], Improvements in and relating to the Manufacture of. H. H. Lake, London. From Farbwerk Mühlheim a. M., Germany. Eng. Pat. 10,669, May 29, 1895.

THE invention is that of a new ethylamidonaphthol sulphonic acid, which combines with diazo or tetrazo

compounds to form valuable colouring matters. On sulphonating ethyl- β -naphthylamine hydrochloride in three times its weight of sulphuric acid monohydrate by adding 20 per cent. anhydride at 40° C., a mixture of isomeric sulphonic acids is obtained, the sodium salt of one of them, termed A, being soluble in cold spirit. When the sulphonation takes place at 140° C. with monohydrate only, another sulphonic acid is obtained, termed B, which is also sparingly soluble in water. When these acids are further sulphonated with five times their weight of 20 per cent. anhydride, a disulphonic acid is obtained, which is easily soluble in water, and in an alkaline solution has a bluish-green fluorescence. When heated with caustic potash at 200° C. in aqueous solution, it is converted into 3.1'.3'-ethylamidonaphthol sulphonic acid, which can be separated by acidifying a tolerably concentrated alkaline solution. The new compound, when combined with diazo-azo derivatives, gives cotton colouring matters, and can also, of course, be combined with tetrazo compounds, the dyestuffs being characterised by great purity of shade. For instance, aniline is diazotised and combined with α -naphthylamine hydrochloride. When the combination is complete, after about 12 hours, the benzene-azo- α -naphthylamine hydrochloride is further diazotised by means of sodium nitrite in an acid solution, and the diazo solution, after filtering, is run into the calculated quantity of ethylamidonaphthol sulphonic acid kept alkaline with sodium carbonate. The violet colouring matter separates at once, and is best kept as a paste. Amido-azobenzene sulphonic acid, when diazotised and combined with the new compound, gives a red colouring matter, which is salted out from the hot solution.

—T. A. L.

Azo Dyestuffs [Violet and Blue-Blacks], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 11,228, June 7, 1895.

THESE colouring matters are derived from acidyl derivatives of *m*-diamines, capable of being combined with diazo and tetrazo compounds (*cf.* Eng. Pat. 10,668 of 1895; this Journal, 1896, 351). Such acidyl diamines are acetyl-*m*-phenylene diamine, acetyl-*m*-tolylene diamine, *m*-amido-phenylene, and *m*-amidotolylene oxamic acid. The following is a typical example resulting in the formation of a violet-black colouring matter. The diazo solution from 14.3 kilos. of α -naphthylamine is run into a solution of 18 kilos. of *m*-amidophenylene oxamic acid containing a small quantity of caustic soda lye, and an excess of sodium acetate. After agitating for 24 hours the mixture is made alkaline and raised to 50° C. The amido-azo compound formed, is then filtered off, mixed with a small quantity of water, 7 kilos. of sodium nitrite, and sufficient hydrochloric acid at about 5°–10° C. The diazotisation is complete in about 12 hours, and after filtering off the diazo compound it is added to an alkaline solution of 22.4 kilos. of 1.4'-naphthol sulphonic acid. The combination requires about 12 hours, when the mixture is heated to 50° C. and the dyestuff salted out, filter-pressed and dried. It gives violet-black shades on wool, which, after treatment with potassium bichromate, are fast to washing and fulling. The production is also claimed of the simple azo dyes obtained by combining the diazo compounds of the amidophenylene oxamic acids, their homologues and analogues, with the usual dyestuff components. Certain of the compounds derived from tetrazo derivatives and two molecular proportions of an acidyl diamine, when dyed, can be diazotised and further combined on the fibre. In all cases dark shades are obtained.—T. A. L.

Dyestuffs [Blacks and Blues] suitable for Dyeing Cotton, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 11,276, June 8, 1895.

By the action of alkaline sulphides on 1.1' or 1.4'-dinitronaphthalene, or tri- or tetranitronaphthalenes, certain dinitronaphthalene sulphonic acids or certain dinitrohalogen naphthalene derivatives, products are obtained

which may either be used directly as dyestuffs or may be further converted by the action of acids. These latter products in their turn can undergo a further change by the further action of alkalis, alkaline sulphides, sulphites, &c. Two kilos. of 1,1'-dinitronaphthalene are added to 8 kilos of sodium sulphide fused in an oil-bath. A violent reaction sets in, the melt being subsequently heated until it has become homogeneous. After cooling, it is dissolved in water, filtered, and evaporated to dryness. Unmordanted cotton is dyed from a cold concentrated solution of the dyestuff, a deep black shade fast to acids, alkalis, light, washing, and fulling. By using a much larger proportion of sulphide (12:1) and heating until a dark-bluish homogeneous liquid is obtained, a dyestuff is produced which, when employed in a similar manner, gives blue shades. By heating these and similar dyestuffs with acids, products are obtained which dye unmordanted cotton black from hot alkaline baths containing oxidisable substances, such as grape sugar, glycerin, or the like. When treated with alkalis, alkaline sulphides, sulphites, or bisulphites, the products may be used for dyeing unmordanted cotton directly. The following example illustrates these two methods:—One kilo. of finely powdered 7-trinitronaphthalene (1,4,1') in 150 litres of water, is boiled with 12 kilos. of crystallised sodium sulphide until dissolved, when the solution is filtered and mixed with 10 kilos. of concentrated hydrochloric acid, which throws down a greyish-black precipitate. After heating the acid mixture for some time, the liquid is allowed to cool, and the intermediate compound, which forms a bluish-black mass, is filtered off. It may be used directly for dyeing purposes, giving black shades on unmordanted cotton when dyed from a hot alkaline bath in presence of oxidisable substances such as grape sugar or glycerin, or it may be converted into a colouring matter giving similar shades from a cold bath by treatment with alkalis, alkaline sulphides, sulphites, or bisulphites, when it is used preferably as a paste.—T. A. L.

Chemical Compounds [Stable Diazo Salts] suitable for the Production of Colouring Matters in Bulk or on Fibre, The Manufacture of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 11,557, June 17, 1895.

THIS is an extension of Eng. Pat. 8989 of 1895 (this Journal, 1896, 349), referring to the production of so-called tetrazo salts. According to the present invention, not only do the β -naphthol trisulphonic acids and their salts give sparingly soluble tetrazo salts, but this property is also shared by 2,1-naphthol sulphonic acid and its salts. In addition, the patentees have also discovered that the diazo compounds of nitramines, such as nitraniline, also give stable sparingly soluble salts with β -naphthol trisulphonic acid or with 2,1-naphthol sulphonic acid, and these compounds they term diazo salts. As an example of the preparation of one of these latter, a solution of 24.6 kilos. of 2,1-naphthol sodium sulphionate is run into the diazo solution from 13.8 kilos. of *p*-nitraniline and 7 kilos. of sodium nitrite in presence of hydrochloric acid. The diazo salt separates as an orange-yellow precipitate, having probably the formula $O_2N.C_6H_4.N=N.SO_3Na.C_{10}H_6O$. It is filter-pressed and may be used for combinations in place of *p*-nitrodiazobenzene chloride.—T. A. L.

Dyestuffs [Safranines], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 11,843, June 18, 1895.

THESE dyestuffs, which are identical with those obtained according to Eng. Pat. 9610 of 1894 (this Journal, 1895, 478), are obtained by the oxidation of a molecular proportion of a *p*-amido-alkylaniline (such as *p*-amidomethyl- or ethylaniline) together with two molecular proportions of *o*-toluidine and a mixture of equimolecular proportions of *o*-toluidine and a primary aromatic amine, such as aniline, xylidine, or the like. These alkyl-tolu-phenosafranines can also be produced by the oxidation of a mixture of equi-

molecular proportions of *p*-tolylenediamine and an alkylaniline (methyl- or ethylaniline) and a molecular proportion of a primary aromatic amine. The same products can also be obtained by other methods employed for the production of safranines; for instance, by condensing one molecular proportion of a nitroso-alkylaniline with two molecular proportions of *o*-toluidine, or a mixture of equimolecular proportions of *o*-toluidine and another primary base, or else by the reaction of equimolecular proportions of quionedi-chlorodi-imide, an alkylaniline, and *o*-toluidine, or by the action of toluquinonedichlorodi-imide on an alkylaniline and any primary amine.

An aqueous solution containing 19.4 kilos. of *p*-tolylene-diamine hydrochloride and 16 kilos. of ethylaniline hydrochloride has added to it as a 5 per cent. solution, 20 kilos. of potassium bichromate and a small quantity of acetic acid. When the formation of the indamine is complete, 13 kilos. of aniline hydrochloride in solution are added, and afterwards the same quantity of potassium bichromate as above. The mixture is gently heated on the water-bath, and the safranine, which is separated in the usual manner, dyes tanned cotton bright red. The same colouring matter can be obtained as follows:—An alcoholic solution of 17.2 kilos. of nitrosomethylaniline hydrochloride and 22 kilos. of *o*-toluidine is heated on the water-bath until a pure red solution is obtained. A small quantity of acetic acid is then added, and 20 kilos. of potassium bichromate as a 5 per cent. solution. After the reaction has ceased, the alcohol is distilled off, and the safranine is separated in the usual manner.—T. A. L.

Purpurine-sulpho Acid and Purpurine, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst a. M., Germany. Eng. Pat. 12,094, June 21, 1895.

By oxidising alizarin sulphonic acid in sulphuric acid solution with nitric acid or a nitrate, it is converted into a purpurin sulphonic acid, and this, on heating with concentrated sulphuric acid or dilute mineral acids under pressure, is converted into purpurin. 50 kilos. of alizarin are sulphonated with 200 to 300 kilos. of fuming sulphuric acid (10–20 per cent. SO_3) at 120° – 150° C. until soluble in water. After dilution with sulphuric acid (66° B.), the melt is cooled and has carefully added to it $1\frac{1}{2}$ molecular proportions of nitric acid or a nitrate, the temperature being kept below 10° C. The melt is constantly agitated for about a day, and is finally heated on the water-bath. It is then poured into water, and the purpurin sulphonic acid separated by means of potassium chloride as the potassium salt, which forms sparingly soluble small red crystals. In dilute alkali the product is soluble with a red colour, whilst alizarin sulphonic acid dissolves to a bluish-red. When dyed on an alumina mordant, purpurin sulphonic acid gives a fiery red, much bluer than the shade obtained with alizarin sulphonic acid.—T. A. L.

Azo Colouring Matters [Blacks and Greys], Improvements in the Manufacture of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 12,529, June 28, 1895.

IN Eng. Pat. 7859 of 1894 (this Journal, 1895, 361) a process is described for the manufacture of dyestuffs by combining equimolecular proportions of a diazo compound and 1,1',4,3'-amidonaphtholdisulphonic acid. It has now been discovered that the amidonaphtholdisulphonic acid will combine with two molecular proportions of a diazo compound, which may be the same or different. The diazo solution from 14.3 kilos. of α -naphthylamine is added to a solution of 34.1 kilos. of the acid sodium salt of 1,1',4,3'-amidonaphtholdisulphonic acid in presence of sodium acetate. When the combination is complete, sodium carbonate is added, and afterwards the diazo derivative from 17.3 kilos. of sulphilic acid, the solution being kept alkaline by means of sodium carbonate. The dyestuff is separated in the usual manner and gives black shades on wool.—T. A. L.

Brown to Black Azo-Colouring Matters Dyeing Direct on Cotton, Manufacture of New. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst a.M., Germany. Eng. Pat. 12,607, June 29, 1895.

THESE are colouring matters of the general formula:—Diazo-compound. N.D.M. diazo-comp., where D is tetrazo-diphenyl or ditolyl, N is 1.1'-dihydroxynaphthalene mono- or disulphonic acid, and M is a *m*-diamine. A number of different examples are given, of which the following may be taken as a typical one:—The tetrazo compound from 2.12 kilos. of tolidine is combined with the azo colouring matter from 2.25 kilos. of diazotised naphthionic acid, and the calculated quantity of chromotrope acid or dihydroxynaphthalene sulphonic acid S, together with 3 kilos. of sodium carbonate. When the formation of the intermediate compound is complete, a solution of 1.08 kilos. of *m*-phenylene diamine is added. The trisazo colouring matter so formed is further combined with the diazobenzene sulphate from 2.31 kilos. of sodium sulphanilate in presence of 1 kilo. of sodium carbonate. The colouring matter is separated in the usual manner. It dyes easily on unmordanted cotton and gives shades fast to light.—T. A. L.

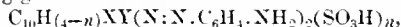
Hydroxyanthraquinone, The Manufacture or Production of Derivatives of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 12,667, July 1, 1895.

ACCORDING to Eng. Pat. 975 of 1894 (this Journal, 1895, 30), anthraquinone is converted into derivatives of hydroxyanthraquinone when heated in sulphuric acid in presence of boric acid with nitrous acid, or with salts which yield nitrous acid under these circumstances. By treating 8-hydroxyanthraquinone in this manner it might have been expected that purpurin would have been obtained. As a matter of fact the chief product is quinizarin, only small quantities of purpurin being formed. The following are the proportions given in an example:—A solution of 10 kilos. of 8-hydroxyanthraquinone in 200 kilos. of sulphuric acid (100 per cent.) has added to it 10 kilos. of crystallised boric acid and 13 kilos. of sodium nitrite. The melt is kept at 220°–230° C. until it has become an intense yellowish-red, and a considerable amount of quinizarin has been formed, which may be determined by spectroscopic examination. After cooling, the melt is poured into water, heated to boiling, and the precipitate is filtered off. It contains a small quantity of purpurin, which may be removed by treatment with sulphate of alumina solution, in which the purpurin is soluble. The residue, after drying and crystallising from glacial acetic acid, gives pure quinizarin.

—T. A. L.

Direct-dyeing Azo Colouring Matters, Manufacture of. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 15,947, July 22, 1895.

IN Eng. Pat. 7969 of 1895 (this Journal, 1896, 270), colouring matters are described which are derived from the tetrazo compounds of diamido derivatives having the following general formula:—



in which X and Y are suitably placed amido or hydroxyl groups. It has now been discovered that these diamido compounds may be diazotised by the action of one molecular proportion of nitrite, and the diazo compounds thus formed will combine with one molecular proportion of an amine or a phenol to form strong colouring matters fast to light and acids. For instance, the dark blue diazo solution from 28 kilos. of the diamido compound—

1.1'.2.2'.3.3'.C₁₀H₂.NH₂(OH)(N:N.C₆H₄.NH₂)(SO₃H)₂ and 3.5 kilos. of sodium nitrite in presence of hydrochloric acid, are allowed to run into a solution of 7.2 kilos. of β-naphthol kept alkaline. The colouring matter separates as a dark precipitate, and after agitating for some time it is salted out, filter-pressed, and dried. It dyes cotton a bluish-black.—T. A. L.

New Brown Azo Dye-stuffs and Method of Producing the same. H. H. Lake, London. From K. Oehler, Offenbach a.M., Germany. Eng. Pat. 14,633, Aug. 1, 1895.

THE orange dye-stuff obtained from diazotised tolylene diamine sulphonic acid (CH₃.NH₂.SO₃H:NH₂=1:2:4:6), β-naphthylamine, and *m*-phenylene diamine (Eng. Pat. 17,546 of 1892; this Journal, 1893, 674), can, according to the present invention, be further combined with one molecular proportion of a diazotised amidosulphonic acid—for instance, diazonaphthionic acid—to give a very fast yellowish-brown cotton dye-stuff. The dye-stuff obtained according to the foregoing patent from 10.1 kilos. of tolylene diamine sulphonic acid, 9 kilos. of β-naphthylamine hydrochloride, and 10.3 kilos. of *m*-phenylene diamine sulphate, has added to it the diazonaphthionic acid prepared from 13 kilos. of sodium naphthionate. After stirring for 24 hours the mixture is heated and neutralised with soda, when the dye-stuff formed is salted out, filter-pressed, and dried. It forms a dark brown powder soluble in water with a yellowish-brown and in concentrated sulphuric acid with a dirty violet colour. Hydrochloric acid precipitates the colouring matter in brown flocks from its aqueous solution. It dyes cotton a yellowish-brown.

—T. A. L.

New Colouring Matters Dyeing Cotton without Mordants, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 5167, March 7, 1896.

THE process described depends upon the fact that the azo colouring matters obtained from diazobenzaldehyde and a dye-stuff component will condense with hydrazine (diamide) H₂N.NH₂ to form colouring matters which will dye unmordanted cotton. The condensations can be performed in a number of different ways, the specification containing 19 claims. The following may be taken as a typical example illustrating the production of a wool dye-stuff which is subsequently converted into a cotton colouring matter:—8 kilos. of *p*-amidobenzaldehyde hydrochloride and 10 kilos. of hydrochloric acid are dissolved in water cooled with ice and diazotised with 3.5 kilos. of sodium nitrite. After filtering, the solution is run into an aqueous solution containing 16 kilos. of 1.1'.3.3'-amidonaphthol disulphonic acid cooled with ice and containing an excess of sodium acetate. The mixture, after standing 12 hours, is neutralised with soda, which changes the reddish-violet colour to a bluish-violet, and a solution of diazobenzene from 4.7 kilos. of aniline is then run in. The combination is complete in about 12 hours, and after heating to boiling, the colouring matter is salted out and filter-pressed. It forms, when dry, a brown powder, dissolves in water to a blue solution, and gives deep bluish-black shades on wool from an acid bath, fast to fulling. In order to convert it into a cotton colouring matter, 6 kilos. are dissolved in about 200 litres of water, acetic acid is added until the solution is distinctly acid, and then a solution of 0.8 kilo. of hydrazine sulphate in 8 litres of a 10 per cent. sodium carbonate solution is added and the mixture is heated for about three-quarters of an hour, when, after adding an excess of sodium carbonate and letting stand half an hour, the colouring matter is salted out, filter-pressed, and dried. It dyes unmordanted cotton indigo-blue shades.—T. A. L.

Thiazine Colouring Matters, Process for the Transformation of the Thiosulphonates of the Indamines and Indophenols into. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 5268, March 2, 1896.

IN the preparation of thiazine colouring matters from the thiosulphonates of the corresponding indamines and indophenols the reaction has hitherto been carried out in dilute aqueous solutions at about the boil, in presence of zinc chloride. The patentees propose to effect this transformation, without the presence of water, in sulphuric acid monohydrate, with or without the presence of fuming sulphuric acid, sulphuric chlorhydric, pyrosulphates, chlorides, or the like, at ordinary temperatures or at temperatures between 60° C. and 80° C. The process is appli-

cable to a number of indamine and indophenol thiosulphonates which are mentioned in the claims. A solution of 10 kilos. of tetra-ethylindamine thiosulphonate in 50 kilos. of fuming sulphuric acid (24 per cent. SO_3) is heated at 80—100° C. until of a deep green colour. After cooling somewhat, the melt is poured into 300 litres of water and mixed with salt and 50 kilos. of a 20 per cent. zinc chloride solution. The ethylene blue gradually crystallises out in green bronzy needles.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

PATENTS.

Klof, Ramie, and China Grass, Improvements in the Treatment of. R. W. E. Melvor and J. Chester, London. Eng. Pat. 12,218, June 24, 1895.

The material, in strips or ribbons, is boiled for $\frac{1}{2}$ —2 hours in a 2 per cent. solution of borax. At the end of this period there is added to the solution a composition consisting of four parts of soft soap and one part of oil containing 5—10 per cent. of its bulk of turpentine, the whole mixture forming about one-tenth of the liquid in the vat. Boiling is continued until the bark and fibre are readily separated, and the material is then washed in hot water and dried.—R. B. B.

Silk and Silk Waste, Improved Process for Loading. C. E. Fuller and A. Biermann, Crefeld, Germany. Eng. Pat. 5332, March 11, 1896.

In addition to the successive treatment with stannic chloride, sodium phosphate, and sodium silicate comprised in the usual process, the silk is further treated in a solution of an aluminium salt at 1—15° B., in which the material is heated for 20—90 minutes. It is claimed that by this means an increased weight of 50 per cent. for each application is obtained, and that durability is also enhanced.—R. B. B.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Lactic Acid, its Properties and Uses in Dyeing, Printing, and Finishing. C. Dreher. *Färber Zeit.* 1896, 7, 233—236. (See also this Journal, 1882, 363; 1883, 176; 1885, 116; 1886, 677; 1891, 362; 1896, 196; also J. Soc. Dyers and Col., 1895, 98.)

The author has now used lactic acid in wool-dyeing for two years, and has studied its properties for other possible uses.

Lactic acid has the advantage over oxalic acid that it is not poisonous, and over acetic acid that it is not volatile. Its viscosity in the pure state is greater than that of glycerin; it wets and penetrates both animal and vegetable fibres easily, and imparts to the fabric a soft feel, as glycerin does. Of greatest importance, however, is its property of being readily oxidisable by chromic acid.

Lactic acid being readily oxidised at low temperatures, it is best to let the oxidation proceed at 52·5° C., and to raise to boiling only towards the end. The wool should be well washed and wetted out before entering, and the oxidation is to be promoted by the addition of a little sulphuric acid rather than by continued boiling, which is detrimental to the fibre.

Author recommends as the most suitable proportions: 2·5 kilos. of lactic acid (30 per cent.), 2·75 kilos. of potassium bichromate, and 0·5 kilo. of sulphuric acid, which gives the same results as with 2·5 kilos. of best refined tartaric acid, 3·0 kilos. of potassium bichromate, and 0·35 kilo. of sulphuric acid.

Dyeing operations on wool mordanted as above showed very "fiery" results; the material had a fine, soft "handle" and a beautiful lustre, and was superior in respect of these qualities to dyeings where tartaric acid had been used.

Trials with pure lactic acid have shown that it is particularly suitable for printing on wool, but with acid dyestuffs (sulphonic acids) it has been found too weak. In combination with sulphuric or tartaric acid, however, much better

results as regards evenness and depth of shade are obtained, particularly with "Brilliant" and "Naphthol blacks," than when sulphuric or tartaric acid is used alone. The printing composition wets exceedingly well. A saving in tartaric acid may be effected by substituting lactic acid for a part of it; but too much of the lactic acid must not be used, as otherwise the colour is liable to "run" during steaming.

In many cases lactic acid may also take the place of glycerin both for printing and finishing, and particularly where its feebly acid character is without detriment it may be useful for vivifying the colour.—I. S.

Electrolytic Bleaching. M. G. Saget. *Monit. Scient.* 1896, 257—258.

The author has investigated, comparatively, the action upon cellulose of Hermite's solution, obtained by electrolysis of a solution of magnesium chloride and sea salt; Gebauer-Knoeffler's solution, which is prepared by electrolysis of sodium chloride solution free from magnesium chloride, and a solution of ordinary bleaching powder.

According to the descriptive pamphlet by Dübosc, oxycellulose is not formed by Hermite's liquor; but Gebauer and Knoeffler raised the question by stating, in their circular, that as salts of lime and magnesia are absent from their solutions, the formation of spots due to these salts is avoided. The author's experiments show that just the same precautions are necessary with the electrolytic solutions as with ordinary chloride of lime solution. Two series of experiments were made. In the first series, the tissue was completely immersed in the liquid and exposed to the sun; under these conditions, oxycellulose was not formed with Gebauer's solution provided the available chlorine was less than 0·25 gm. per litre; or with Hermite's liquor if the chlorine did not exceed 0·26 gm.; but with ordinary bleaching powder solution, as much as 0·54 gm. chlorine might be present. In the sun, therefore, the action of the electrolytic solutions is more energetic than that of bleaching powder solution. In the second series of experiments, the tissue was partially immersed, in the shade, the liquid being drawn up into the fabric by capillarity. In this case, chloride of lime was the most active, oxycellulose being distinctly formed even with less than 0·30 gm. chlorine per litre, whilst the Hermite and Gebauer liquors of the same available strength formed none.

As it appeared possible that free chlorine might be present in the electrolytic liquor, an experiment was made with chlorine water; but not a trace of oxycellulose was formed in the shade, even with a concentration of 2 gm. per litre. On the contrary, with exposure to the sun, free chlorine energetically attacks the tissue, unless the strength of the solution fall below 0·25 gm. per litre.

A solution of magnesium hypochlorite, prepared by the action of a current of chlorine upon magnesia suspended in water, behaved very much like Hermite's solution; but a solution prepared by double decomposition between magnesium sulphate and chloride of lime, behaved exactly like bleaching powder solution.

Comparative results show that Hermite's solution is more active than Gebauer's, due no doubt to the instability of magnesium hypochlorite. Not improbably, by electrolysis, a more active persalt of magnesium is formed, which adds its effects.

It is not surprising that, in the experiments made in the shade, bleaching powder solutions gave most oxycellulose; this is attributable to the presence of free alkali, which is known to facilitate the oxidation of cellulose.

As a bleaching agent, Hermite's solution is the most active, Gebauer's next, and chloride of lime least. Very good pure whites may be obtained with Hermite's solution, containing not more than 0·30 gm. active chlorine per litre; to obtain the same result with bleaching powder, a solution of almost double the strength is required. Hermite's solution of the strength named is harmless to the cotton fibre, and the formation of oxycellulose is prevented by exclusion of the direct rays of the sun.—L. A.

Cellulose, Action of Nitric Acid on. E. Kuecht. J. Soc. Dyers and Colourists, 1896, 12, 89—90.

If cotton be placed for 15 minutes in pure nitric acid of 82° Tw. and then washed and dried, it is found that considerable contraction of the fibre results and that the material increases in weight and tensile strength. More dilute acid tenders and weakens it. Analysis shows that partial nitration of the cellulose has occurred, and its behaviour towards direct cotton dyestuffs, from which baths it takes a three or four times deeper shade than ordinary cotton, points to the fact of mercerisation. It will not dye with basic colours, hence, argues the author, no oxycellulose has been formed. The use of strong nitric acid for stripping certain colours and for mercerising, is suggested.—H. I.

Cotton, A New Method of "Animalising." E. Kuecht. J. Soc. Dyers and Colourists, 1896, 12, 90—91.

250 grms. of wool are dissolved in an equal weight of barium hydrate. The barium is then precipitated with carbon dioxide, the clear solution made up to 1 litre, and 10 per cent. of commercial formaldehyde (40 per cent. strength) added. Cotton, when padded with this solution, dried, and steamed for half an hour under pressure (15 lb.), after washing, may be dyed directly with any acid or basic dyestuff, but the shades produced are not so fast as on wool.

The author has not been able to animalise cotton by L. Vignon's process, *viz.* treatment with zinc or calcium chloride and ammonia under pressure.—H. I.

Manganese Bistres, Albumin Discharges on. A. Brandl. Bull. Soc. Ind. de Mulhouse, 1896, 79.

AFTER trials with various reducing agents, the best results were obtained with a printing colour in which sodium bisulphite and ammonium sulphocyanide formed the reducing agents. The printing colour was prepared by mixing 350 grms. of British gum with 200 grms. of glycerin and 1,350 grms. of sodium bisulphite (40 B.). This mixture was heated to 50° C. on the water-bath, and, after cooling, 500 grms. of albumin solution (50 per cent.) and 1,000 grms. of ammonium sulphocyanide were added, dissolved by agitation, and strained. For printing, 1,000 parts of thickening to from 750 to 1,000 of the above printing colour are used. After printing, the goods are steamed for from 2 to 3 minutes, lightly washed, and dried.—C. O. W.

Paper Colouring [in the Engine]. H. Spitteler. Papier Zeit. 21, 1896, 763.

The author advises, in certain cases, the addition of albumin as an auxiliary in dyeing pulps in the engine with soluble dyestuffs. The quantity required is 0.5 to 1.0 per cent.

It should be added to the stuff when half beaten. It is rendered insoluble, and therefore becomes fixed, by the alum subsequently added.—C. F. C.

Mercerising, Improvements in Effects obtained by. W. E. Kay. Textile Colorist, 1896, 18, 101.

In this method, in the case of aniline black, the fabric is first treated with a solution capable of forming aniline black when steamed. That portion of the pattern which is to be felled ("crinkled") is next treated with a thickening prepared from a highly baked dextrin, which acts as a resist to the mercerising material, and to this is added an aniline black resist, and, when desired, a suitable colour. The black is then developed on the ground, the printed portions resisting it. After this, the fabric is padded with a solution of caustic alkali (about 54° B.), which shrinks the portions not treated with gum resist, and so produces the crinkling of the pattern. After leaving the padding machine, the fabric is allowed to lie for a short time, to let the caustic complete its action, prior to washing and finishing.

In the case of ordinary dyes, the process is analogous. The fabric is first dyed all over, the pattern which is to be crinkled is printed with a gum resist to prevent mercerisation, but, in addition, chemical reagents capable of discharging or destroying the dye when subjected to steaming, are admixed, and also, when desired, a suitable colour. After steaming to effect the discharge, the non-printed part is mercerised by padding with caustic soda as before.

The resist and discharge materials may sometimes be printed before the fabric is dyed.—A. S.

PATENTS.

Soluble Colloids, such as Gelatin and Isinglass, Improvements in the Formation and Preparation of. E. J. Mills. Glasgow. Eng. Pat. 8847, May 4, 1895.

See under XIV., page 462.

Beta-Naphthol on the Fibre, Process for the Partial or Total Destruction of [in Calico Printing], by Oxidation by Means of Persulphates. O. Inray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Höchst a Main, Germany. Eng. Pat. 12,162, June 22, 1895.

To obtain coloured discharge effects with the naphthol-azo colouring matters produced directly upon the cotton fibre, the only possible process appears to be that in which the discharge colours are also naphthol-azo compounds. For this purpose a substance must be added to the printing colour, which, after the formation of the dye, prevents the naphthol from further coupling when worked in a diazo solution; such substances the inventors have discovered in the persulphates. As an example of the process, the goods after preparation with β -naphthol are printed with a blue discharge colour consisting of diazotised d'anisidine, copper chloride, ammonium persulphate, stannic chloride, and suitable thickening. The addition of stannic chloride is found to increase the effect of the persulphate. The goods are then dyed in a solution of diazotised paranitraniline, to which acetate of soda and ammonium oxalate are added.

—R. B. B.

Fibre, Vegetable and Animal: Improvements in Apparatus for Treating with Liquids. J. F. Lester, Atlanta, Georgia, U.S.A. Eng. Pat. 6318, March 21, 1896.

THE dyeing, bleaching, or scouring liquid is caused to circulate through a cylindrical digesting vessel. Along each side of this vessel a series of pipes is arranged, one series connected with the inlet, the other with the outlet for the liquid. Joining these is a number of transverse pipes, alternately communicating with the first and second series above described. Those connected with the inlet series are perforated tangentially, and are capable of revolving, thus distributing the liquid in a spray through the fibre, which is placed in wire cages between the pipes. The transverse pipes communicating with the outlet series are rigid and perforated radially, and serve to remove the liquid from the digester.—R. B. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Cyanogen, Formation of, from Ammonia. E. Bergmann. J. für Gasbeleucht. 1896, 39, 117.

THE experiments of Bueb are first recapitulated. Bueb found that only a small quantity of hydrocyanic acid was produced by the action of ammonia upon charcoal at 800° C., about 4 per cent. of the nitrogen of the ammonia being converted into cyanogen. At 1,000° C. he found that 24 per cent. of the nitrogen became combined as cyanogen. On passing a mixture of ammonia and coal-gas over charcoal heated to between 1,150°—1,180°, 60 per cent. of the nitrogen was recovered as cyanogen, 20 per cent. remained as undecomposed ammonia, and 20 per cent. was liberated as free nitrogen. The author has continued Bueb's investigations, and has examined into:—(1.) The influence of coal-gas upon ammonia in the

presence of red-hot charcoal. (2.) The influence of carbonic oxide, producer gas, &c. (3.) The influence of temperature upon the yield of cyanogen.

(4.) Five experiments were made by passing coal-gas and ammonia over heated charcoal. Hydrocyanic acid, and not ammonium cyanide, was produced. A table gives the data of the experiments.

(5.) When the coal-gas was carburated with pentane, the cyanogen formation increased as the amount of pentane decreased. The author explains this by ascribing it to the dilution of the ammonia by the products of decomposition of the pentane.

(6.) When carbonic oxide, producer gas, and mixtures of hydrogen and nitrogen were used instead of coal-gas, the formation of cyanogen proceeded in the same way as with coal-gas, except that more of the ammonia was decomposed.

Experiments with ammonia and carbonic oxide without charcoal gave only minute quantities of cyanogen. The most favourable temperature for the formation of cyanogen was found to lie between 1,000 and 1,100°.—H. S. P.

Perchlorates, Quantitative Estimation of. D. A. Kreider. *Zeits. anorgan. Chem.* 1895, **10**, 277.

See under XXIII., page 473.

Aluminium Sulphate. *Papier Zeit.* **21**, 1896, 599 and 794.

See under XXIII., page 473.

PATENTS.

Acid Vapours, Improvements in Condensing and Cooling Apparatus for. E. Hart, Easton, Pennsylvania, U.S.A. Eng. Pat. 12,383, June 26, 1895.

This is an improvement on Eng. Pat. 17,289, 1894 (this Journal, 1197, 1894), wherein an apparatus is described and shown for condensing nitric acid and other vapours, the condensing chamber of which consists of a number of parallel glass tubes, cooled by a fall of water delivered from a pipe over the topmost tube. To prevent fracture of these tubes, while heated, by the cold water, it is now provided that they be covered by some porous material serving to distribute the water (which may be warmed) over the whole surface. Preferably, each tube is separately wrapped in cheese cloth. A heater is shown through which the water for sprinkling may be passed. In other respects the apparatus conforms to that shown in the abstract cited.

—E. S.

Zinc Chloride and other Metal Chlorides, Improvements in and relating to the Manufacture of Solutions of. C. Hoepfner, Giessen, Germany. Eng. Pat. 8449, April 29, 1895.

Zinc oxide, obtained, for instance, by roasting zinc blende, is treated with sulphurous acid, any excess of acid is distilled off or neutralised, and the zinc sulphite is decomposed by a solution of calcium chloride, to obtain zinc chloride in solution. The precipitated calcium sulphite may be dissolved by sulphurous acid, and utilised for the manufacture of wood pulp. Zinc sulphite obtained as described may be oxidised by exposure to warm air, or to oxygen or chlorine, and the resulting sulphate be decomposed by sodium or potassium chloride: the alkali metal sulphate is then crystallised out, zinc chloride being left in solution. Zinc and chlorine may be obtained from the solution by electrolysis.—E. S.

Salt, Improvements in or relating to the Manufacture of. E. P. Gutierrez, Cabezon de la Sal, Spain. Eng. Pat. 1729, Jan. 24, 1896.

There is claimed "the combination with a process of melting salt and moulding it afterwards, for the use of animals, of the utilisation of the heat from the melting furnaces for manufacturing salt for cooking purposes, by evaporating salt water in suitable boilers," &c.—E. S.

Silicic Acid from Argillaceous Substances [Sulphate of Alumina and Compact Silica], An Improved Process for the Separation of. F. Brünjes, Langelsheim am Harz, Germany. Eng. Pat. 6157, March 19, 1896.

The attack of argillaceous substances by waste sulphuric acid from tar and oil refining is attended by the difficulty that, owing to the organic matter present, the sulphate of alumina formed is impure and strongly coloured. The patentee seeks to remove this disability and at the same time to obtain the silica separated from the clayey material in a filterable condition, by adding molasses, starch, &c. in the proportion of 0.1 to 0.5 per cent. for each 1 per cent. of silica to be set free.—B. B.

VIII.—GLASS, POTTERY, ENAMELS.

Metallic Deposits on Porcelain, Glass, &c., Production of. Hansen. D. Töpfer- und Ziegler Zeit. **19**, 774.

To prepare the surface of glass or porcelain for the production of these metallic deposits by the electrolytic method, the author makes use of a solution of gold or platinum salt in ether, to which is added sufficient of a solution of sulphur in paraffin oil to render the mixture of a consistency such that it can be readily applied with a brush. The article so treated is then heated in the kiln.

For the production of copper, silver, or gold deposits, the following baths are recommended:—*Copper*:—2 parts of copper sulphate in 3 parts of distilled water. *Silver*:—17 parts of silver nitrate and 13 parts of potassium cyanide in 300 parts of distilled water. *Gold*:—7 parts of metallic gold are dissolved in aqua regia and precipitated with ammonia; the moist precipitate is then dissolved in a hot solution of 9 parts of potassium cyanide in 90 parts of distilled water.—J. G. W.

PATENTS.

Muffle Furnaces [Pottery and Enamels], Improvements in. A. Helzel, Bodenbach, Austria-Hungary. Eng. Pat. 10,067, May 21, 1895.

The muffle consists of an annular channel, one section of which serves as a burning chamber, one as a cooling chamber, and one as a preliminary heating chamber. The goods to be fired are carried on trollies running beneath the annular space and provided with supports projecting upwards into the annular space. The lower part of the annular space is sealed by a sand joint. The process of burning can be carried out continuously by the rotatory movement of the chain of trollies along the annular muffle. An alternative method of construction is also described.

—B. B.

Earthenware, Improvements in the Manufacture of. E. Bilton, Fenton, Stoke-on Trent. Eng. Pat. 10,079, May 22, 1895.

To the raw material of earthenware containing red marl or clay, barium carbonate (or other barium salt) is added in the proportion of about 1:10 for the purpose of lightening the colour of the finished goods.—B. B.

Composition, Improved, for Use in the Plastic Arts. J. L. Rawdon and The British and Foreign Patent Syndicate, Limited, Manchester. Eng. Pat. 11,595, June 14, 1895.

One pound of commercial silicate of soda solution is mixed with 1 oz. of dry powdered calcium chloride and $\frac{3}{4}$ oz. of slaked lime; 12 oz. of the mixture are used to render plastic 1 lb. of pipeclay or potter's clay, previously ground and sifted. Borax and colouring materials may be added, and silicate of potash may be substituted for silicate of soda. The product is used as modelling clay which will dry without cracking, and can be fired if necessary, and as a substitute for moulding sand.—B. B.

Pottery Ware and like Glaze-firing Furnaces and Kilns, Improvements in and relating to. C. Mayer, Oeslau, Germany. Eng. Pat. 5622, March 12, 1896.

CONTINUOUS and systematic firing of ceramic goods in muffles is secured by the use of a series of kilns, to any one of which

a shifting furnace may be applied. Air to feed the furnace is drawn from previously heated kilns, and similarly the products of combustion from the kiln in process of firing are turned through the kilns about to be fired.—B. B.

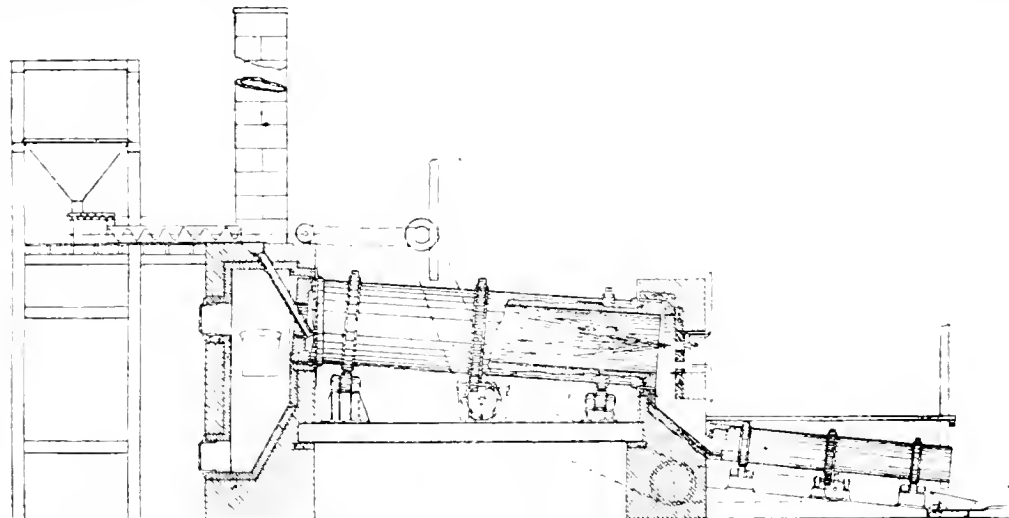
IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement. E. Candlot. Bull. Soc. d'Encouragement, 1895, 1278—1313.

THE article consists chiefly of a review of the improvements which have been introduced from time to time in the process and plant used in the manufacture of cement. The

following statements may be reproduced:—In French practice it is customary when making cement by the wet method to allow the slurry flowing from the wash mill to pass into tanks of 100—150 cb. m. capacity, provided with agitators running at 20—30 revolutions per minute. A further blending of the raw materials is thus effected, and greater homogeneity is obtained than when the slurry passes direct from the wash mill to the "backs." The usual samples for analysis needed to check the composition of the slurry are taken from these mixing tanks.

In the United States a rotating cylindrical furnace fed by petroleum is said to be successfully used. As shown in the figure, it has a burning cylinder into which a jet of burning petroleum is introduced, and a cooling cylinder



down which the clinker passes, regeneratively heating the incoming air. The dried slurry is fed in as a powder and is completely burnt in traversing the upper cylinder, its passage through which takes about half an hour. It is alleged that attempts to substitute producer gas for petroleum have not been successful.—B. B.

Dinas Bricks. E. Seger and E. Cramer. Stahl und Eisen, 1895, 1084—1087.

BRITISH Dinas firebricks are sometimes preferred in Germany to the home-made product, without adequate reason. In comparing the quality of bricks of different origins, the following tests were used:—(1.) The toughness of the brick was adjudged by noting its ring when struck by a hammer. (2.) The fusing point of the brick was taken in a Deville furnace, using Seger's cones as a means of comparison. (3.) Its degree of permanence as regards volume before and after firing, was determined. The following table of analyses shows the small differences existing between British and German Dinas bricks:—

	SiO ₂	Al ₂ O ₃ + Fe ₂ O ₃	CaO
British, No. 1.....	97.40	1.19	1.11
" No. 2.....	96.80	2.23	0.97
Homburg.....	95.40	1.19	3.20
Eschweiler, No. 1.....	96.24	2.36	1.40
" No. 2.....	96.54	2.03	1.43

All five samples fused between 2,120 and 2,150° C.; no difference could be detected in this respect. As regards constancy of volume, however, the German are said to be better than the British bricks.—B. B.

Bricks Refractory to the Action of Fused Alkalis and Alkaline Sulphides. W. Hempel and W. Jezierski. Chem. Ind., 1896, 179—181.

CERTAIN stones are found in Norway, South Tyrol, and North America, called "pot-stones," which are soft in their

native state, but attain a considerable hardness when burnt. The material of which these stones are composed is a mixture of talc, chlorite and dolomite; it resists the action of fused alkalis and alkaline sulphides almost completely. A sample analysed, had the following ultimate composition:—SiO₂, 44.3; CaO, 3.4; Fe₂O₃, 4.2; FeO, 7.6; Al₂O₃, 4.3; MgO, 20.7; Na₂O, 4.7; Cl, 0.2; and H₂O, 10.6 parts per cent. respectively. Test pieces exposed to the action of fused caustic soda, alone, and mixed with 40 per cent. of sulphur, lost only a trifling weight, whereas a piece of ordinary firebrick under like conditions lost more than half its weight. The fusing point of the stone is above that of cast iron, but below that of steel. Attempts were made to prepare artificial stone of approximately the same composition from the following raw materials:—

(1) Loam or brick earth containing—SiO₂, 72.82; Fe₂O₃, 4.04; Al₂O₃, 10.48; CaO, 0.62; MgO, 0.31; Na₂O, 5.66; CO₂, 0.09; H₂O, 5.63 per cent.; and (2) Crude magnesia from the magnesium chloride process for making HCl and Cl₂ as carried out at Stassfurt, having the composition—SiO₂, 3.42; Fe₂O₃, 0.12; Al₂O₃, 5.15; MgO, 83.76; Cl, 0.65; SO₂, 1.89; CO₂, 0.75; H₂O, 3.97 per cent.; or as an alternative—(3) Dolomite containing SiO₂, 5.13; Fe₂O₃, 2.33; FeO, 1.56; CaO, 27.86; MnO, 2.75; MgO, 16.84; CO₂, 42.35; H₂O, 0.8 per cent.

From these raw materials it is impossible to obtain a mixture containing both SiO₂ and MgO (the dominant acid and base) in the same percentage as those present in the natural stone. Taking SiO₂ as a basis for calculation, it is found that 100 parts of crude magnesia and 142 parts of loam will yield a substance of the right composition as far as SiO₂ is concerned. Taking MgO, however, as the criterion, there were required 100 parts of magnesia to 309 parts of loam. The first mixture when strongly heated in a graphite crucible gave a product which resisted the action of caustic alkali and alkaline sulphide very well; the second mixture withstood an alkaline sulphide fusion, but was attacked by caustic soda. Both mixtures did not fuse at the temperature of molten cast

iron, but ran down at a temperature high enough to melt steel.

Using dolomite as a source of magnesia, a mixture from that and the same loam was prepared, taking the percentage of silica as a basis for calculation. The actual proportions taken were 236 parts of dolomite and 325 parts of loam, and the product resisted the action of caustic soda, alkaline sulphide, and strong hydrochloric acid, and was less fusible than the natural stone. The use of such artificial stones therefore appears to be practicable.—B. B.

PATENTS.

Cement, Improved, for firmly binding together Light Substances. A. Hafter, Glasgow. Eng. Pat. 9861, May 18, 1895.

CLAY is treated with such quantity of sulphuric acid as will yield 50 per cent. of soluble sulphates in the product. Poor clay is improved by the addition of a soluble sulphate. To 100 parts of this material 10 parts of "an amylaceous substance" are added, the resulting mass being suitable for cementing together light substances, e.g. textile fibres, peat, and cork shavings.—B. B.

Cement Concretes, Improvements in the Manufacture of. S. G. Bird and J. Wright, London. Eng. Pat. 10,207, May 23, 1895.

WHAT is known in the trade as "slag" is mixed with about 5 per cent. of ferrous sulphate and the product is mixed with cement. Cement concretes are thus said to be rendered "harder and more durable."—B. B.

Cement Manufacture, Improvements in the. W. Stark, London. Eng. Pat. 11,267, June 8, 1895.

SUGGARY is made in the way usual for the manufacture of Portland cement, but with a somewhat higher proportion of chalk. This is loaded into the kiln together with Roman cement stone in such proportions that the ratio of acid to basic oxides in the whole mass is normal for Portland cement. The mixed material is burned and ground in the usual way.—B. B.

Plaster, Improvements in the Manufacture of. J. C. Bloomfield, Leggs, Ireland. Eng. Pat. 12,382, June 26, 1895.

100 PARTS by volume of hydraulic lime are mixed with 5 parts by volume of sulphate of lime (preferably plaster of Paris) and 5 parts by volume of finely-ground shale. The product may be coloured with oxide of iron or ochre, and used as a plaster.—B. B.

Cement, A New or Improved. A. Clery, London. Eng. Pat. 3985, February 21, 1896.

THE material patented consists of (1) powdered marble, 75 parts; zinc oxide, 12 parts; powdered sandstone, 10 parts; and (2) Muriatic acid, 90 parts; zinc, 10 parts; prepared separately, and mixed as wanted in the proportion of 2:1; the proposed use of the cement is as a substitute for Portland, Roman or Keene's cement.—B. B.

Cement Manufacturing, Improvements in the Art of. R. A. Cheseborough, New York, U.S.A. Eng. Pat. 4918, March 1, 1896.

THE process patented consists in showering slurry in powder down a vertical kiln provided with crossbars and heated by an ascending flame emanating from a petroleum jet at the base of the kiln. The slurry is fed in by a conveyor, hopper and screw, and the clinker withdrawn from a hopper-shaped opening at the bottom of the tower. The products of combustion on their way to the chimney are led down a vertical flue forming part of the kiln, and serve to raise steam for power and for driving the oil-jet.—B. B.

Artificial Stone, The Manufacture of an, and the Manufacture of Various Articles therefrom. W. H. Metcalfe, Plaistow, and F. B. Wrightson, London. Eng. Pat. 9283, May 10, 1895.

BROKEN pottery and earthenware ("schraff") saggers and the like are crushed, sized by sifting, and mixed with

Portland or other cement in the proportion of 60—75 per cent. of the former to 40—25 per cent. of the latter. The mixture is moistened and moulded into slabs, sills, mantelpieces and similar articles.—B. B.

Artificial Stone, Improvements in the Manufacture of. E. M. Arndt, Stettin, and G. de Bruyn, Hamburg, Germany. Eng. Pat. 12,242, June 24, 1895.

A CEMENTITIOUS mixture of gypsum and caustic lime is treated with sulphurous acid or a sulphite, in order to convert the lime into calcium sulphite, which may ultimately, by oxidation, crystallise as sulphate. Silicic acid may be added to unite with a further portion of the lime, and simultaneously aluminium sulphite may be used, so that there may be formed "a double silicate with the silicic acid and with the base set free by the lime from the sulphite employed." Cinders, sand, infusorial earth, and the like may be added. The product is used for the manufacture of artificial stone.—B. B.

Artificial Stone Blocks or Plates, An Improved Method of and Apparatus for Making. P. Jantzen, Elbing, Germany. Eng. Pat. 23,980, Dec. 14, 1895.

THE apparatus patented consists of a mould for the reception of the plastic material from which the blocks are to be prepared, resting on a rising pillar, bearing in its turn on a pawl gearing with a ratchet wheel driven by a horizontal shaft. The rotation of the shaft and the consequent rising and falling of the pawl over the teeth of the ratchet wheel, communicate a series of vertical shocks to the pillar and mould borne thereby, the motion thus obtained consolidating the mixture in the mould. A lever serves to raise the pillar and eject the plate or block from the mould when the shaking is complete. Surplus water appearing on the surface of the block is removed by placing a slightly moistened layer of mortar thereon, and applying heavy pressure.—B. B.

Artificial Stone, Improvements in the Manufacture of. W. P. Thompson, London. From La Société Anonyme la Néo-Litho, Moll, Belgium. Eng. Pat. 3800, Feb. 19, 1896.

AN artificial sandstone of close texture is said to be made from: silica, 40 per cent.; hydraulic lime, 20 per cent.; oxide of alumina, 20 per cent.; oxide of potassium or sodium, 10 per cent.; oxide of calcium, 5 per cent.; oxide of iron, 5 per cent., mixed, moulded, and subjected to the action of high-pressure steam.—B. B.

Mortar Analysis, [Time] Precipitation Process of. J. Patchett, Birmingham. Eng. Pat. 10,089, May 22, 1895.

See under XXIII., page 474.

Mortar Analysis, Measure Process of. J. Patchett, Birmingham. Eng. Pat. 10,090, May 22, 1895.

See under XXIII., page 474.

Asphalt Composition or Covering, An Improved Protective. R. D. Upham, New York, U.S.A. Eng. Pat. 24,479, Dec. 20, 1895.

THE composition patented consists of about 70 parts of copper filings and 30 parts of "asphaltic cement," the latter being composed of 43 parts of pure refined asphalt, 7 parts of "flux," and 50 parts of pulverised silica. The resulting mixture is applied hot as a coating for ships, as a roofing composition, or in any connection in which a waterproof coating is required.—B. B.

X.—METALLURGY.

Magnetic Iron Sands, New Zealand, Treatment of. E. M. Smith. Iron and Steel Institute, Spring Meeting, 1896. The Ironmonger, 265, 266.

AT New Plymouth, Taranaki, New Zealand, magnetic iron sand occurs as a beach deposit 14 ft. deep, extending about 13 miles along the shore, and at least three miles out to sea. It is a product of the degradation of neighbouring cliffs, and when any of it is removed from the beach the

incoming tide replaces it. Furthermore, there is coal, limestone, and timber in the vicinity. The composition of the iron sand is 82 per cent. of iron oxides, 8 per cent. of titanium oxide, 8 per cent. of silica, and 2 per cent. of water and loss, and, when made into bricks by pugging with about 15 per cent. each of yellow and blue clay, consisting chiefly of silica and alumina with about 9 per cent. of oxide of iron and small quantities of lime and magnesia or alkalis, and smelting these bricks in a blast furnace with half their weight of a flux consisting chiefly of lime, it has yielded metal of the following composition:—

	Pig Iron.	Bar Iron.
	Per Cent.	Per Cent.
Iron.....	94.09	98.94
Manganese.....	Traces	Traces
Titanium.....	1.00	0.21
Silicon.....	2.12	..
Sulphur.....	0.02	Traces
Carbon.....	2.33	0.46
Loss and undetermined.....	0.44	0.39
	100.00	100.00

The pig iron is fairly granular, the bar iron fine-grained and of excellent quality.—A. W.

Iron, The Influence of Carbon on. J. O. Arnold. Proc. Civil Eng. 123, [1], 6—41.

THE author, in a paper of some length, deals with the influence of carbon on iron. The chief points are given in a general summary of the paper.

The constituents of steel may be:—(a.) Crystals of pure iron, which remain bright on etching. (b.) Crystals of slightly impure iron, which become pale brown on etching, probably due to a small quantity of an intermediate carbide of iron, Fe_{10}C (?). (c.) Normal carbide of iron, Fe_3C , which exists in three distinct modifications, each one giving particular mechanical properties to the iron in which it is found. (1.) Emulsified carbide present in an exceedingly fine state of division in tempered steels. (2.) Diffused carbide occurring in normal steels in small ill-defined stric and granules. (3.) Crystallised carbide occurring as well-defined laminae in annealed and in some normal steels. (d.) Sub-carbide of iron, Fe_{23}C , a compound of great hardness, existing in hardened and tempered steels. This compound is decomposed by the most dilute acids, and at 400°C . it splits up into Fe_3C and free iron, with evolution of heat. It has a remarkable capacity for permanent magnetism. (e.) Graphite or "temper carbon."

The existence of Fe_{23}C is proved by the fact that iron containing 0.89 per cent. of carbon presents several correlative critical points when examined by different methods of observation.

The influence of annealing is:—(1.) To increase the size of crystals and also the inter-crystalline cohesion.

TABLE GIVING APPROXIMATE THEORETICAL CONSTITUENTS OF HARDENED AND NORMAL IRON AND CARBON STEELS REQUIRED BY THE SUB-CARBIDE THEORY.

Carbon.	Hardened Steels.				Normal Steels.	
	Fe.	Fe_3C .	Fe_3C .		Fe.	Fe_3C .
Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.
0.1	89	11	0		99	1
0.2	78	22	0		97	3
0.3	67	33	0		95	5
0.4	56	44	0		93	7
0.5	45	55	0		91	9
0.6	34	66	0		89	11
0.7	22	78	0		87	13
0.8	11	89	0		85	15
0.9	0	100	0		84	16
1.0	0	99	1		82	18
1.1	0	97	3		81	19
1.2	0	95	5		79	21
1.3	0	93	7		77	23
1.4	0	91	9		..	..
1.5	0	89	11		..	..

(2.) To convert elongated masses of iron containing diffused Fe_3C into compact rounder bodies containing laminae of crystallised Fe_3C , between which the iron becomes more or less dove-tailed throughout the mass.

The sub-carbide theory accounts for several facts that are observed in every-day experience. For instance, steel containing 1.3 per cent. of carbon would be useless for steel which has to carry a cutting edge and yet be able to withstand a shock. The reason is that such a steel is full of lines of weakness along the junction of the sub-carbide granules with the normal carbide membranes. For turning tools, a steel containing more than 0.9 per cent. of carbon is necessary, as in this case no shock has to be encountered, and the normal carbide simply augments the hardness of the sub-carbide. It is also evident that a steel with much below 0.9 per cent. of carbon cannot carry a cutting edge on account of the presence of soft free iron amongst the hard sub-carbide.

The author points out that on heating a saturated steel in air, the surface of the metal falls below saturation point, owing to the oxidation of some of the carbon; whereas in a steel containing, say, 1.2 per cent. of carbon, the membranes of Fe_3C act as reserves to replace the oxidised carbon, and thus the steel is maintained in a saturated condition.

The paper is accompanied by 10 drawings and a set of 19 photographs.—A. S.

Iron Carbides, Some Alloys with, mainly Manganese and Tungsten. J. S. De Benneville. Iron and Steel Institute, Spring Meeting, 1896. The Ironmonger, 298—311.

ANALYTICAL data indicate that liquid iron does not differ as a solvent from other liquids, except in the comparatively great complexity of its molecular structure. On the cooling of such a mass containing in combination with it other elements, according to the conditions of such cooling, and the volume and the chemical affinity of such elements for the solvent, the solidified mass would present a structure homogeneous throughout, through intermediate forms, to a highly segregated and crystalline condition in which a number of definite compounds have been formed. Such definite compounds in iron are present in two forms: (1) Compounds common to alloys of wide range of composition, Fe_3C , and the prismatic forms found in manganese and chromium carbides, phosphides, and sulphides; (2) Compounds varying in composition from one alloy to another, and dependent within narrow limits on the conditions of cooling, and often on the immediately surrounding magma from which the constituents are drawn. Such are the granular residues, differing only in degree from the ground-mass of the alloy. With the ground-mass of the alloy, directly comparable with vitreous structure of basalts, there is found a regular gradation in iron alloys, and they are to be classed according to the amount of differentiation undergone. Iron carbides tend to form homogeneous masses in which definite compounds are of minor importance, the great bulk of the alloy entering into the ground-mass. Rapid cooling preserves this structure, whilst slow cooling promotes crystallisation. Owing to their tendency to form ground-mass, iron carbides are more subject to control even in the presence of elements with which they form inert compounds; if present in small quantity, limits of homogeneity are comparatively wide. To a considerable extent this is also the case with ferro-manganese, but definite compounds assume a more regular form, and the granular masses form a considerable percentage of the total mass. In carbides with the sixth family—tungsten, molybdenum, and chromium—definite crystallised compounds are an important factor, and the dominant influence of the added element is shown in the chemical inertia of the granular residue, sharply differentiating them from the soluble portion to an extent not found in iron carbide or ferro-manganese, in which the separation chemically from the ground-mass is not marked. Such elements, when present in large quantities, are less capable of control. Although manganese and tungsten form a ternary carbide with iron, the chemical properties of the manganese, when present in sufficient quantity, class the

resultant product in its reactions with ferro-manganese. When tungsten is present in large proportion as compared with manganese, the latter is masked; this refers to large proportions. In small quantities their action should be almost independent of each other.

Proximate analysis of the alloys shows that outside of phosphorus, carbon, and silicon, present presumably in combination with iron, a considerable portion of these elements is present in a readily soluble form, and this is attributed to the "ground-mass" of the alloy. It has been attempted to show that the reaction which takes place on dissolving iron carbide alloys in acid is analogous to the process which takes place when an organic substance is subjected by steam to destructive distillation, and that the resulting compounds consist mainly of hydrocarbons and carbon compounds and small quantities of nitrogen, sulphur, and phosphorus compounds. The assumption therefore of a large number of compounds differing in their action with reagents is unnecessary.—A. W.

Iron, Rate of Diffusion of Carbon in. W. C. Roberts-Austen. Iron and Steel Institute, Spring Meeting, 1896. The Ironmonger, 281, 282.

Is a verbal statement, after instancing the kernel roasting of pyrites and the migration of platinum and gold through lead heated below its melting point, as examples of the movement of particles of solids and drawing attention to the similarity of this movement to the process of diffusion of common salt in water or in jelly at ordinary temperatures, the author pointed out that the carburising of iron might be regarded as a parallel case of diffusion. A piece of electro-iron carburised from one end by a diamond by Osmund, showed all the stages of diffusion from the carbide of iron to the pure unchanged iron. In Harveyised plates the carbon has been observed to penetrate in a similar manner, the curves of penetration being comparable with the curves of diffusion of gold in tin or lead, of platinum in lead, and of salt in jelly or water.—A. W.

Steel, Hardening of. H. M. Howe and A. Sauveur. Iron and Steel Institute, Spring Meeting, 1896. The Ironmonger, 289—293; with notes on the same by F. Osmund, The Ironmonger, 293—295.

THE first-named authors give the results of further microscopical examination of bars of the same low-carbon steel heated to the same high temperature and cooled slowly to certain points in the critical range and suddenly quenched. The changes in the carbon and iron are discussed and also the changes in the physical condition of the various carbides themselves, and suggestions are offered to account for the discrepancies between structural changes and physical properties. They think the retardations and their accompanying phenomena are due primarily to changes in the nature of the iron itself, which therefore are the real causes of the structural changes, and the changes in carbon condition, tenacity, hardness, &c.

M. Osmund states that recent researches tend to establish a parallelism between nickel, manganese, and carbon steels. In each series there are to be found—(1) a group of steels which are soft, magnetic, and are not polar-magnetic or hardly so when the metal is in the form of short bars; (2) a group of steels which are either absolutely or relatively hard, are magnetic and polar-magnetic; and (3) a group, or the representative of a group of steels, which are difficult to work in the cold, do not possess much mineralogical hardness, and are extensible and non-magnetic.

The metals of the first group have well defined and perfect critical points, which occur above 400°; the bulk of the iron is in the α state.

The metals of the third group do not possess the transformation point at all; the iron then is present in the γ form. It is suggested that it may ultimately be necessary to divide the γ modification into two. The existence of iron in an allotropic form in non-magnetic steels is considered as fully established. As regards the second group, that of the hard and polar-magnetic steels, their characteristic properties are attributed to the maintenance of a part of the iron in the β form, inasmuch as experiments show that in the case of metals of this group the transformations

take place below 350° or 400°; that is to say, below the temperature at which tempering obliterates in carbon steels the greater parts of the effects of hardening, under which conditions it is presumed the transformations of iron are incomplete. But experimental data in support of this presumption are necessarily imperfect owing to insurmountable difficulties. Yet it is thought that the facts are already capable of being grouped in a satisfactory way, and that the distinction established between γ and β iron, which is not an arbitrary, but an experimental one, will cause the difficulties to disappear which, at the outset, left a certain amount of confusion existing between the two varieties. This grouping of facts also removes the difficulties which were ushered in by the more complete knowledge of manganese steels and by the discovery of nickel steels.

While speaking in favour of Howe's carbo-allotropic theory M. Osmund thinks it may be necessary to introduce a separate theory for each substance, such, for instance, as a nickel-allotropic and a manganese-allotropic theory.—A. W.

"Pickling" in the Wire-drawing Industry. A. Menrice. Bull. de l'Assoc. Belge des Chimistes, 9, [11—12], 343—358.

To remove the coating of oxide formed on the iron rods during their passage through the rolling mill, the coiled rods are immersed in a "pickling" solution containing from 12 to 16 kilos. of sulphuric acid in 1,500 litres of water at an initial temperature of 100° C. After about two hours' exposure, during which time the bath temperature will have fallen to about 40° C., the rods are removed, washed, dried, coppered by immersion in a bath of copper sulphate, and transferred to the drawing mill.

The quality of the acid is found to have considerable influence on the ultimate condition of the wire, as well as on its behaviour in the operations subsequent to the "pickling." Testing a sulphuric acid (A) characterised as good, and a second one (B) which proved less satisfactory, the author found that the most striking difference in their constitution appeared to lie in their content of arsenious oxide, of which the good acid contained 5.8072 grms. per litre, whereas the inferior quality had only 1.2825 grm. per litre.

In practice, the acid A attacks the coating of oxide regularly, without effervescence, and the "pickled" wire has a uniform bluish-grey colour, is soft to handle, takes the copper well, and makes a wire of even gauge, without breaking in the mill. On the other hand, the bath liquor composed of the acid B gives off much malodorous gas during the pickling process, and the wire is white, rough, rusts quickly on exposure to the air, does not take the copper evenly, and when passed through the drawing mill is irregular and loses its tenacity, exhibiting a decided tendency to break. Furthermore, it wears out the face of the drawing-plate in one-seventh the time taken by the wires pickled with the acid A.

An examination of the surface of the wire from these two baths revealed the presence of arsenic on both, but that from the A acid amounted to 0.33 per cent. of the filings, whilst the proportion from the filings in the other case was only 0.15 per cent. This deposition of arsenic is believed to afford an explanation of the different action of the two baths. In the arsenical acid liquor, for example, the coating of oxide is loosened by the solvent action of the acid, but the metallic surface becomes quickly covered by a deposit of arsenic, probably as the result of galvanic action, and is not attacked by the acid. Consequently there is a considerable saving of acid, and, moreover, the coating of arsenic on the wire protects it from oxidation and facilitates the deposition of the copper. Where, however, the proportion of arsenic is insufficient to provide this protective coating, the acid continues to attack the iron in all the exposed places, with the results already signalled, the percentage of arsenic being still further reduced by the evolution of hydrogen arsenide formed during the reaction.

The most favourable proportion of arsenic for the satisfactory performance of the pickling process is 7 centigrams. per litre of bath liquor, preferably added as sodium arsenite. By this means the action and product of the bath B were

raised to the same standard as those of the acid A, the wire taking the copper and drawing equally well without more than usual injury to the drawplate.

From laboratory experiments made with oxidised and scraped iron wire, the evolved gases being absorbed by bromine, it appears that the presence of the coating of oxide economises both the acid and arsenic in the solution.

The economy of acid effected by the suitable addition of arsenic to the baths is said to amount to 50 per cent.

—C. S.

Copper and Zinc Alloys, On the Structure and Constitution of. G. Charpy. Comptes rend. 122, 670—672.

Alloys containing not more than 34 or 35 per cent. of zinc are entirely made up of a network of needle-shaped crystals. Above 35 per cent. of zinc, the crystals do not fill the whole mass, but are embedded in a glassy magma. The crystals become fewer as the proportion of zinc is further increased, until, when the zinc reaches 67 per cent., a homogeneous substance with a conchoidal fracture is obtained. These facts explain certain known mechanical properties of such alloys. Thus, in the brasses of commerce containing less than 35 per cent. of zinc, small quantities of lead and tin form, as it were, a solder between the crystals, this solder being strong at low temperatures but weak when the metal is heated above 200° C. When there is more than 40 per cent. of zinc, the lead and tin are embedded in the vitreous magma and do not weaken the structure, which explains the fact that brasses containing from 35 to 40 per cent. of zinc can be worked hot. The author is of opinion that alloys containing up to 34.5 per cent. of zinc are isomorphous mixtures of copper and of the compound Cu₂Zn, alloys containing from 34.5 to 67.3 per cent. of zinc are mixtures of Cu₂Zn, a malleable substance, and of CuZn, a hard and brittle substance; and, finally, alloys containing more than 67.3 per cent. of zinc would be mixtures of zinc with the compound CuZn.—V. C.

Alloys of Copper and Zinc. Discussion on Charpy's Mémoire. Bull. de la Soc. d'Encouragement, 1896, April, 564—570. (Compare this Journal, 1896, 117.)

A. LE CHATELIER finds that there is a limit to the increase of strength obtained by the cold working of pure metals or of those containing less than 1 to 2 per cent. of impurities. Thus the strength of an annealed copper wire, 1 mm. in diameter, was raised (by a diminishing increment) after each passage through a draw-plate without further annealing, from 25 kilos. to 51 kilos. per sq. mm. at which strength it remained constant. The strength of nickel was similarly raised from 55 to 105 kilos., at which it was constant; that of aluminium, from 12 to 25; of silver, from 18 to 33; and of cadmium, from 2.5 to 5 kilos. For all metals examined, excepting silver, the maximum strength after cold-working is double that of the perfectly annealed specimens. The maximum limit is raised by the presence of impurities, silver with 1 per cent. of Sn, breaking finally at 45 kilos. and with 1 per cent. of Cu at 55 kilos. instead of 33 kilos. In the case of alloys, some (e.g., brass, which may be drawn down indefinitely without annealing) follow the same law as pure metals; others, such as bronze, copper-silver alloys, and aluminium bronze, become more and more brittle after each successive draw without annealing, and the strength increases regularly, but at last the metal becomes too brittle to be further worked, and gives way.

In regard to annealing, five laws are formulated as the result of experiments. (1.) Annealing is never instantaneous: its effects, rapid at first, become more and more slow, and the softening tends towards a limit for each temperature. (2.) This limit is lower and is attained more rapidly, as the annealing temperature is raised. (3.) Above a certain temperature annealing is complete, and a further increase of temperature does not diminish the strength, but a crystallisation due to annealing occurs, and increases with the time of annealing, ultimately reducing the tensile strength and elongation to those of the cast metal. (4.) The presence of impurities retards the action of annealing, and demands a higher temperature for its completion. (5.) The crystallisation from annealing is due

to the presence of impurities which have lower fusing points than the metal itself, or which form compounds which have these properties.

Cold-worked metals tend to recover their malleability even at ordinary temperatures by a process which Le Chatelier terms *spontaneous annealing* (*recuit spontané*) and copper or silver wire may lose 3 to 4 kilos. of its tensile strength after merely remaining at the normal temperature for a few hours after drawing. This observation explains the phenomena of cold-working. The maximum limit of strength attainable by cold-working is reached at the moment when the increase produced by continued working is just balanced by the diminution due to spontaneous annealing. Similarly, in wire drawing, if the thickness of the metal be reduced too rapidly by successive passes without annealing, it will break owing to the failure of the spontaneous annealing to keep pace with the distorting force; but the metal may be fractured even in course of a very gradual reduction, unless it be allowed to remain at rest for 5 or 10 minutes between the passes; with this precaution, however, it may be drawn down indefinitely even without heating. Spontaneous annealing affects the mechanical properties of metals under test, causing the breaking load at any given temperature to be greater in proportion to the rapidity with which the stress is applied, whilst the deformation produced is not instantaneous, but increases more and more slowly up to a certain limit. A specimen of zinc, for example, which could support a load of 20 kilos. per sq. mm. for 2 or 3 minutes, broke under a stress of 6 kilos. at the end of 11 minutes, whilst elongating steadily up to an extension of 173 per cent. at the moment of rupture. In replying to the discussion, Charpy calls attention especially to the fact that although metals of which the fracture is crystalline may be brittle and inferior, those which show a crystalline structure under the microscope are ductile and satisfactory.—W. G. M.

Nickel and Aluminium as Minor Currency. Eng. and Mining J., June 6, 1896, 539.

EXPERIMENTS regarding the use of pure nickel, aluminium, or other substances for minor coins of the United States, and their relative adaptability for the purpose of coinage, are being made at the Mint. The United States Minister at Vienna has made a report regarding the operations of the new coinage system in Austria-Hungary, which went into operation with the laws providing for the gold standard in 1892. Austria-Hungary began the coinage of minor coins composed of pure nickel in October 1892. Regarding the success of the Austrian Mint, the United States Minister made the following statement:—

"The director and chief engineer of the Austrian Mint states that pure nickel for minor coins has many advantages. It does not change colour, it is very hard and wears very well, yet it receives a beautiful, clear impression, works well in the presses, does not oxidise, is strongly magnetic, and is superior to every other metal or combination of metals for minor coinage. The only possible objection to it which has been found in Austria-Hungary is that sometimes during the process of milling the edges of pure nickel coins nickel dust is formed in the coining ring, which adheres to the coins and sometimes dulls their brilliant surface. For this reason the authorities of the United States Mint advise that minor coins of pure nickel should have smooth edges. The composition of pure nickel as used for minor coins in Austria-Hungary is as follows:—Nickel, 97.37 per cent.; cobalt, 1.30 per cent.; copper, 0.32 per cent.; iron, 0.80 per cent.; carbon, 0.07 per cent. Excess of cobalt darkens the colour. Excess of iron and cobalt makes the metal too brittle. The plates from which the pieces are coined must be exposed beforehand to white heat for annealing in closed furnaces in order to make them sufficiently soft."

The Austrian Government makes no effort to apportion the amount of metal in the coins to their face value, but makes the lower pieces of comparatively higher value in order to make them large enough for convenient circulation. The Austrian Mint has made some coins for Serbia containing 25 per cent. nickel and 75 per cent. copper, but the Minister reports that "this composition does not receive so good or so clear an impression as the pure nickel; it soon

wears smooth, loses its bright colour, is not at all magnetic, and does not work any easier or more advantageously in the presses."

Platinum, Fusibility of, in Coke Blast Furnaces.

V. Meyer. Ber. 29, 1896, 850—852.

THE author formed two cavities in a block of fireclay and placed in one a piece of platinum foil whilst into the other he introduced a piece of foil consisting of an alloy of 25 per cent. of iridium, and 5 per cent. of platinum. The cavities were then roofed over with more of the fireclay and the block heated in a furnace provided with a powerful blast. The combustible material used in the furnace was retort graphite powdered into pieces the size of a hazel nut. Carbon and the products of combustion being very perfectly excluded in this way, the author has succeeded in melting the platinum foil whilst the iridium alloy was quite unchanged.—J. S.

Aluminium and Silicon, Some Metallurgical Applications of. H. Le Chatelier. Bull. de la Soc. d'Encouragement. Nov. 1895, 119, 1196—1202.

ALTHOUGH aluminium remains without important applications in the metallic state, it now fulfils an important part in metallurgical processes, since it is an energetic reducer, is less volatile than sodium and does not oxidise in damp air. The slowness with which it combines with oxygen under normal conditions, which may be attributed to the infusibility and insolubility of its oxide, disappears at high temperatures and when the metal is alloyed. This powerful oxidation can be utilised either in removing the small amount of oxygen taken up by metals such as iron, melted in contact with the air, or in the extraction of those metals from their oxides, which carbon fails to completely reduce. It now partly replaces manganese in the manufacture of iron and steel, wholly replaces magnesium in the making of nickel, and is used in the production of brass. In the case of iron manufacture, it is difficult to understand *a priori*, why a change from ferric oxide to alumina should improve the quality of the metal, and it is supposed that a molten metal dissolves its own sulphide, oxide, &c., and that at the moment of solidification these crystallise out throughout the mass of the metal, whereas, if the oxide, sulphide, &c. of a foreign metal be present, they are insoluble and pass into the slag. Most of the aluminium manufactured, is to-day used up in this way.

It has only quite recently been employed to reduce metals from their ores where carbon fails. Green and Wahl have used it in the preparation of manganese, and latterly they have employed it in extracting several metals. Carbon can only reduce manganese to Mn_2C containing 6 per cent. of carbon. By the use of aluminium a metal was obtained which only contained 1 to 2 per cent. of silicon, and about as much iron, which were derived from the impurities of the materials employed. The crucible used was non-siliceous, of magnesia or of earth well lined with magnesia. The mixture employed was manganese protoxide, 68; aluminium, 12; fluor spar, 10; quicklime, 10. The aluminium was powdered. The lime retained the silica and prevented the slag from becoming too fluid, and thus allowing the aluminium to float up to the surface before the reaction was complete. The crucible was heated to 1200°. The reaction was energetic and sufficient heat was evolved to melt the manganese, which was found in a button. The yield was more than 90 per cent. of the theoretical. Hadfield has used aluminium in obtaining absolutely pure iron, containing 99.8 per cent. of the metal, employing a similar mixture. Roberts-Austen has also obtained chromium by the same method and M. Vautier has reduced the oxides of sodium, potassium, calcium, and barium. With easily reducible oxides the reaction is explosive.

Moissan suggests a practical method of utilising this process in the incorporation of the elements, tungsten, molybdenum, uranium, vanadium, titanium, silicon, and boron which are difficult to reduce or fuse into the metals, iron, steel, copper, and the useful alloys. He reduces the oxide of the desired element by means of aluminium, forming an alloy of the metal with aluminium which fuses even at

the heat of the reaction. This alloy is added to the iron, steel, or copper when molten and the excess of aluminium removed by refining with oxide of iron or copper as the case may be. This method is easier, and has the advantage that the presence of the excess of aluminium aids in refining the iron, steel, or copper.

Silicon, though its heat of oxidation is lower than that of aluminium, reduces a great number of other oxides. Green and Wahl have substituted ferro-silicon for aluminium in the preparation of alloys of iron with manganese, chromium, nickel, molybdenum, and tungsten. It has, besides other advantages, that of producing an alloy containing but little carbon. Riley has shown that the percentage of carbon decreases as the amount of silicon increases. In conclusion, it seems that the alloys of silicon, and of aluminium behave in the same way. A certain excess of the metal employed must always remain in the casting and modify the properties of the pure metal.—A. W.

Metals, Behaviour of, at Abnormally Low Temperatures. Berg. u. hüttenm. Zeit. 1896, 55, 113.

STEINER found that the extension at the yield point was increased, whilst the breaking load was diminished by cooling to $-70^{\circ}C$, and that the influence was greater in the case of ingot iron than in that of weld iron. But under bending stress the influence was most clearly seen at flawed places, many samples being as brittle as glass. Dewar found that iron wire, as well as tin, lead, solder, and Wood's alloy had a higher tenacity at $-182^{\circ}C$. than at $+15^{\circ}$, whilst at this low temperature the strength of mercury is identical with that of bismuth and antimony. The strength of zinc, bismuth, and antimony decreases in the cold by 50 per cent. Tin and lead are equally extensible at normal temperatures, but at -182° tin breaks almost without elongation, whilst the ductility of lead is almost unimpaired. By alternate cooling and reheating, the magnetic properties of steel alter greatly, but a constant point is finally reached, all samples showing an increase of from 30 to 50 per cent. in the magnetic moment at $-182^{\circ}C$.—W. G. M.

Gold Ores, Roasted: Treatment of, by Means of Bromine. R. W. Lodge. Technolog. Quart. 1895, 8, 378.

THE author states that bromine seems to have the following advantages over chlorine:—

A much higher percentage is extracted, the results being estimated not only on the assay of the tailings, but also on the actual gold recovered.

The solutions obtained are much more free from base metals.

Less time is required, and the ease in using and handling bromine is much greater.

The least amount of bromine required for a successful extraction in the author's experiments was 0.3 per cent., or 6 lb. per ton. As bromine costs 25—40 cents per lb., this would make the cost very high; but with chlorine the cost would be still higher, as it is necessary to use as much as 10 per cent. of chloride of lime and 6 per cent. of sulphuric acid for even a fair extraction.—A. S.

Gold Ores, An Improved Process of Extracting. W. M. Grosvenor. Eng. and Mining J. 1896, 61, 424.

THE improved process is one combining the advantages of the stamp mill, the cyanide or chlorination, and the Siemens-Halske processes. The novel features are a mill acting as a pulveriser, amalgamator, extraction vat, and electrolytic bath combined, and a "dolly-tub" to further amalgamate the pulp and electrolyse the solution, and to allow further time for leaching.

The action in both mill and "dolly-tub" is continuous, and as only the most finely-divided gold is left for solution, larger particles being amalgamated, a single "dolly-tub" usually gives at least 90 per cent. complete extraction.

As a stamp mill the plant shows great efficiency and durability. A plant requiring a 20-h.p. engine will crush over a surface of about 200,000 sq. in. per minute.

Ore has been treated at a cost of about 1.50 dol. per ton with coal costing 5.50 dols. per ton in a rough experimental

plant. It is claimed that with four 25-ton mills, a modern engine and boiler, and coal at 3.50 dol. to 4 dol. per ton, extraction would cost less than 1 dol. per ton, whilst with water power, the cost could be reduced to about 70 cents.

—A. S.

Cyanide Process, The, as Applied to the Concentrates from a Nova Scotia Gold Ore [Arsenical]. R. W. Lodge. *Techn. Quarterly*, 8, 339.

The author refers to the experiments of W. A. Tucker with the cyanide process, on a gold ore containing a large amount of arsenic.

The ore contained free gold and about 12 per cent. of sulphides, and the concentrates obtained from it contained about 66.5 per cent. of arsenical pyrites.

The percentage of gold extracted from the concentrates (passed through a 30-mesh sieve) by the cyanide process varied from 51.84 per cent. to 93.68 per cent., according to the manner and duration of the extraction.

These experiments seem to show that the presence of arsenic does not materially affect the cyanide process.

If the extraction be performed in closed vessels, the consumption of potassium cyanide is lessened, also the extraction is increased, thus contradicting Elsner's equation in which oxygen is necessary. Agitation of the ore, and solution, increased the amount extracted, although such is not generally the case in actual practice.—A. S.

Gold Extraction in Cyanide Works [Sources of Error and Loss]. W. A. Caldecott. *Standard and Diggers' News*, Johannesburg, April 25, 1896, 19.

The author gives his opinion from facts observed as to the discrepancy between the actual and theoretical yield of gold by the cyanide process.

With fresh zinc or amalgamated copper plates, a little gold is lost by remaining on the plates. Errors may also occur in the calculation of the tonnage of tailings. Another source of error occurs in the attempt to obtain representative samples of the tailings. The best way is to take one with a sampling-rod from each truck, and then quarter down in the usual way.

A serious error often occurs through the leakage of gold-bearing solutions, owing to imperfect construction of the leaching vats. The author suggests that soluble cellulose might perhaps be applied as a waterproof lining for the vats.

Loss often occurs by gold slimes, after precipitation, being mechanically carried on into the sumps by the force of the current in the extractors. This may be obviated by using more extractors, or by adopting a lower speed of solution. Also some finely-divided gold may pass through the filters used for draining the gold slimes; it is advisable therefore to run all solutions from the zinc boxes into a settling vat to allow the gold to deposit.

Some gold may be left behind in slags, but this may be brought down to a very small amount by the proper adjustment of fluxes.—A. S.

Cyanide Process: Notes on the Treatment of Zinc-box Precipitate (Slimes) from, as practised at the Standard Consolidated Mines, Bodie, California. R. G. Brown. *Inst. Mining and Met.*, May 20, 1896.

In view of the position, more commonly taken of late, that the sulphuric acid treatment of zinc-box precipitate ("slimes") leads to large losses, the following notes are considered interesting:—

The slimes are filter-pressed, the effluent giving no more than the faintest sign of sediment after 24 hours, the average amount of gold present being valued at only 2½ d. per ton of solution; and since 1,000 oz. of precipitate are washed by 2½ tons of water, this loss is inconsiderable. The cakes are dried on an iron pan placed in a rectangular brick furnace with an iron top, and provided with a hood and stove-pipe flue. Working upon 4,400 oz. of precipitate the loss was only 0.03 per cent. Several pounds of mercury were recovered from the flue during the year. With every ounce of bullion, 1.1 oz.

of slag was produced, containing gold to silver in the ratio of 1:6.5, whilst the corresponding ratio in the bullion was 1:2.9. Fluxes were used to the amount of one-quarter of the precipitate by weight, and consisted of borax 4 parts, sand 2 parts, soda 2 parts, and nitre 1 part. The consumption of cyanide and of zinc per ounce of precious metals recovered was 0.52 lb. and 0.31 lb. respectively during a run of eight months.—W. G. M.

Petroleum Products, Action on Aluminium. K. W. Charitschkow. *Trudy kak. otd. imp. russk. techn. obschtsch.*, 1896, 11, I, 16.

See under 111., page 443.

PATENTS.

Steel Wire, Improvements in the Method of and Apparatus for Hardening, Tempering, and Timing. J. H. Roberts and J. Cooper, Bradford. *Eng. Pat.* 7904, April 20, 1895.

The wire is heated in the ordinary way by passing it through heated tubes; thence it passes through an air-tight chamber provided with a glass window, through which the wire may be examined to see whether it has acquired the proper temperature, before entering the hardening bath. This latter consists of a shallow trough, through which the hardening liquor is made to flow in a continuous current. On leaving this bath the wire passes between strips of "card-cloth," and is thus wiped dry before entering the tempering bath. A cooling chamber, through which a continuous current of air is made to pass, is interposed between this latter and the pickling bath.—J. H. C.

Gold and Silver from their Ores, Improvements in and relating to the Extraction of. A. Schmidt, Berlin. *Eng. Pat.* 8376, April 27, 1895.

CYANIDE of an alkali metal is employed as a solvent in the ordinary way, but its action is accelerated by the addition of a small proportion, usually 1 to 5 per cent. of an organic nitro- or nitroso-compound. Commonly an addition of hydrate or carbonate of an alkali or alkaline earth is also made amounting to about 20 per cent. of the quantity of nitro-compound present.—J. H. C.

Gold-bearing Antimony Ores, An Improved Process for the Treatment of. J. J. Christmas, Adelaide, South Australia. *Eng. Pat.* 10,399, May 27, 1895.

ABOUT 25 per cent. of melted lead at a low temperature and with or without fluxes or reducing agents is added to the melted antimony. After stirring, the molten mixture is run into moulds and "packed" by tapping while cooling, after which the lead containing the gold is found beneath the antimony and can be separated from it by a smart blow.—J. H. C.

Gold or Silver, or both, Improved Process and Apparatus for Treating Ores and Liquids Containing. A. de C. Scott, London. *Eng. Pat.* 12,102, June 21, 1895.

The solvent liquor (such as cyanide of potassium) is injected into the crushed ore or slime under pressure in apparatus as described, periods of rest being allowed in order to limit the consumption of the solvent and to give time for its proper action on the ore, after which the clear solvent is decanted for further use until it has become sufficiently strong for precipitation in the ordinary way by zinc turnings.

—J. H. C.

Furnaces, Improvements in. J. Gjers, Middlesboro'-on-Tees. *Eng. Pat.* 10,815, May 31, 1895.

The furnace is constructed with a closed combustion chamber provided with a grate on which the fuel is burnt, and a closed ashpit with water bottom; heated air is supplied above the fuel, while water vapour is made to ascend through it from below, by which means additional combustible gases are produced.—J. H. C.

Furnaces, Improvements in. A. M. Hewlett, Kewness, Ill., U.S.A. Eng. Pat. 16,297, Aug. 30, 1895.

See under I., page 338.

Zinc, Lead, and Silver, Improvements in and relating to the Treatment of Ores or Materials Containing. C. Hoepfner, Giessen, Germany. Eng. Pat. 8328, April 26, 1896.

Ores containing the sulphides of lead and zinc are powdered and treated in a stirring vessel with a solution of free chlorine, of perchloride of iron, or of a mixture of cupric chloride and sodium chloride at a moderate temperature, so as to dissolve only the lead with any silver that may be present. The residue containing the zinc may be treated for its recovery in any known way, the gold, if present, having been previously extracted by means of free chlorine or by cyanide, after roasting.

The silver is separated from the solution electrolytically or by means of finely divided copper or lead. The copper (if present) is also separated electrolytically or by precipitation, after which the chloride of lead which separates on cooling may be utilised as such or converted into other lead compounds, or into metallic lead.—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Spent Molasses [Strontia and Lime Processes], Electrolysis of: Influence on the Composition of the Ash. Zeits. f. Elektrochem. 1896, 573.

See under XVI., page 463.

PATENTS.

Secondary or Storage Batteries, Improvements in [Aluminium Supports]. L. Falero and H. Lumley, London. Eng. Pat. 10,448, May 27, 1895.

THE improved electrodes consist of receptacles or vessels made of aluminium gauze or tulle, or a perforated sheet of aluminium or its alloys, containing the active material, which preferably consists of a paste made of litharge. These electrodes are provided with one or more central metallic conductors, which latter may be of the same material as the receptacle, and moulded in any desired form.—G. H. R.

Diaphragms or Partitions for Electrolytic Purposes formed of Carbonates of Alkaline Earths. S. S. Bromhead, London. From La Société Anonyme des Anciennes Salines Domaniales de l'Est Actien Gesellschaft, Bieuzee, Germany. Eng. Pat. 23,852, Dec. 12, 1895.

THE diaphragms are manufactured preferably from naturally-occurring carbonates of the alkaline earths, but those artificially prepared may also be employed. For instance, they may be produced from limestone blocks by cutting them into the form of plates, tubes, pots, boxes, or the like, or the diaphragms may be prepared under pressure from a moistened mixture of pulverised limestone and calcined magnesite.—G. H. R.

Alkali-Amalgam obtained in Electrolytic Apparatus, Improvement in the Method and Apparatus for Washing. P. Jensen, London. From H. C. F. Störmer, Christiania, Norway. Eng. Pat. 24,837, Dec. 27, 1895.

A SUITABLE receptacle containing a shallow perforated box or cup is connected with suitable mechanism for lifting it up and down. Inlet and outlet pipes are provided for the amalgam and washing liquid respectively, and a series of receptacles may be arranged in such a way that the amalgam and wash liquid pass through them in opposite directions. When the rod is depressed, the box fills with the amalgam, which falls through the perforations in fine streams when the box is raised, thus exposing a large surface to the action of the washing liquid. The action of the apparatus may be improved by arranging in the bottom

of the receptacle rods of any suitable material, as iron wire or ebonite, of a thickness of one-eighth to quarter of an inch, the rods passing through the holes in the cup, so that there only remains a narrow annular space for the amalgam to fall down through. The surface of amalgam exposed to the water is thus greatly increased.—G. H. R.

Electric Battery, An Improved, and Method or Process of converting the Potential Energy of Carbon or Carbonaceous Materials into Electrical Energy. W. W. Jacques, Newton, Massachusetts, U.S.A. Eng. Pat. 4788, March 3, 1896.

THE battery consists of an iron vessel forming the cathode, closed by a non-conducting lid, from which the carbon anode is suspended. Pipes are provided for the admission and withdrawal of the electrolyte, and for the escape of gases formed in working. The electrolyte is fused sodium or potassium hydrate, which is maintained at a temperature of about 400° to 500° C. by means of a furnace surrounding the vessel, and the electrolyte is kept in a state of violent ebullition, and constantly supersaturated with oxygen by means of air passed into it under pressure through a finely perforated rose. It is claimed that the addition of a small quantity of magnesium oxide greatly diminishes the formation of carbonate.—G. H. R.

Electrolytic Processes and Apparatus therefor, Improvements in. G. B. Baldo, Trieste, Austria. Eng. Pat. 5098, March 6, 1896.

THE apparatus is an improvement on that described in Eng. Pat. 18,406, 1895 (this Journal, 1896, 204 and 198), and consists of an outer vessel which contains a porous cell forming the cathode, inside of which is a second porous vessel containing the anodes, which are of carbon or other suitable material. The cathode, which is provided with a flange which forms a lid to the outer vessel, is constructed of an open or skeleton framework of earthenware or the like material, which is covered with linen, and surrounded by a layer of asbestos board about 1 mm. in thickness, which again is surrounded and is in contact with an open-work metal sheet, such as close wire netting. The inner porous vessel is similarly constructed, with the exception that it is covered with an outer layer of linen instead of a metal sheet. This vessel is closed with a cover, and both it and the containing vessel are provided with an inlet pipe for the liquid and an outlet pipe for the gases, and all three divisions of the tank have pipes by which their contents may be drawn off. When the apparatus is employed for the electrolysis of sea water, the outer vessel is filled with fresh water and the two inner divisions with sea water. On the passage of the current, hydrogen is given off at the cathode and chlorine at the anode, while filtered caustic soda solution is produced in the outer vessel, and the oxides of calcium and magnesium are deposited in the space intervening between the cathode and the inner porous vessel. The liquid in the inner vessel contains free sulphuric acid produced by the decomposition of sulphates contained in the sea water, together with undecomposed sodium chloride and other salts.—G. H. R.

Ozone, Improvements in and Apparatus for the Manufacture or Production of. M. Otto, Paris, France. Eng. Pat. 5195, March 7, 1896.

THE improved apparatus comprises a number of elements each consisting of a conducting sheet, which may be plain or in the form of a grating, but the corners of which must be rounded off. Each sheet is placed between two plates of glass or other dielectric, and the elements so formed are enclosed in a casing, and separated from each other, so as to allow the gases to be treated to pass between them. The alternate elements are connected together and to the opposite terminals of a high-tension transformer. By suitably choosing the dimensions of the constituent elements of the apparatus, it may be made to act as a resonator, and give an oscillatory discharge, which is stated to give the highest yield of ozone. This condition is satisfied when the ratio between the co-efficient of self-induction L of the apparatus,

and its electrical capacity, C , is such that the resistance of the system is less than $\sqrt{\frac{4L}{C}}$. With an apparatus having glass sheets 0.40 m. long, 0.16 m. wide, and 0.001 m. thick, with sheets of conducting metal 0.27 m. long, 0.05 m. wide, and 0.0001 m. thick, the elements being arranged at a distance of 0.0015 m. apart, and the apparatus being supplied with a current having a periodicity of 80 per second and a tension of 5,700 volts, the power consumed in full operation is 10 watts. The yield in ozone is stated to be considerable, and to be obtained at a low cost.—G. H. R.

(B).—ELECTRO-METALLURGY.

Lead, Quantitative Electro-deposition of, as Peroxide.
O. von Giese. Zeits. f. Elektrochem. 1896, 586.

See under XXIII., page 473.

PATENTS.

Electric Furnaces, Improvements in [Liquid Forge].
G. D. Burton, Boston, U.S.A. Eng. Pat. 7712, April 17, 1895.

In this apparatus the metal is fused, or the ore is smelted by means of an electric arc sprung between the metal or ore and an electric bath. The bath is contained in a tank constructed of or lined with a non-conducting material, and divided into three compartments by a vertical transverse partition near one end and a longitudinal partition near one side. These partitions are perforated below the surface of the liquid, or may be formed of a reticulated screen of any non-conducting material. The bath is composed of an electrolyte having a density greater than water, and capable of evolving hydrogen and of forming an electric arc with the metal to be heated. For small work, the bath preferably consists of a chloride of sodium solution of a density of 1.050, but for larger work the density of the solution and its composition may be varied. The anode, which is preferably in the form of a serpentine plate of lead, is placed in the transverse compartment, and is connected at one end with a copper conductor which rises through the cover, and is suitably connected with the positive lead from the source of electric supply. The hearth is composed of fireclay, perforated through its depth. A pump placed in the longitudinal compartment enables the level of the liquid in the hearth compartment to be raised into or out of contact with the work placed on the hearth. A bar of copper or other suitable conductive metal is connected with the negative pole, and forms a rest on which the implement grasping the article to be heated may make contact for closing the circuit. A conductive sliding rod, properly insulated, brings one end into contact with the terminal. An electrode provided with an insulated handle is hinged to this rod, and is adapted to make contact with the work on the hearth. An automatic electrode similar to the above, is hinged directly to the negative terminal of the bar.

—G. H. R.

Electric Furnaces, Improvements in [Liquid Forge].
G. D. Burton, Boston, U.S.A. Eng. Pat. 7713, April 17, 1895.

THE liquid forge consists of a tank constructed of or lined with a non-conducting material, which contains the electrolytic bath. This vessel is divided into a plunger compartment, a hearth compartment, and an anode compartment, by two perforated partitions, one of which is placed longitudinally near one side. The bath partially fills the vessel, and is composed of an electrolyte having a greater density than water, and capable of evolving hydrogen and of forming an electric arc with the metal to be heated. For small work the bath preferably consists of a chloride of sodium solution of a density of 1.050, but the density must be increased proportionately with the size of the work. The anode is a plate of lead connected with a copper rod which is in contact with the positive pole of the source of electric supply. The hearth, which is formed of fireclay or other non-conducting material, is divided into two portions, one of which is fixed in a recess in the bottom of the bath,

while the other portion is supported on a slide, so that it can be moved to or from the other portion of the hearth. A gauge and pointer are provided so that the movement can be regulated. By means of a lever the liquid in the hearth compartment can be forced into or out of contact with the metal placed on the divided hearth. A copper bar connected with the negative terminal of the source of electric supply is supported on the front side of the tank on insulated studs. This bar serves as a rest on which the tool for grasping the article to be heated may form contact for closing the circuit. When it is desired to heat a piece of metal, the latter is laid with its two ends resting on the opposite portions of the divided hearth, the negative electrode is connected with the metal, and the level of the liquid in the hearth chamber is raised into contact with the metal, thus closing the circuit. Hydrogen is evolved from the electrolyte, and forms a film between the work and the liquid, and causes an arc to be struck which heats the former.—G. H. R.

Metals or Metallic Alloys by Electrolysis, An Improved Method or Process for obtaining. E. Jordis, Munich, Germany. Eng. Pat. 11,298, June 8, 1895.

THE improvement consists in the use of lactic acid or its salts in galvanic baths, the lactic acid or its salts being used already formed, or formed by appropriate process in the bath itself. By the employment of lactate solution it is claimed that the use of cyanide of potassium may be dispensed with. As an instance of the process, a silver bath may be quoted:—1 to 3 per cent. silver of nitrate (AgNO_3), 3 to 5 per cent. of lactate of ammonium, and ammonia up to alkaline reaction.

The lactate of ammonium can be replaced, especially in nickelling, partly or wholly by lactate of potassium. Baths for depositing platinum, zinc, and nickel are also described, and a table is given of the current density to employ in the case of copper and iron, and alloys of these metals.

It is also proposed to replace, wholly or partially, the lactic acid by its homologues, especially by glycolic acid.

—G. H. R.

Electro-Plating Bath, An Improved. S. Pitt, Sutton, Surrey. From W. B. Hollingshead, East Chester, U.S.A. Eng. Pat. 5113, March 6, 1896.

THE improved bath is made as follows:—12 parts by weight of ammonium cyanide dissolved in three times its bulk of water at a temperature of 110°F. ; 61 parts by weight of potassium tartrate (neutral) dissolved in about three times its bulk of water at about 110°F. ; 27 parts of a mixture of oxide of copper and water mixed to a pasty consistence, the last two ingredients are then mixed, the potassium tartrate forming the solvent for the cupric hydrate. The ammonium cyanide is then added to the mixture and a quantity of water equal in bulk to about three times that of the other two ingredients is added to reduce the bath to a proper strength for use. The potassium tartrate may be replaced by Rochelle salt.

—G. H. R.

XII.—FATS, OILS, AND SOAP.

Wool Oils. J. Lewkowitch. J. Soc. Dyers and Col., 1896, 12, 60.

THE so-called wool oils used for lubricating the wool in wool spinning may be sub-divided into (a) fatty oils, (b) oil emulsions, (c) solutions of soap. Mineral oils by themselves are unsuitable for oiling wool, though they are largely used for the adulteration of fatty oils intended for the woollen industry. The fatty oils used are olive oil, lard oil, oleine (oleic acid), distilled grease oil, black recovered oil, "seek oil," and brown (grease) oil. The emulsion oils are chiefly aqueous solutions of soda or ammonia, containing larger or smaller proportions of oleic acid soap and mineral oils held in solution by them. The soap solutions are represented by solutions of castor oil soap, or of a neutral alkali salt of sulphorcinoleic acid. The valuation of wool oils is governed by the principle

that, as they must be easily removable in the scouring, they should not contain any drying oils or their fatty acids, nor any resin oil or resin acid. Whether mineral oils are permissible in wool oils has not been satisfactorily decided yet, some investigators fixing the practicable limit of the admixture of mineral to fatty oils at 80 per cent., others at 20 per cent., whilst others maintain that they should be altogether excluded. Wool oils should produce as little heat as possible, both in the stored raw material and during the working of the oiled material. Therefore the flash point of an oil and its liability to cause a fire or favour its spreading, are matters of the greatest importance, and the charges of fire insurance companies are in direct proportion to the quantity of unsaponifiable matter, hydrocarbons, in wool oils. The determination of the flash point and of the amount of unsaponifiable matter, are therefore most important in the analysis of wool oils. But the last-named factor should not be determined by difference as is frequently done, but should be estimated directly, as in the presence of wool grease or its distillates in wool oils, much of the unsaponifiable matter may consist of a solid alcohol (cholesterol). The flash point is determined by the open test, and the liability to spontaneous combustion in Richard's or preferably Mackey's apparatus. The objection of the insurance companies to neatfoot or tallow oil is strange, considering their approval of the certainly dangerous fish oil. Moreover, the admission of the latter renders the detection of the prohibited cotton-seed oil almost an impossibility.

In the discussion following the paper it was remarked that the elimination of mineral oils from wool in the scouring process is a very difficult matter, and that, indeed, the excess of soap required for this purpose partially neutralised the saving in the original price of the wool oil. Also fatty oils may offer considerable resistance to their removal from the fibre in the scouring process when they had had time to undergo oxidation, and for this reason, from the spinner's point of view, an oil was the more objectionable the more readily it would undergo oxidation, and the interest of the insurance companies tended in exactly the same direction, since the liability of an oil to induce spontaneous combustion was directly proportional to its readiness to undergo oxidation. Any oil possessing an iodine number of from 80 to 90 would be quite safe; if it went beyond 100 it would be absolutely useless as a wool oil, as also if the rise of temperature on mixing with sulphuric acid were considerable.—C. O. W.

Wool Grease, Composition of. L. Darmstaedter and J. Lifschütz. Ber. 29, 1896, 618—622.

THE alkaline liquid obtained from the partial saponification of wool grease was separated by the authors (this Journal, 1896, 206) into a soluble and an insoluble portion. From the latter the authors obtained two new alcohols which they propose to term "lanestols," whilst the former was divided by a process of fractional neutralisation into three distinct soaps, which have now been submitted to a closer examination. The first of these proves to be chiefly the potassium salt of carnaubic acid, whilst the second contains potassium myristate. The third fraction consists principally of foreign fatty acids, derived from the soap used in washing the wool, which constitute from 20 to 28 per cent. of commercial wool grease, together with a small quantity of myristic acid. From the properties of the above soaps and the acids resulting therefrom it appears that the carnaubic acid is identical with that described by Stürcker (Ann. d. Chem. 223, 306; this Journal, 1884, 148), and the myristic acid with those acids described by Playfair, Krafft, and Heinz. —J. S.

Lanolinum Anhydricum, Adeps Lanæ and Wool-Fat. Von Coehenhausen. Dingl. Polyt. J. 1896, 299, 256.

See under XXIV., page 480.

Colza Seeds, Adulteration of. Journal de Pharm. [6], iii., 434.

PAJOT gives a case of adulteration of colza seeds, with grains of a variety of mustard known as "snavé" and also

of *Brassica Juncea*, both being artificially treated with a coating of blue colouring matter—a kind of litmus. Maceration in water revealed the fraud, a blue solution being afforded giving with acids a rose coloration, restored to blue by alkalis. This sophistication it is alleged was carried out in Germany. The coloured seeds are far below the market value of true colza seeds, and yield 10 to 12 per cent. less oil. The oil-cake could not be honestly employed as cattle food, and the article, it is significantly added, was only fit for manure.

Cod Liver Oil. A. Jorissen. Chem. Zeit. Rep. 20, [30], 103.

ACCORDING to the Belgian, French, German, and Swiss pharmacopœias, this is the white oil derived from the fresh liver of the cod, *Gadus Morrhua*. In the Russian pharmacopœia that from the dorsch, *G. Callarias* is also official.

The author has examined the reactions given for pure cod liver oil by these different authorities, which are not, in his opinion, always in accord.

A specimen of oil prepared according to the directions of the "Codex Français" had a specific gravity of 0.929 at 15° C., while three samples obtained from different druggists in Liège gave from 0.924—0.9255. A mixture of equal parts of cod liver oil (0.929) and cotton-seed oil had a gravity of 0.9225. By the action of concentrated sulphuric acid on an oil known to be pure, the author obtained a reddish violet colour. This is given as characteristic of a pure product by the Swiss pharmacopœia. With fuming nitric acid there was a rose-red colour, which changed gradually into yellow. The oil from the liver of *Gadus Carbonarius* gave with fuming sulphuric acid a violet blue colour, soon changing to brown. Oils of different origin showed a difference in the separation of solid glycerides when exposed to cold. Some samples purchased at Liège gave no deposit, while those prepared by the author invariably did so, though the bulk of the oil remained fluid. Others again deposited so much that the oil could no longer be poured out. The refractive power of liver oils (determined by the Zeiss refractometer) was changed by the addition of vegetable oils. Variations were obtained with the different kinds of cod-liver oil in the rise of temperature with sulphuric acid. In a sample from Ostend the temperature rose to 114° C., while in three bought in Liège the rise was to 93°, 104°, and 107° C. respectively. A liver oil which showed a blue colour with nitric acid gave as the final temperature 85° C., and a mixture of equal parts of official cod-liver oil and cotton-seed oil gave 81° C.—C. A. M.

Oils, Oxidation of; Researches on the Determination of the Degree of. M. W. Bishop, Mon't. Scient. 1896, 259—264.

See under XXIII., page 475.

Wax, Analysis by Cold Saponification. R. Henriques. Zeits. angew. Chem. 1896, [8], 221.

See under XXIII., page 476.

Liquid Fats, the Saponification and Saponification Number of. D. Holde. Mit. aus den Königl. tech. Versuchsanst. zu Berlin, 1896, 14, [1], 82.

See under XXIII., page 476.

PATENT.

Soap Extract, a New or Improved, and a Process for Manufacturing the Same. A. Luhn, Ritterhausen, Barmen, Germany. Eng. Pat. 7442, April 11, 1895.

"180 parts of soda are dissolved in 300 parts of boiling water. In this solution is allowed to melt 200 parts of

pure soap having a base of turpentine and ammonia, to which is added 200 to 300 parts of dried, sifted, neutral soap. The soap thus obtained is shredded or divided into threads or filaments and mixed by continual agitation with a pulverised neutral soap in the proportion of 100 parts of the former to 200 parts of the latter, two-thirds per cent. of caustic ammonia being added thereto."—J. A.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

PATENT.

Pigments, Sulphate of Lead and Lead; Improvements in the Manufacture of. H. R. Gregory, London. Eng. Pat. 9891, May 18, 1895.

A mixture of galena and magnesite in equivalent proportions is roasted, treated with water and sulphuric acid for 12 hours, and the soluble matter removed. The residue is boiled for one hour with a slight excess of caustic alkali; the lead hydrate washed, dissolved in nitric acid, and precipitated again as sulphate. Other alkaline earths may be used in the roasting; but if chalk be employed, the mass requires treating with a weak solution of sodium carbonate for several days to decompose the crude sulphate of lead.

To improve the quality of the pigment 100 parts of the sulphate are boiled with about 9 parts of caustic lime or 5 parts of magnesia. The resulting substance is thoroughly washed and dried.—F. H. L.

(B.)—RESINS, VARNISHES.

Varnishes, Notes on the Drying of. L. E. Andés. Chem. Zeit. 1896, 20, 307.

By the addition of a certain limited amount of mineral oil to linseed varnish, the drying of the latter may be retarded, or even completely prevented. If, however, the adulterant be introduced in sufficient quantity, it is found that a thin film of the substance on exposure to air separates into two layers; the true varnish absorbing oxygen and drying in the usual manner, whilst the lubricating oil remains on the surface. A mixture of equal parts of linseed varnish, drying resin oil, and mineral oil behaves in a similar manner, the two former drying together and the latter separating out. A parallel result was also obtained by the addition of excess of turpentine to a spirit varnish. Experiments were tried as to the possibility of improving the working qualities of such a medium (*i.e.*, lowering the speed of its drying) by mixing in turpentine, when a point was reached at which the varnish worked better under the brush, but dried almost instantaneously, separating as before into two distinct layers, dry varnish underneath and turpentine above. When the latter had evaporated, the varnish was found to have a matt surface. Smaller amounts of turpentine may be, and often are, added to spirit varnishes without harmful results; the mixed solvents evaporating together. In the case of oil varnishes where the turpentine is adulterated with petroleum spirit, the only effect of the sophistication is to hinder the drying of the material, without influencing, however, the durability of the final product.

It is suggested that this phenomenon of separation should be employed as the basis of a method for testing the purity of any sample of linseed oil varnish.—F. H. L.

Paraffin, Pine Resin in, Detection and Determination of. T. Klimont. Chem. Rev. ii. d. Fett- u. Harz-Ind. 1896, [38], 76.

See under XXIII., page 475.

Linseed Oil, Linseed Oil Varnish and Oil Colours [Resin and Resin Oil]; Simple Method of Testing. R. Hefelmann and P. Mann, Pharm. Central H. N.F. 1895, 16, 685.

See under XXIII., page 475.

(C.)—INDIA-RUBBER, &c.

India-Rubber Tubing, Action of Coal-Gas upon. H. Groshentz. Bull. Soc. Ind. Mulhouse, 1895, 73.

See under XVIII. B., page 466.

PATENTS.

Plastic Mixtures [Rubber or Horn Substitutes] or Compounds; Improvements in the Manufacture of. L. F. A. Magdolf, Berlin. Eng. Pat. 3412, Feb. 14, 1896.

A resin, such as shellac, copal, &c. is dissolved in alcohol and mixed with some insoluble material such as chalk, powdered glass, &c., the weights of the ingredients being in proportion to their respective specific gravities. The mixture is well stirred and precipitated by the addition of water; the deposit being finally dried, compressed, powdered, and melted into the desired shape.

The composition is adapted for the manufacture of buttons, door handles, and insulators.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

The Sweating Process in the Tannery. W. Schmitz-Dumont. Dinger's polyt. Jour. 1896, 300, 139--144.

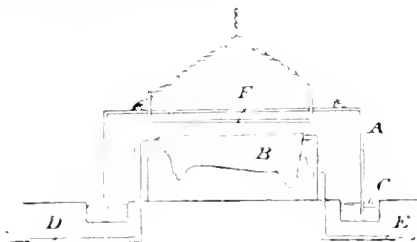
VILLON (*Traité pratique de la fabrication des cuirs et du travail des peaux*, 1889) claims to have traced the loosening of the hair in the sweating process to the putrefactive action of a specific bacterium which he styles the *bactérie pilline*; this organism is aerobic and feeds upon the hair substance (pilline), converting it into leucine, tyrosine, butyric acid, margaric acid, and ammonia; the ammonia dissolves the corium and thus swells the hide. Villon further claims that he has obtained pure cultures of this bacterium on ammoniacal gelatin—ammonia having an inhibitory effect upon other bacteria—and to have inoculated sterilised hide therewith, when an evolution of ammonia and loosening of the hair followed.

The author criticises the experiments on which Villon bases his conclusions, on the ground that the method adopted for obtaining antiseptic conditions was not sufficiently drastic. He next describes in detail some experiments which he has himself conducted with the hope of confirming Villon's results. Sterilisation of hide by exposure to a temperature of 50° C. for 24 hours, followed by 10 minutes at 110° C. (the method adopted by Villon) was found to be impossible. Recourse was therefore had to the use of antiseptics, and carbon bisulphide in the form of potassium ethyl dithiocarbonate (potassium xanthogenate) was employed as being easily removed by washing and not deleterious to the hide.

The following conclusions are drawn:—A dilute solution (1—0.25 per cent.) of potassium xanthogenate will gradually kill all micro organisms existing in hide from which the hair has not been removed, without changing the hide to a perceptible extent, even after half a year's immersion. A short exposure (24—48 hours) to this antiseptic will prevent general putrefaction, but will not destroy a streptococcus which, by decomposing the *rete malpighii*, loosens the hair. The organisms which remain active in this way evolve ammonia without any marked quantity of other odiferous compounds, and are apparently killed, before there has been any attack on the hide fibre, by the decomposition products of the *rete malpighii* cells. The identity of these micro-organisms with a known form remains to be proved; so far, a tendency of the colonies to develop in the form of an intricate and extensive net work seems to characterise this streptococcus.

It is proposed that, in the very probable event of a pure culture of the bacterium which is responsible for the loosening of the hair in the sweating process being obtained, a rational system of sterilising the hide by carbon bisulphide vapour and then inoculating it with the necessary bacterium, shall be followed by the tanner who unhairs by sweating. An apparatus for accomplishing this end is represented in the figure, in which A is a sheet-iron box suspended by a chain working over a pulley, so that the hides B may be readily placed in position. The edges of the box rest in the seal C, containing water, to which an antiseptic has

been added. The carbon bisulphide may be sprayed into the chamber by a suitable pulveriser, and may be removed when sterilisation is complete, by a current of air led in



through the pipe D, having been previously passed through a system of hot tubes, and out through the pipe E. The pure culture of the unhairing bacterium, suspended in water, is sprinkled on to the hide through the pipe F.

—A. G. B.

PATENTS.

Leather, Imitation or Artificial; Improvements in the Manufacture of. H. Schmiedel, Vienna, Austria. Eng. Pat. 8215, April 25, 1895.

A LIXEN or cotton fabric is glued on to strong paper, then painted with water colours, aniline colours, or a lacquer made of shellac dissolved in diluted borax solution, or of tannin or casein, and finally calendered and embossed by calendering and goffering rollers. The material serves for binding books and for other fancy purposes to which leather is applied.—A. G. B.

Soluble Colloids, such as Gelatin and Isinglass, Improvements in the Formation and Preparation of. E. J. Mills, Glasgow. Eng. Pat. 8847, May 4, 1895.

ACCORDING to one modification of this invention, gelatin or a gelatin containing a gelatinous substance, is heated with a solution of fixed alkali. In a short time a gelatin compound is formed which remains liquid in the cold. The proportion of alkaline material necessary, depends partly on the nature of the gelatin under treatment. A fair sample of gelatin can, in general, be permanently liquefied by heating it at 100° C. with about five times its weight of water and one-twentieth of its weight of slaked lime for two hours; in many cases a smaller proportion of water will suffice.

Another modification consists in dissolving the gelatin in about 10 times its weight of water, keeping the solution at a temperature distinctly above its setting point, and seeding it with microbes capable of permanently liquefying gelatin. *Bacillus liquificiens*, for example, succeeds well. After three days it will generally be found that the solution remains permanently liquid in the cold. The addition of a small proportion of meat extract, together with a trace of sodium carbonate, will accelerate the action of the microbes.

By either process, non-corrosive colloid products of value as gums, thickeners, detergents, emulsifiers, and media for photo-lithographic and other photographic purposes are obtained.—A. G. B.

Whalebone, Imitation; Improvements in the Manufacture of. J. Baier, London. Eng. Pat. 10,193, May 23, 1895.

SINews, muscles, guts, and other parts of animals are first thoroughly cleansed from adhering skins, and fatty or meaty parts, then soaked in soda, salt, or other preserving agent, then treated with a solution of oxide of zinc, which acts as a deodoriser, and subsequently steeped in water for one or two days. The material is then passed through a solution of sulphate of iron—say, 1 lb. of sulphate of iron to $\frac{1}{2}$ ton of the material to be treated—and subsequently immersed for a day or more in a suitable mixture, say, of $\frac{1}{2}$ lb. of carbonate of potash, 5 galls. of spirits of wine, and 10 oz. of saffron, to $\frac{1}{2}$ ton of the material, but other suitable chemicals which will give the necessary elasticity may be substituted if desired. The soaked material is dried

in suitable frames below 90° F., and cut up in the desired form. Greater elasticity may be imparted by immersion in oil, such as linseed or poppy oil, at 90°–100° F. for 48 hours.—A. G. B.

Substitute for Whalebone, A New and Improved Manufacture of a Material suitable as a. G. L. A. Kuhlmann and J. Baier, London. Eng. Pat. 2090, Jan. 29, 1895.

This specification is virtually identical with the preceding one. The substitute is called "Myoline."—A. G. B.

Whalebone, Artificial or Imitation. W. Hunkemöller, Amsterdam, Holland. Eng. Pat. 1214, Jan. 17, 1896.

THE sinews or tendons and other similar parts of oxen, buffaloes, and horses, in a fresh or salted condition, are soaked in a solution of chrome alum, to which is added chloride of sodium up to one-twentieth of the weight of the alum. After being superficially dried, the tendon is flattened out to the desired thickness and cut according to requirements. In some cases the outer membrane is detached from the oore, flattened, and cut into strips.—A. G. B.

Horn-like Material, An Improvement in the Treatment of Skins for Producing a. C. Marter and J. Levy, London. Eng. Pat. 4718, March 2, 1896.

IN addition to, or instead of, the application of linseed oil, described in Specification 1820 of 1895 (this Journal 1896, 208), other oils and oleaginous substances, such as cotton seed, rape, cocoa-nut, and other vegetable oils, also animal and fish oils, vasoline, paraffin, stearin wax, and the like, or mixtures of these, may be applied to the prepared skins.

—A. G. B.

XV.—MANURES, Etc.

"Available" Phosphoric Acid in Basic Slag, Estimation of, by Direct Precipitation with Magnesia Mixture. W. Hoffmeister. Chem. Zeit. 20, 305.

See under XXIII., page 474.

PATENTS.

Inoculation of Soil for the Cultivation of Leguminous Plants, Improvements relating to the. Dr. F. Nobbe and Dr. L. Hiltner, Tharand, Germany. Eng. Pat. 11,460, June 12, 1895.

THE inventors find that the nitrogen-transforming bacteria proper to the Leguminosae, and obtained by Von Beyerrinck, when introduced into soil free from the bacteria, produce, in accordance with his statements, the root nodules or tubercles on the plants having papilionaceous flowers, these growths being capable of assimilating free nitrogen. Thus, a soil containing no assimilable form of nitrogen, when inoculated with these bacteria, will produce a rich yield from the growth of Leguminosae, which plants without such inoculation would have starved.

Pure colonies of the active bacteria for the Leguminosae are obtained in agar-gelatin, with suitable additions, such as sugar, asparagin, or the green substance of the plant, placed in glass tubes. Or the bacteria can be prepared in fluid cultures. The contents of a tube are dissolved in from 1 to 3 litres of water, previously mixed with one of the named substances, and, immediately before sowing, the emulsion is poured over the seeds, the contents of three tubes sufficing for 20 kilos. of clover seeds; the whole is then mixed with sand or earth until its condition is suitable for sowing in the soil. Instead of this method, a small quantity of sand or earth may be moistened with the bacteria-charged emulsion, and, after air-drying, be worked into the soil.—E. S.

Fertilising by the Aid of Artificial Nitrogenous Manure, Improvements in. H. Mehner, Charlottenburg, Germany. Eng. Pat. 12,470, June 27, 1895.

THE invention consists in applying silicon nitride, alone or mixed with other substances that will not expel ammonia,

such as kainite, to the soil as manure. The silicon nitride slowly develops ammonia, under the influence of moisture and of carbonic acid, thus supplying plants with the necessary nitrogen.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Wood-wool, Use of, in Sugar Manufactories. Herzfeld. Zeits. Rübenzucker Ind. 1896, 46, 92.

AFTER a series of experiments the author, confirming the statements of Engel and Siegert, advises that wood-wool or sawdust should be used in an unprepared condition, otherwise trouble will be experienced in working.—J. L. B.

Basic Lead Acetate, Behaviour of, towards Sugar Solutions. H. Svoboda. Zeits. d. Ver. Rübenzucker Ind. 1896, 46, 481.

See under XXIII., page 477.

Spent Molasses (Strontia and Lime Processes), Electrolysis of, Influence on the Composition of the Ash. Zeits. f. Elektrochem. 1896, 573—577.

THE author investigates the question as to whether a substantial improvement (as regards elimination of chlorine) in the quality of the crude potash—obtained as a by-product in sugar manufactories by the incineration of spent molasses—may be effected by the electrolysis of such molasses prior to incineration. Experiments were made on a small scale only (2—3 litres of liquid—currents of 10—100 watts). The best results as regards current efficiency and increase in the proportion of potassium carbonate were obtained by operating on highly concentrated liquids, and without the use of a porous septum between the electrodes. For example:—specific gravity of spent molasses, 44° B.; composition of ash before electrolysis, K_2CO_3 , 53.44 per cent.; Na_2CO_3 , 20.89 per cent.; KCl , 13.98 per cent.; K_2SO_4 , 7.77 per cent.; loss, &c., 3.92 per cent.; after electrolysis, K_2CO_3 , 61.44 per cent.; Na_2CO_3 , 18.42 per cent.; KCl , 5.74 per cent.; K_2SO_4 , 5.89 per cent.; loss, &c., 5.51 per cent.

With weaker liquids, the results were less satisfactory, probably because a portion of the current goes to waste in decomposing water. In any case the anode (carbon) is strongly attacked by the chlorine set free; whilst a non-conducting layer of lime and strontia—which must be frequently scraped off—is deposited on the cathode. From a monetary point of view, the improvement effected appears to be balanced by the cost of the power consumed, electrodes, &c. On the other hand the process would offer decided advantages if—and this point requires further investigation—the chlorine liberated by the current were found suitable for the production of bleaching powder.—H. T. P.

Sugars in Fruit Essences, Syrups, Liqueurs, Preserves, and Honey, Estimation of. De Raczowski. Monat. Scient. 1896, 19.

See under XXIII., page 477.

XVII.—BREWING, WINES, SPIRITS, Etc.

Water, Fermentative Changes in. W. E. Adeney. Trans. Royal Dublin Soc. V., Part II.

THE author describes the method and special apparatus which he has used, for studying quantitatively the changes in composition of the dissolved gases in liquids, which may accompany fermentative changes in the same.

He draws the following conclusions, among others, from his experiments recorded in this paper:—

That it is possible to demonstrate that the fermentation of substances under aerobic conditions, and in the presence of organisms usually present in water, takes place progressively in two distinct stages: (1) That in which the organic substances are completely broken down, the carbon and nitrogen being largely converted into carbonic anhydride and ammonia, a little organic matter remaining as such, but in an altered form; and (2) that in which ammonia is oxidised to nitrous or nitric acids, or both.

That the first stage of fermentation must be complete before the second stage can set in.

That the organic substances which result as products of the first stage of fermentation may undergo further change during the subsequent stage, and give rise to the formation of carbonic anhydride, and possibly also to nitric acid.

That peaty matters when present alone in a water, undergo very slow change, but when present with ammonia compounds in water they readily undergo fermentation, together with the ammonium compounds, just as the organic matters, which, as above stated, are formed during the first stage of fermentation of animal, vegetable, or artificial organic substances do, during the after-fermentation of ammonium compounds, which may have been also formed thereby, or which may have been previously present or added.

That the above-mentioned fermented organic matters, and also peaty matters, appear to determine the nitric fermentation of ammonia, since in their complete absence, similar organisms being present, only nitrous acid is obtained.

That during the intermediate stages of a fermentation of mixed peaty matters and ammonium compounds, various interchanges between the two appear to take place, the character and extent of which apparently depend on the relative quantities of peaty matters, ammonia, and dissolved oxygen present, and also on the character of the peaty matters themselves whether they have been freshly formed, or have undergone any previous fermentative changes.

That in the presence of small quantities of peaty, or other fermented organic matters, carbonic anhydride and ammonia may become "fixed" during fermentation, in appreciable quantities, no doubt, from Winogradsky's researches, to form organic matter.

That the formation of 1 part by weight of nitrous nitrogen during the fermentation of ammonia, in the complete absence of organic matter, is attended by the consumption of about 4.2 parts by weight of oxygen.

That for similar volumes of oxygen consumed, the quantity of nitrogen oxidised during the fermentation of ammonia is distinctly greater in the presence of peaty or other fermented organic matter than in their absence.

That for similar volumes of atmospheric oxygen consumed, the quantities of carbonic anhydride and of ammonia "fixed" are also more appreciable in the presence of those organic matters than in their absence.

That the observed facts in reference to nitrification may be summarised as follows:—

(a.) The nitrous organisms of soil thrive in inorganic solutions containing ammonia.

(b.) The nitric organisms of soil are gradually killed, or lose their vitality, in organic solutions containing ammonia.

(c.) The nitric organisms of soil thrive in inorganic solutions containing nitrites.

(d.) The nitrous organisms cannot oxidise nitrites to nitrates in inorganic solutions.

(e.) The presence of peaty or humus matters appears to preserve the vitality of nitric organisms during the fermentation of ammonia, and establishes conditions whereby it is possible for the nitric organisms to thrive simultaneously in the same solution with the nitrous organisms.

That by determining the changes in the composition of the dissolved gases, and that of the organic and inorganic nitrogen compounds, which accompany fermentation in natural and polluted waters, it is possible not only to differentiate easily fermentable from difficultly fermentable substances present in them, but to approximately estimate their quantity.

That such determinations are of very great value in the case of polluted waters, because, in addition to affording very accurate estimations of the total quantities of fermentable matters in them, in terms of the exact volume of atmospheric oxygen necessary for their complete fermentation, it is possible by proper examination to determine what fraction of such volume is required for the first stage of fermentation, and what fraction for the second, distinctions of the utmost importance in considering the technical aspect of the question of the pollution of rivers.

Brewing Waters, Nitrates in. R. E. Evans. J. Fed. Inst. Brewing, 1896, 2, 188—198.

WHEN the amount of nitric acid present in brewing waters exceeds 2 grains per gallon, deeper colour, sluggish

fermentations, and peculiar flavours are generally noticed; phenomena, though much modified by the character of the yeast, which are probably due to the bacteria being unaffected, whilst the development of the yeast is checked. The influence of nitrates is slight if a strong and healthy yeast be employed, whilst the same water with a weak yeast would give unsatisfactory results. The objectionable colour produced in worts brewed with water rich in nitrates is frequently attributed to the oxidation of the sugar or albuminoids; the author does not hold this view, for he found that a wort prepared with water containing 10 grains of potassium nitrate per gallon when boiled for four hours showed no increased coloration. Experiments were carried out with the object of studying the effect of nitrates in the brewing process. Wort containing 20 grains per gallon of potassium nitrate was fermented with ordinary yeast. No nitrates were found, thus showing that yeast cannot reduce nitrates to nitrites. A negative result followed an experiment to demonstrate whether yeast is similar to the higher plants in its capability of assimilating nitrates.

Steep Water, The Employment of Lime in. Wochenschr. f. Brau. 1896, 13, 401.

THE use of lime in steep water not only keeps the water fresh but causes the barley on the growing floor to retain a fresh aroma, whilst its vitality is increased and the growth rendered even. It is possible that the presence of weak alkali diminishes the solubility of phosphoric acid salts, and, moreover, renders the barley more permeable to water, thus favouring the absorption of the latter. Faulkner (Brewers J. 1895, 658) states that the employment of lime in steep water is becoming more general and is employed in one of the largest American maltings. The precipitate of chalk which forms in the tank carries down and retains water-borne bacteria, which play so important a part in the production of unpleasant smelling compounds when grown in a liquid rich in nitrogen. Phosphates are also well known to be especially favourable to bacterial development, and by diminishing their solubility the lime acts indirectly as an anti-septic. The author accordingly recommends the use of lime in steep water, and the use of calcium chloride in the mashing water.—T. A. G.

Fermenting Plant, The Cleansing of. B. W. Valentin. J. Fed. Inst. Brewing, 1896, 2, 184—185.

TO avoid difficulty in removing slumage incrustation deposited by yeast heads the author recommends painting with a wash consisting of whitening and water for two or three feet above the level of the beer, and allowing the layer to dry before the vessel is filled. After the fermentation is completed the yeasty slumage, together with the chalk, can be easily removed by a jet of water and a limited amount of brushing. The chalk prevents the slumage from persistently adhering to the wood; when once dry it is not acted on by the yeast heads, and, being practically insoluble in water or wort, it is not washed off to any appreciable extent, even when the wort is splashed up during reusing.—J. L. B.

Yeast Cells, Experimental Studies on the Variation of. E. C. Hansen. Annals of Botany, 1895, 9, 549—560.

IN 1870 Rees published a work on alcoholic fermentation fungi, in which yeast cells are referred by him to a particular genus *Saccharomyces*. He described a number of species, founding his views on the form and size of the cells. In 1883 and in subsequent years the author proved that the limits previously drawn were non-existent, and that from each of the species named by Rees it was possible to develop the rest. It is not in the form and size *per se* in which the distinguishing characters lie, but in the form and size depending upon particular conditions of cultivation. It is probable that the oval is the primitive form of yeast cell, so that the species *S. Pastorianus* has developed from the groups *S. cerevisia* and *S. ellipsoideus*.

The author has investigated the disappearance and recovery of spore formation, and has found that it is possible to bring about profound transformations of a permanent character. Thus, five species described in 1883, also several

beer bottom-fermentation and distillers' top-fermentation yeasts lost their power of forming spores when cultivated for a long period in an aerated wort at a temperature above the maximum for spore formation, and approaching that required for vegetative development.

Saccharomyces, which had lost the property of sporulation when placed in the earth, showed a decreased vitality as compared with their original forms. But in sugar solutions in which they had produced aleoholic fermentation they remained alive for several years, and the author considers that in this respect they do not differ much from the parent form.

A variation of *S. cerevisia* 1 can be effected by cultivating some of its spores partly in wort, and partly on the surface of yeast water-gelatin; the cultures being renewed fairly frequently during some months. It was found that the growth cultivated on gelatin gave 3 per cent. more alcohol than the corresponding cultivation in wort. The following experiment is cited to show the effect of the chemical composition of the nutrient liquid:—*S. Pastorianus* 1, one of the di-ease yeasts of beer, according to Mach and Portelli, affords a good wine. When this species is cultivated for a number of generations in a solution of cane-sugar in yeast water a growth is obtained, the cells of which have for a time lost the disagreeable properties which this organism formerly produced in beer. From this it may be seen that it is possible to act upon yeast cells in such a manner that they may be made to impart to fermenting liquids a taste and odour different from that originally characteristic of the yeast. The degeneration of culture yeast has been generally ascribed as the cause of most of the difficulties in brewery fermentations; this, however, is not in accordance with the author's views, for in no case has it been possible to carry one single species of *Saccharomyces* back to its progenitor.

Concerning the causes to which variation is due, the author is of opinion that special chemical compounds do not play any part, whilst the nutritive substratum and aeration are of importance only in so far as they permit of vigorous multiplication of the cells. The question of temperature is of most weight, for if it be too low the effect will not be sufficiently marked, whilst if too high the multiplication of the cells prematurely ceases; the consequence being that the inceptive change does not become permanent.—J. L. B.

Slaked Lime as a Disinfectant in Breweries. L. Steuber. Zeits. für das ges. Brauw. 1896, 44.

SLAKED lime has been used for a considerable time as a disinfectant for walls, &c. in breweries. Steuber has in consequence carefully investigated the action of quick-lime on yeast, and finds that protracted contact results in the destruction of the yeast. A thick coating of lime-wash on a wall, slightly contaminated with yeast, was effectual in disinfecting it. If, however, a layer of yeast of an appreciable thickness occur on the wall, mechanical cleansing must be resorted to before the application of the lime-wash. Better results were obtained where the wall dried slowly, the coating of lime-wash remaining moist for some time. The lime should be used as fresh as possible and have been exposed as little as possible to the carbon dioxide of the air. Lime wash has also the advantage of being inexpensive and easy of application, whilst the author's results prove its efficiency.—J. G. W.

Cellulose, Solution of by Enzymes (Cytase). J. Grüss. Wochenschr. Brau. 1895, 12, 1257—1259.

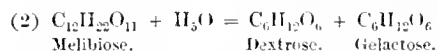
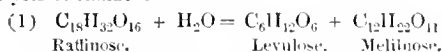
THE author has investigated the fact that malt extract can render certain forms of cellulose soluble. He finds that the hemi-celluloses which are readily hydrolysed by dilute acids, are also hydrolysed by the enzymes of malt extract; but their resistance to the action of enzymes varies. The enzyme attacks the hemi-cellulose through the cell walls, there transforming them, with the result that they become hyaline. In fact, as compared with hydrolysed cell walls, they behave differently towards dyes. Thus the hemi-cellulose of the date reed, when treated with potash and then alizarin, is stained violet, whereas when it has been previously subjected to the action of the enzyme, it assumes a much

fainter tint. Fuchsin or Congo red stains the intact cell-walls in the endosperm of barley and maize an intense red, but after treatment with the enzyme they remain uncoloured. The cell walls of barley are not dissolved but are converted into dextrinous substances (saccharo-colloids) insoluble in water. As stated by Brown and Morris the cytohydrolytic function of malt extract is destroyed by heating for a long time at 60°; the author also finds that the saccharifying action of such heated malt extract on starch paste is reduced by about one-tenth.

This behaviour does not necessarily involve the assumption of the presence of two enzymes, but may be due to the diastase becoming weaker in its action after heating.—J. L. B.

Raffinose, Hydrolysis of, by Soluble Ferments.

E. Bourquelot. *J. Pharm. et Chim.*, 1896 [6], 3, 390–394. THE author has investigated the action of the aqueous extract from a pure culture of *aspergillus niger* upon solutions of pure raffinose. He found that the specific rotatory power sank from $[\alpha]_D^{20} 103.12^\circ$ to $[\alpha]_D^{20} 50$ and 1 grm. of crystalline or 0.848 grm. anhydrous raffinose gave rise to 0.69 grm. of reducing sugar calculated as dextrose. According to Scheibler and Mittelmeier there are two stages in the hydrolysis of raffinose—



The first stage in the hydrolysis would require a specific rotation of $[\alpha]_D^{20} 52$ to 53 ; the author's experiments, however, show that the enzymes of *aspergillus niger* will carry the hydrolysis further than weak acids. The enzymes in an aqueous extract of baker's yeast had the same effect on raffinose as *aspergillus niger*, whilst extracts of bottom fermentation yeasts hydrolysed more strongly, since the specific rotation sank to 45° and the reduction corresponded with the formation of 0.79 grm. of dextrose.—J. L. B.

Attenuation, Some Remarks on. H. T. Brown

Brew. Trade Review, 1896, 10, 42–43.

THE application of cold air in attenuation can be effected by two methods. In the first, brine pipes are enclosed within the hood of the fermenting vessel, and are suspended near the surface of the wort. In the second, the air of the fermenting room is cooled down to 50–52° F. by brine pipes running the whole length of the room. The temperature of a union room in summer may be controlled in this manner without internal attenuators; but, in a fermenting room with large gyle-tuns, the water-coil attenuators must also be used. This method has disadvantages, for the cold air becomes saturated with moisture, which condenses on the walls, floor, and brine pipes, and the latter being always coated with ice, a considerable amount of drip is formed. Inasmuch as these brine pipes are often placed immediately over the gyle-tun, in the event of the drip troughs not being water-tight, the worts become contaminated. The continually moist surfaces of such a room form favourable media for the growth of moulds and other organisms, and this is the case with the surfaces of the fermenting vessels. The one essential in effectively cooling fermenting rooms, is, that the air should be fairly dry and its temperature some degrees above the dew point.—J. L. B.

Fermentation, The By-Products of. K. Kruis and B. Rayman.

Woch. für Brau. 13, 161 and 162.

THE authors have been endeavouring to ascertain whether the by-products of alcoholic fermentation, such as the higher alcohols, acetaldehyde, acetic acid, and the higher fatty acids, result from the action of the pure yeasts employed or whether they are the products of foreign organisms. In the course of their experiments they have arrived at the following conclusions:—Formic acid is slowly formed in wort kept for some time under sterile conditions with access of air and is therefore attributed to the action of oxygen on the constituents of the wort. Experiments of varying duration, with pure cultures of several distillery yeasts, under various conditions of temperature, showed that the by-pro-

ducts varied with the yeast, thus:—*S. cerevisia*, L., yielded formic acid, acetaldehyde, furfural, acetic acid, higher fatty acids, and amylie alcohol; *S. cerevisia*, V., gave traces of furfural and acetaldehyde but no amylie alcohol; *S. cerevisia*, Jørgensen No. 55, produced volatile acids and higher fatty acids together with slight amounts of acetaldehyde and fusel oil; *S. mycoderma*, D., gave formic acid, acetic acid, furfural, very little acetaldehyde, and no amylie alcohol; while *S. mycoderma*, B., yielded only formic acid, a good deal of acetaldehyde but no amyl alcohol.

Amylie alcohol, acetaldehyde, and furfural are therefore produced by pure cultures of yeasts without the aid of bacteria. A high fermentation temperature and anaerobic conditions favour the production of amylie alcohol. The authors do not consider it by any means certain that the production of fusel oil in industrial fermentations is entirely due to yeasts. They attribute the formation of valericianic acid and other higher volatile fatty acids to the decomposition of the nitrogenous constituents of the wort by the yeast employed.—J. G. W.

Beer, Fining of, by Light. Otto Reinke. Wochenschr. f. Brau. 1896, 13, 100.

IF a column of fermenting wort be illuminated by direct, or diffused sunlight, a rapid "fining" action takes place, the yeast being deposited in a compact state. Fermenting wort, which is not so illuminated or only feebly so, fines much more slowly and deposits its yeast in a more bulky and less compact layer. Since other sources of light behave in a similar manner, we have a means of rapidly clearing fermenting liquids. If, for example, the beer in the storage cask is illuminated, one obtains a somewhat rapid deposition of yeast together with resinous, albuminous, and glutinous bodies. Moreover, if electric lamps be suspended in fermenting vessels, quicker and better clarification of the beer is obtained. This influence of light can be readily demonstrated by placing a flask or cylinder containing a fermenting liquid before a window preferably one which faces south. Considerable experience has convinced the author that this fining action is not due to changes of temperature, but to the action of light alone.—T. A. G.

Lupulin, The Chemical Constituents of. H. Seyffert and R. von Antropoff. Zeits. ges. Brauw., 1896, 1.

BUNGENER'S hop-bitter acid is identical with the authors' β -hop-bitter acid, which was obtained from the petroleum spirit and ethylie ether extracts of hops, after precipitating the α -bodies with lead acetate, and which crystallised in fine needles and had a melting point of 83 – 86° C. It readily changed into β -resin when exposed to the air. The α and β acids when treated in ethereal solution with caustic potash, show slight formation of resin but no decomposition. Lerner's bitter-acid cannot possibly be identical with their α -acid. Beside the two hop-bitter acids, α and β , no other crystallisable body could be obtained, to which the name of hop-bitter acid could be applied. The γ -resin, a yellow, crystallisable body, has clearly the characters of a weak acid and evidently belongs to a quite different class of bodies. The hop resins are a mixture of substances in a continual state of decomposition and among the products of this decomposition are the resin-modifications investigated by Hayduck. To determine quantitatively the α and β bodies, the hops are exhausted with ethyl ether, and the residue from the distillation of this extract, treated with petroleum ether.—J. G. W.

Fusel Oil, Quantitative Determination of, in Alcohol.

M. G. Kutcherow. Chem. Zeit. Rep. 19, 2082.

See under XXIII., page 477.

Beer Worts, Products of the Fermentation of. A. Straub. Forschungs-ber., &c., 2, 382.

See under XXIII., page 478.

Hops, The Tannin of. J. Heron. J. Fed. Inst. Brewing, 1896, 2, 162.

See under XXIII., page 477.

PATENTS.

Fermentation of Worts which have been rendered Antiseptic. An Improved Process for the. W. P. Thompson. Liverpool. From J. Effront, Brussels. Eng. Pat. 8123, April 24, 1895.

THE process described depends upon the elimination or suppression of foreign organisms by means of antiseptics, but under such conditions that the latter have no paralysing action on the fermentative power of the yeast, the method being intended more particularly for distillery purposes where it is important to obtain a high percentage of alcohol. The yeast is first acclimatised to the antiseptic which it is intended to add to the distiller's wort, and this is done by causing it to ferment successively several quantities of wort to which gradually increasing quantities of the antiseptic, e.g., hydrofluoric acid, formic aldehyde, salicylic acid, &c. have been added, and this process must be carried on until the yeast is able to endure at least double the amount of antiseptic added to the distiller's wort. The acclimatised yeast thus obtained is pressed, moulded into cakes, and these are then dried in vacuo at a temperature of about 35°. In five or six days the yeast will have formed spores and the temperature is then raised to 45° at which it is maintained for another five to six days. This dried yeast retains the high fermenting power of the acclimatised yeast. For its employment, 100 grms. are mixed with 10 litres of malt and maize wort containing the antiseptic, and the mixture maintained at 30°. As soon as fermentation has commenced, 40 litres of similar but fresh wort is added, and again after 24 hours four times its bulk (200 litres) is again added, the whole being then left to ferment. The product is then employed in the proportion of 2 hectolitres to 100 hectolitres of wort. The acclimatised yeast may also be used advantageously for the fermentation of molasses, as it requires the addition of only $\frac{1}{4}$ to $\frac{1}{2}$ per cent. of grain, and in certain cases the latter may be omitted altogether.—A. K. M.

Pneumatic Malting, Improvements relating to, and Machinery or Apparatus therefor. W. Adlam, Bristol. Eng. Pat. 10,096, May 22, 1895.

THE air employed for the aëration of the grain is conducted through a multitubular attenuating appliance, by means of which its temperature can be regulated, cold water, hot water, steam, or other suitable cooling or heating agents, being passed through an outer casing for this purpose. After issuing from the multitubular appliance, the air is conducted through a pipe fitted with a damper for its regulation, into a chamber into which a water-spray is discharged under pressure. Arrangements are described for regulating the fineness of the spray and also its temperature. After passing through the spray-chamber, the attenuated and saturated air is conducted by a pipe fitted with a hygrometer to the malting vessel.—A. K. M.

Foaming or Effervescent Liquids, Improvements in or relating to Vessels for containing. J. Friedländer, Breslau. Eng. Pat. 3018, Feb. 10, 1896.

See under 1., page 538.

XVIII.—FOODS; SANITATION, WATER PURIFICATION DISINFECTANTS.

(A).—FOODS.

PATENTS.

Fish Liver, An Improved Process for the Preservation of. C. M. U. Dable, Stanisund, Lofoten, Norway. Eng. Pat. 22,886, Nov. 29, 1895.

IN the process known as "boiling" fish liver in oil, the latter is, as a rule, merely heated to a temperature slightly above the boiling point of water, the object being to remove any water present and to preserve the liver. This is better

done by actually boiling the oil under a diminished pressure, equal to 12 inches of mercury. It is important that the temperature employed under these conditions be insufficient to burst or destroy the tissues of the liver, as otherwise the oil contained in the latter would mix with the oil in which the liver is preserved.—A. K. M.

Meat, Improvements in the Preservation of. C. L. Villar, Buenos Aires. Eng. Pat. 6920, March 30, 1896.

IN the process described (injection of solution of salt into the veins, emptied of blood), practically the whole carcass is preserved, and it is claimed that the meat appears as fresh and juicy as when first killed, whilst the hide has an increased value, and the wool and hair may be readily removed as soon as the animal is prepared. The leather produced from such hide is said to be thicker and better than that obtained in the ordinary way, since the tanning process may be completely and speedily effected.—A. K. M.

(B).—SANITATION; WATER PURIFICATION.

India-Rubber Tubing, Action of Coal-Gas upon. K. Grosheintz. Bull. Soc. Ind. de Mulhouse, 1896, 73.

COAL-gas, in passing through india-rubber tubing, undergoes absorption and diffusion, the former prevailing. In experimenting with tubing of different qualities it was found that this action is the more pronounced the smaller the proportion of mineral matter contained in the india-rubber. From these observations it follows that for gas-tubing employed in inhabited rooms, qualities containing a considerable amount of mineral matter are preferable to the more expensive black rubber tubing.—C. O. W.

Water, Fermentative Changes in. W. E. Adeney. Trans. Royal Dublin Soc. V., part II.

See under XVII., page 463.

PATENTS.

Smoke, Purification of; and the Recovery of Soot from the Products of Furnaces, Improvements in or relating to the. G. Mugna, Budrio, Italy. Eng. Pat. 5834, March 20, 1895.

THIS invention relates to the purification of smoke from furnaces, particularly that from locomotive boilers. The smoke is withdrawn from the chimney by a fan, and passed through a closed tank. The latter is partially filled with water, and is fitted with revolving vanes inside, which suck the smoke into the water. The soot is thereby washed out of it, and the purified product then passes into the atmosphere.—R. B. P.

Smoke Purification, An Improved System of. G. C. Marks, London. From M. Ringelmann, Paris. Eng. Pat. 9302, May 10, 1895.

THIS is a method of purifying the smoke from houses, factories, &c. of a town by a plant situated at a central station.

The smoke from the various parts of the town, instead of passing into open chimneys, is drawn into a network of conduits by means of a fan situated at the central station, where it is purified by being passed through suitable soot-settling chambers.—R. B. P.

Smoke [Purification], An Improved Method of and Apparatus for the Treatment of. D. W. Stone, Leamington Spa, and B. Chaplin, Rugby. Eng. Pat. 9739, May 16, 1895.

BY means of suitable fans, the smoke is first passed through a stove-chamber and then through a condenser fed with steam-jets.—R. B. P.

Sewage, Improvements in Apparatus for the Disinfection of. P. O'Dowd, Ballyglass, Mayo, Ireland. Eng. Pat. 8877, May 4, 1895.

An intercepting tank or chamber is provided, in connection with the house drains, fitted with screens, and containing chemical reagents, such as copperas and peat charcoal. The house sewage filters through these materials, and the accumulated deposit is removed from time to time and used for manure.—L. A.

Sewage, Improvements in the Treatment of, and in Apparatus therefor. D. Cameron and F. J. Commis, Exeter. Eng. Pat. 21,142, Nov. 8, 1895.

CRUDE sewage is caused to flow through a closed tank (air-tight cover), in which it undergoes purification by bacteriological action. The inlet and outlet are arranged so that the flow of sewage does not disturb the brown scum which begins to form upon the surface of the sewage when the tank has been in operation for two or three days. This scum is formed by bacteriological action; and the further changes which take place in the tank lead to the solution of the organic portion of the sludge and the production of an effluent which is so free from suspended matter as to be fit for treatment by coke-breeze filters or by irrigation.

—L. A.

(C).—DISINFECTANTS.

Insect Destroyers. E. Perroneito. Arch. ital. de Biolog., 23, 47.

THE author has investigated the action of various solutions on the vitality of the eggs of *Bombyx mori* with a view of ascertaining the best means of destroying insects prejudicial to agriculture. These eggs retained their vitality after several hours' immersion in solutions of ammonia (0.3 per cent.), milk of lime, sodium chloride, iron and copper sulphates, potassium permanganate (1 per cent.), potassium cyanide (1 per cent.), mercuric chloride (0.1—0.2 per cent.), sulphuric, hydrochloric, and nitric acids (1—5 per cent.), phenol and thymol, carbon bisulphide (5 per cent.), benzene or oil of turpentine and emulsions of kerosene or of olive or sesame oils. All mineral oils exert a deadly action on the eggs, but the intensity of the action varies considerably. The larvae of the Diptera resist the action of mineral oils and their emulsions; they are, however, killed by carbon bisulphide. In lime water is found a sure and cheap means of destroying earthworms.—J. G. W.

Phenols, Toxicological Action of the. P. Binet. Chem. Zeit. 1896, 20, 32.

See under XXIV., page 479.

PATENT.

Sewage and the like, An Improved Means for Treating. J. J. Hood and A. G. Salamon, London. Eng. Pat. 11,527, June 13, 1895.

WELDON mud is treated so as to remove from it the calcium chloride; it is then air-dried until it assumes the form of a fine powder, which, probably owing to its finely divided state and powerfully oxidising properties, is found to possess in a remarkable degree the property of deodorising faecal matter when sprinkled over it. In this form the substance is used for dry closets and the like. The washed mud may also be used in a wet state if desired, and may be thus applied to the treatment of all forms of sewage.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Sulphur, Formation of, in the Sulphite Process of Treating Wood. A. Franke. Papier Zeit. 1896, 21, 599.

FREE sulphur is formed in the process of digestion of wood with bisulphite as carried out in the Salomon-Brünger digesters. In this process also an incrustation is formed on the sides of the digester, composed of CaSO_3 (63.23 per cent.), CaSO_4 (26.77 per cent.), and organic matter (9.93 per cent.).

At the high temperature prevailing in these digesters (152 °C.), the oxy-sulphur compounds react with the organic matter of the deposit, sulphides being formed, which react in the well-known way with any fresh sulphurous acid.

The author thus accounts for the appearance of the free sulphur.—C. F. C.

Sulphite Pulp, Washing and Bleaching of. Prakt. Handbuch der Papierfabr. [41], 1896, 1591.

SULPHITE pulp is generally bleached like the pulp from rags and other raw materials, as described on pages 1412-13 of this book.

It is necessary to thoroughly wash the pulp before adding the solution of bleaching powder, to eliminate all foreign matters, including sulphur salts, as completely as possible.

W. Palmar reports in Papier Zeit. No. 70, 1890, the results of experiments carried out at the University laboratory of Upsala, to ascertain the cause of the reddish colour often formed after exposure for a time to the air. The pulp, after the lye was run off, was washed in a beating engine, and samples of the washing water and the pulp were taken after $\frac{1}{2}$, 1, 1 $\frac{1}{2}$, and 2 hours' washing. The water contained at first 0.0404, after $\frac{1}{2}$ hour 0.0187, and after 1 hour 0.0106 grm. of SO_2 per 100 c.c., and on continued washing only a little acid was found, so that more washing would be useless. Fresh sulphite pulp contained 1.45 per cent. of ash, of which 1.2 per cent. was CaSO_3 . The latter being only slightly soluble in water, it is difficult to remove it by washing, and it is better to allow the CaSO_3 to settle in large sand-catchers.

When a solution of bleaching powder is added in the bleaching engine, the sulphite pulp often turns to a reddish or brown-reddish colour, but loses the colour when more bleaching powder is added. This colour does not arise from the encrusting materials not removed by boiling, as mechanical pulp containing the whole of the encrusting matter does not show this colour. The fact that unbleached sulphite pulp get rose or violet tinted in air rich in ozone, and especially in rooms where the air contains chlorine, shows that an oxidation of some until now unknown matter contained in the pulp takes place.

According to the experiments of Dr. A. Frank, the rose colour is formed principally by the oxidation of the SO_2 , forming SO_3 , this latter carbonising the encrusting matter by the abstraction of water. This reddening is seen in a stronger manner in the carbonisation of textile fabrics. To prevent the formation of the colour when sulphite pulp is mixed with other pulps, care should be taken that no free chlorine is present, and this may be prevented by adding some antichlor or sulphite lye.

To see whether oxidation was the cause of the colour, Ferd. Wolesky treated different pulps with the oxidising agents in the following table, and obtained the results given:—

Name of Reagent.	Sulphite Pulp (Mitscherlich).		Sulphite Pulp (Ritter-Kellner).		Soda Pulp.	Pulp.
	Ia.	IIa.	Ia.	IIa.		
Solution of bleaching powder	Rose	Rose	Rose	Rose	Light pink	Yellow
Potassium ferricyanide	Rose	Rose	Rose	Rose	Light pink	..
Ferric chloride	Violet-red	Violet-red	Violet-red	Violet-red	Light violet	Green
Mercuric chloride	Rose	Rose	Rose	Rose	Light pink,	..
Potassium bichromate	Rose	Rose	Rose	Rose	but very	..
Potassium permanganate	Rose	Rose	Rose	Rose	indistinct	..

The solutions of ferric chloride, potassium bichromate, and potassium permanganate were used very weak, and that of mercuric chloride rather stronger. The pulp was soaked in the solutions.

When bleaching pulp, the red colour is disregarded, but more bleach is added and the mixture heated to 30° to 40° C., and sulphuric acid is then added until the colour disappears. The solution of bleaching powder seems to change the colouring matters to colourless ones, but it is not known what the change is, neither is the nature of the colouring matter known. The fact that from 14 to 22 per cent. of bleaching powder is required, indicates that it has to perform other actions besides bleaching. The amount of bleaching powder required increases with the amount of encrusting matter left in the pulp. These encrusting matters have to be decomposed before the bleach can get to the fibres, therefore it is much better to beat up the pulp beforehand in such a manner that no bundles of fibres remain, and to wash thoroughly. Some makers wash the pulp with a hot solution of caustic soda, which decomposes many substances unaffected by the SO_2 . Other makers put the pulp into a 13 per cent. solution of bleaching powder, warm, and add 2½ per cent. of sulphuric acid, after an hour's time. The pulp, which is frequently orange-coloured, is washed for 2½ hours, until it looks blue-grey, and it is then rebleached by a solution of 1½ to 2 per cent. bleaching powder for 1 hour, and at the last a solution of ½ per cent. sulphuric acid is added.—S. P. E.

Resin in Sulphite Wood Pulp. H. Mayr. Prakt. Handbuch der Papierfabr. [4], 1896, 1592–1596.

The following table gives the amount of resin per cubic metre of absolutely dry wood from the branchless trunks of coniferous trees:—

Name of Tree.	1 cm. weighs	1 cm. contains Solid Resin.
	Kilos.	Kilos.
Pitch pine (N. America)	700	61.1
Weymouth spruce (N. America) ..	386	21.5
Old spruce (Bavaria)	463	19.6
Larch (Hamburg)	463	18.8
Red spruce (Hamburg)	506	18.7
Old larch (Bavaria)	539	17.2
Weymouth spruce (Bavaria)	343	16.7
Red spruce (Norway)	402	9.9
Douglas fir (N. America)	476	9.2
Fir (Hamburg)	423	8.2
Pine (Hamburg)	412	6.6
Pine (Norway)	400	3.5
Fir (Bavaria)	373	3.1

In the soda treatment, the different resins get converted into soluble soaps, and are easily washed out, but the treatment with sulphite lye has not this effect. Only the soluble parts of the resins go over with the lye. Care should be taken to wash out the dissolved resin adhering with the lye to the fibre before it hardens again, as oxidation of the resin occurs as soon as it comes in contact with the air.

The worst forms of resins are those which are insoluble in hot sulphite lye, and which therefore stay in the pulp, causing brown and yellowish spots to appear in the paper. By grinding such pulp, the resin settles on the sides and other parts of the grinders and kollergangs in dark, sticky masses. It also seems as if a part of the resin formed an insoluble resin-lime soap, with the lime from the lye or the water, since as much as 12 per cent. of lime salts are sometimes found in the accumulations of resin.

Experience has shown the best way to obtain wood pulp containing least resin. The wood cut down in winter contains the least resin, and becomes more free from resin the longer it is stored after being barked. In the spring time, when wood is in its most sappy state, all bark particles and dust coming in contact with the wood adhere so firmly that it is hardly possible to remove them. The drier the wood, the easier and cleaner it is to cut and bark. In any case the felled wood should be brought to the storehouse as soon as possible, and stored in such a manner that the air can have free access to it. To keep wood healthy, it

should be barked as soon as possible, although it will be found impossible to begin before the middle of March in most years, on account of the cold weather and the risk of the barked wood being damaged by freezing.

It seems doubtful whether wood contains the least resin in winter, but it is hard, and easy to remove during the cleaning and sorting. It is also likely to be retained by the strainers, whilst the soft, sticky resin passes through all the processes, later on hardening, and being then very difficult to remove on account of its fine state of distribution.

According to E. Partington, the tar-like particles develop only through the fibres being rubbed at the beaters after boiling. Neither in the wood nor in the boiled pulp are they said to be found. The tar-like particles settle, according to Partington, upon the fibres, as well as on the utensils and boxes, upon which they form black films, which are rubbed off by the circulating pulp, and soil it. By using paraffin oil of sp. gr. 0.8 to 0.85, and inflammable between 27° and 49° C., the formation of these tar-like particles can be prevented. An average addition of 7 to 9 kilos. of paraffin to 1,000 kilos. of dry pulp is sufficient. Pulp, when boiled a long time, requires less paraffin. The paraffin may be added at the pulp opener or disintegrator, but Partington prefers to add it to the pulp in the beating engines.

The tar-like particles, however, are probably not formed by rubbing, but by the oxidation and hardening of the resin in the beaters by contact with the air. The paraffin may simply act so as to keep the air from the pulp until the resin is washed out, by forming a thin skin or film over the watery pulp.

The particles of resin, being lighter than water, float on the surface, and many paper-makers use laths covered with strips of long-haired felt, which float on the thin pulp when passing over the sand troughs, and retain most of the resin.

In practice it was found that felt strips are frequently torn off, so they have been more recently replaced by thin strips of brass or other material, placed obliquely in the sand trap, and dipping a few centimetres into the pulp. The resin is stopped by these, and accumulates at one corner of the cross-strips, from whence it can be easily removed.—S. P. E.

Paper, A Fibrous Filling for. Chem. Trade J. 18, 368.

This is a new material for filling paper, which has been brought forward under the name of "Nematolith." It is a species of pure asbestos, but it is free from the iron, lime, and sulphur compounds that are usually found in crude mineral asbestos. The raw material from which nematolith is prepared was found on analysis to contain 96 per cent. of pure silicate of magnesia. Nematolith improves the white tone of the paper.

It is readily retained by the pulp, as on incinerating the paper when finished, as much as 95 per cent. of the material added is found. It is unattacked by alkalis or acids, even sulphurous acid. Even when it is used in large proportions, the paper does not lose in body or touch. The best method of using it is to boil 220 lb. of the filling with 220 galls. of water; a little starch may be added to more perfectly fix the filling. It is introduced after sizing.—A. S.

Aluminium Sulphate. Papier Zeit. 21, 1896, 599 and 794.

See under XXIII., page 473.

Paper Colouring (in the Engine). H. Spitteler. Papier Zeit. 21, 1896, 763.

See under VI., page 449.

PATENT.

Paper, Treatment of. R. Aitken, London. Eng. Pat. 2709, Feb. 7, 1895.

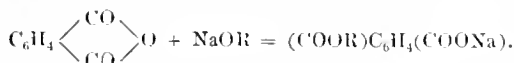
The object is to impregnate paper, either plain or printed, or water-colour drawings, with a waterproofing material such as paraffin, or with an antiseptic substance such as naphthalene, with or without a dye. This is accomplished by steeping the paper in a solution of the substance in a volatile solvent, and then removing the solvent by evaporation. Mural advertisements may be thus waterproofed and wall-papers made sanitary.—L. A.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Alcohols [of the Terpene Group], Method of Purifying. F. Tiemann and P. Krüger. Ber. 29, 1896, 901—903.

THE following method for the purification of alcohols is specially applicable to those of the terpene group, when it is often necessary to separate the alcohol from certain indifferent substances, chiefly hydrocarbons. It is known that terpene compounds are easily decomposed and consequently cannot resist prolonged heating at a high temperature, especially in contact with strong acids, as they are apt to undergo molecular rearrangement, eliminating water, and forming hydrocarbons. In contact with alkalis, however, the terpene alcohols are much more stable. These facts, together with this, that alcohols when heated with the anhydrides of dibasic acids (e.g., succinic, phthalic, and camphoric anhydrides) readily form ester acids, form the basis of the method recommended by the authors.

The alcohol, dissolved in ether if necessary, is first of all converted into the sodium alcoholate. To this substance suspended in absolute ether an equivalent quantity of succinic or phthalic anhydride is added, when, after standing for some days at the ordinary temperature, the sodium ethereal salt is formed according to the equation—



On now adding water and shaking, the sodium ethereal salt goes into solution, whilst the excess of phthalic anhydride, together with unchanged and regenerated alcohol, remains in the ether. By extracting the aqueous solution with ether, the sodium ethereal salt may be completely purified. In order to obtain the pure alcohol the sodium ethereal salt is saponified at the ordinary temperature with alcoholic potash. Camphoric anhydride ought not to be employed instead of phthalic anhydride, as the compounds so formed are in general very difficult to saponify. Acid ethereal camphorates, which can be saponified, can, however, be prepared by heating camphoric anhydride with the corresponding alcohol.

The advantage of this method depends on the fact that the alcohol may be purified without any rise in temperature, and without the use of strongly acid substances. The disadvantages consist in the difficulty of working the process quantitatively, and in the large dissociation of the sodium compounds. Only 40—60 per cent. of the alcohol can be obtained in the pure state.—J. S.

Iodoformine, Preparation of. E. Konteschweller. Pharm. Central-H. N.F. 1895, 16, 651 and 684.

THIS inodorous, and hence to many patients more acceptable, preparation of iodoform is obtained by bringing hexamethylenetetramine and iodoform together in the ratio of their molecular weights. Or alcoholic solution of hexamethylenetetramine is mixed with the corresponding quantity of iodoform dissolved in hot alcohol. The precipitate so obtained, after pressing and drying between filter-paper, is a white inodorous powder.

Another and simpler method of preparation is to rub 26 grms. of hexamethylenetetramine with 74 grms. of iodoform, after the addition of a little absolute alcohol, to dryness in a mortar.—J. S.

Di-iodomethyl Salicylate ("Sanoform"). Pharm Zeit. 12, 320.

A. ARNHEIM has found in this compound an efficient substitute for iodoform. It is prepared by the action of iodine upon methyl salicylate, and contains 62.7 per cent. of iodine. Its form is that of a white crystalline powder of melting point 110° C. It is soluble in 10 parts of hot alcohol, and also soluble in ether and in vaseline. Langaard states that this di-iodomethyl salicylate is not poisonous, and that it possesses other advantages over iodoform.

Pseudoaconitine. M. Freund and R. Niederhofheim. Ber. 29, 1896, 852—855.

STARTING with pseudoaconitine, $C_{35}H_{39}NO_{12}$, the authors have prepared and examined the hydriodide, aurochloride, nitrate, and thiocyanate. When ψ -aconitine is boiled with water it is converted into acetic acid and picro- ψ -aconitine, $C_{34}H_{47}NO_{11}$, which differs from ψ -aconitine inasmuch as it does not form a crystalline nitrate, and the aurochloride is easily soluble in cold alcohol. On further hydrolysis by boiling with freshly prepared caustic potash, picro- ψ -aconitine is converted into pseudacarine, $C_{25}H_{35}NO_8$, which forms a well-defined compound with acetone and veratric acid.

—J. S.

Orypiperidine Hydrochloride ("Eucaïne"), $C_{19}H_{27}NO_4 \cdot HCl$. Pharm. J. 1896, 342 and 413.

THIS is a new substitute for cocaine for producing local anaesthesia. It does not, it is stated, possess the property (a disadvantage in the case of cocaine) of affecting the action of the heart, and the anaesthesia lasts longer and is more widespread. An injection of 30 grains can be tolerated. Eucaïne is not decomposed on boiling its solution. The base itself is almost insoluble in water, but the hydrochloride is readily soluble.

Ethereal Oil of Ledum Palustre. J. Trapp. Pharm. Zeits. Russl. 1895, 34, 962.

THE author calls attention to the fact that the yield of ethereal oil obtained on the distillation of *Ledum palustre* depends on the period of vegetation of the plant, and that this fact explains the variations in the results obtained by other authors. The largest yield of an ethereal oil rich in ledum-camphor is obtained from the plant at the time of flowering.—J. S.

"Galactite" from the Seeds of the Yellow Lupin.

H. Ritthausen. Ber. 29, 1896, 896—899.

FROM an alcoholic extract of the seed of the yellow lupin the author has obtained a beautiful crystalline compound (1.05 per cent. of the seeds) for which he proposes the name "Galactite." The composition of the substance is represented by the empirical formula $C_9H_{15}O_7$, and it may possibly be related to Quercite. On hydrolysis by dilute sulphuric acid, it gives over 60 per cent. of galactose.

—J. S.

Convicine: Alloxantin obtained on the Hydrolysis of.

H. Ritthausen. Ber. 29, 1896, 894—896.

CONVICINE prepared from broad beans (*Vicia Faba minor*) and vetches (*Vicia Sativa*) gave on hydrolysis with sulphuric or hydrochloric acid 34—37 per cent. of a crystalline substance, which in the case of the first-named preparation is certainly, and in the second probably alloxantin. Further observations lead the author to suppose that Convicine, $C_{10}H_{15}N_3O_7 \cdot H_2O$, is a glucoside similar to vicine, on which latter further details are promised.—J. S.

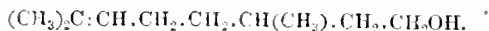
Alloxantin, A Reaction of. H. Ritthausen. Ber. 29, 1896, 892.

See under XXIII., page 475.

Rhodinol, the Active Principle in Otto of Roses, Constitution of. Ph. Barbier and L. Bouveault. Comptes rend. 122, 673—675.

THE authors find that the rhodinol extracted from roses is identical with that obtained from the essence of pelargonium. Rhodinol is a primary alcohol, forming upon oxidation the aldehyde rhodinal. Rhodinic acid and the rhodinate of rhodinyl were also prepared. Rhodinic acid and rhodinyl acetate combine with two atoms of bromine. This fact proves the existence of an ethylene bond.

By further oxidation of rhodinol, acetone and β -methyl adipic acid were obtained. The formula deemed most probable is—



—V. C.

Mandelic Acid, New Process for the Manufacture of [for Antipyrine Salt]. C. Pape. *Chem. Zeit.* 1896, 20, 90.

SIX: the introduction of the antipyrine salt of mandelic acid the author has improved the method of manufacture. Commercial benzoic aldehyde is converted into the well-known bisulphite compound by shaking with a concentrated solution of sodium bisulphite. This compound is pressed, washed with alcohol, if necessary, and dried. It is then made into a thin paste with water and mixed with the theoretical quantity of a concentrated solution of potassium cyanide. The undissolved portion of the bisulphite compound goes rapidly into solution, and the nitrile of mandelic acid immediately separates out as an oil, which is removed from the aqueous liquid as quickly as possible. It is thus obtained very pure, and is therefore easily converted into mandelic acid. For this purpose the freshly prepared nitrile is mixed with three times its volume of concentrated hydrochloric acid, when the mixture becomes heated up to the boiling point, at which temperature it is kept for some time and the conversion into mandelic acid is complete. The separation and purification of the acid is conducted in the usual way.—J. S.

Levo-Fenchone, a New Isomer of Camphor. O. Wallach. *J. de Pharm. et de Chim.* 1896, 3, [9], 465.

WALLACH has discovered in the essential oil of Thuja a levo-fenchone exactly similar to the dextro-fenchone found by him in oil of fennel. The fraction of oil of Thuja boiling at 190°–200° contains levo-fenchone and thujone. This is warmed in portions of 20 grms. with 80 grms. of concentrated nitric acid; the unaltered fenchone is distilled over by steam, dried, and purified by crystallisation in a freezing mixture.

Levo-fenchone is exactly similar to dextro-fenchone, except in its rotatory power, $\alpha_D = -66.94^\circ$; sodium amalgam reduces it to fenchyl alcohol, the rotatory power of which ($+10.36^\circ$) is equal to that of fenchyl alcohol prepared from dextro-fenchone, but of opposite sign; in brief, a series of compounds has been prepared from levo- similar to those from dextro-fenchone.—A. C. W.

Menthone: Its Conversion into Thymol. E. Beckmann and H. Eickelberg. *Ber.* 1896, 29, 418.

IN chloroform solution, dextro- and levomenthone react with two molecules of bromine, forming a dextro-rotatory dibromomenthone, $C_{10}H_{16}Br_2O$, of melting point 79°–80°, which contains the carbonyl group unaltered, and regenerates menthone by reduction with zinc-dust and acetic acid. The dibromomenthone on boiling with quinoline is converted into thymol; thus menthone is 1-methyl-3-keto-4-isopropylhexamethylene.—A. C. W.

PATENTS.

Albumin-Tannin Compound [Astringent], Improvements in the Manufacture or Production of an. W. L. Wise. London. From Knoll and Co., Ludwigshafen, Germany. Eng. Pat. 6110, March 23, 1896.

ALBUMINATE of tannin, if employed in a freshly precipitated state, will be digested by an effective gastric juice within a few minutes; if it be air-dried, its digestion will occupy about two hours; but if it has been heated for 6 to 10 hours at 110° C. and upwards, it will hardly be attacked by gastric juice, even within 24 hours, and will, in consequence, be well fitted for producing an astringent action on the mucous membrane of the intestine without affecting that of the stomach, and in this way causing indigestion. The following method of manufacturing albuminate of tannin of the required degree of insolubility in gastric juice has been found to give satisfactory results. Ten kilos. of albumin and 20 kilos. of tannic acid are dissolved separately in cold distilled water, and the solutions are afterwards mixed whilst being continually stirred. The mixture having been allowed to settle, the supernatant solution is decanted, and the precipitate is repeatedly lixiviated to free it from excess of tannic acid; it is then filtered, pressed, and dried, and is finally heated during a

period of 6–10 hours at 110°–150° C. either in an air-bath or in some liquid, such as xylene, which is without action on the albuminate. The yield is about 10 kilos.—A. G. B.

A Pharmaceutical Substance [Active Constituent of Thyroid Gland], Improvements in the Manufacture of, and in the Purification of the same. H. E. Newton. London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 12,295, June 25, 1895.

FRESH thyroid glands (of sheep or other animals), freed from fat, are boiled with 4 parts of sulphuric acid of from 5–10 per cent. strength, for 20–30 hours with a reflux condenser. The precipitate formed on cooling contains almost the whole of the active constituent; the part remaining in the filtrate is obtained by neutralising or adding common salt, evaporating down, and cooling. The crude product is extracted with hot alcohol, and the alcoholic solution either evaporated down or precipitated by ether, and finally washed with ether or ligroin.

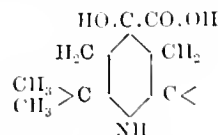
The active principle is neither an albumin nor a peptone; it has the properties of a weak acid and contains iodine; for medicinal purposes it should be mixed with some neutral substance, such as sugar of milk.—A. C. W.

Pyrocatechin-Monoacetic Acid [Medicament; Substitute for Guaiacol] Process for Obtaining. W. Majert, Falkenberg, Prussia. Eng. Pat. 17,160, Sept. 14, 1895.

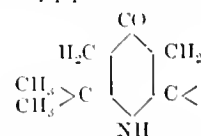
CHLORACETIC acid and pyrocatechol in molecular proportions in aqueous solution are boiled with an inverted condenser, and sodium hydroxide or carbonate gradually added in calculated quantity. On cooling, sodium pyrocatecholmonoacetate separates, and is purified by recrystallisation. The acid $OH.C_6H_3(O.CH_2.CO_2H)$ forms whitish crystalline needles moderately soluble in water, melting at 131°, but by overheating is changed to its lactone, melting at 56°.—A. C. W.

Oxypiperidine Carbo-Acids and Derivatives therefrom, Production of. A. Zimmermann, London. From Chemische Fabrik auf Actien, vormals E. Schering, Berlin. Eng. Pat. 12,465, June 27, 1895.

THE production is claimed of γ -hydroxypiperidine carbonic acids having the general constitution—



as the carbonic acids derived from triacetoneamine and analogous derivatives from γ -piperidone, as benzalldiacetoneamine and vinylldiacetoneamine, by first linking hydrocyanic acid to a γ -piperidone derivative—



and then saponifying the nitrile produced to a γ -piperidine carbonic acid. Also producing benzoylated and tolylated alkyl esters from the said γ -hydroxypiperidine carbonic acids is claimed, and, moreover, the production of a variety of other esters. Thus it is proposed to form benzoyl- γ -hydroxypiperidine carbonic esters and *n*-alkyl benzoyl- γ -hydroxypiperidine carbonic esters, &c., by linking hydrocyanic acid to triacetoneamine, &c., saponifying the nitrile so produced to γ -hydroxypiperidine carbonic acid, and converting the latter into ester, and into compounds thereof, by replacing the H of the OH group with benzoyl, &c., and the H atom of the NH group by alcoholic radicals. Other variations are described, and the substances produced as described, are laid claim to.

—A. C. W.

Cinchona Barks, Estimation of the Total Alkaloids in. C. C. Keller. Schweiz. Wochenschr. Chem. Pharm. 1895, **33**, 449.

See under XXIII., page 478.

Cacao Leaves, Estimation of the Alkaloids in. C. C. Keller. Schweiz. Wochenschr. Chem. Pharm. 1895, **33**, 453.

See under XXIII., page 478.

Nux Vomica Seeds, Estimation of the Alkaloids in. C. C. Keller. Schweiz. Wochenschr. Chem. Pharm. 1895, **33**, 452.

See under XXIII., page 478.

Morphine, Estimation of, in Opium. G. Looff. Apoth. Zeit. 1896, **11**, 192.

See under XXIII., page 478.

Acids contained in Vegetables, Detection and Separation of the Principal. L. Lindet. Comptes rend. **122**, 1135.

See under XXIII., page 475.

Quinoline and Quinoline Derivatives, An Improvement in Skraup's Process for the Preparation of. C. A. Kneppel. Ber. **29**, 1896, 703.

See under IV., page 444.

Tartaric Acid, Levo-rotatory, Preparation of.

W. Marekwald. Ber. **29**, 42.

See under XXIV., page 479.

XXI.—PHOTOGRAPHY.

Gelatin-Chloride Dry Plates, New Sensitisers for. Eder and Valenta. Dingler's Polyt. J. **300**, [1], 18.

THE authors investigated several substances belonging to the Rose Bengal class, and found that tetra-iodotetrachloro-fluorescein produced the best effect. The sensitising action of this substance reaches a maximum in the yellowish-green before the D line and extends to D $\frac{1}{4}$ C. Of the Rhodamines examined, the 3 B of the Badische Anilin und Sodafabrik proved to be good, with a maximum effect in the neighbourhood of E $\frac{3}{4}$ D and extending to D $\frac{1}{2}$ C. Still better are the actions of tetrachlorotetra-ethylrhodamine hydrochloride and tetrachlorotetra-ethylrhodamine ethyl ether, which reach as far as D $\frac{1}{2}$ C and D $\frac{2}{3}$ C. Nitrilo-rhodamine takes effect in the orange-red as far as D $\frac{1}{2}$ C. These colouring matters produce a greater sensitiveness in the blue than either Erythrosine or Rose Bengal. Good sensitisers for the region of the green are Acridine yellow and Acridine orange, of which the former is the better. Diamidodimethylacridine hydrochloride (A. Leonhardt) gave a closed spectrum extending from D $\frac{1}{2}$ E nearly to the violet, and is hence valuable for spectrum work and for three-colour printing.

—J. S.

PATENTS.

Soluble Colloids, such as Gelatine and Isinglass. Improvements in the Formation and Preparation of. E. J. Mills. Glasgow. Eng. Pat. 8847, May 4, 1895.

See under XIV., page 462.

Gelatin Coatings from Paper Supports in the Manufacture of Photographic Films, Improvements in Means for Facilitating the Separation of. J. B. B. Wellington. Elstree, Herts. Eng. Pat. 11,821, June 18, 1895.

PAPER is coated (1) with an alcoholic solution of sandarac, copal, &c., (2) with gelatin containing chrome alum, and (3) with celluloid. The backing is then stripped off, and the film coated with the sensitive emulsion. As an alternative process, the silver film may be applied direct to the gummed paper and the celluloid afterwards. The essential point consists in the use of the layer of resin to assist in the stripping.—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitroglycerin, On the Boiling Point of. L. de Bruyn. Rec. trav. Chim. des Pays-Bas, 1895, **14**, 131.

ACCORDING to Champion, the boiling point of nitroglycerin is about 185°. The author, however, found that on heating

nitroglycerin to 160° under a pressure of 15 mm., volatilisation, but no boiling, took place. Since the boiling point is reduced about 100° by lowering the pressure to 12–20 mm., the author concludes that the boiling point of nitroglycerin must at least be above 200°.

Champion gives the temperatures of explosion of nitroglycerin and gun-cotton as 257° and 220° respectively. These were also found to be inaccurate, as neither substance could be heated above 190° without exploding.—J. S.

PATENTS.

Smokeless Explosive or Gunpowder, A New or Improved. T. Hawkins, S. H. Hawkins, and H. Hawkins, Upton Park, Essex, and the Donmithorne Gun Patents and Ammunition Company, Limited, London. Eng. Pat. 6271 March 26, 1895.

THIRTY-TWO parts of chloride of potash, 16 parts of sugar, and 1–2 parts of wool-pulp flour or lampblack are mixed together, and then 1–4 parts of bichromate of potash incorporated, the last ingredient being dry or mixed with an equal quantity of water. The paste is granulated and dried by hot air or other methods. The explosive may be used for small arms, ordnance, charging shells, blasting, &c.; when intended for blasting, the wool-pulp flour or lampblack is omitted, and an increased amount of bichromate of potash employed.—A. C. W.

Amorphous Phosphorus as Substitute for the Yellow Phosphorus for Matches, Primings, and the like, Process for rendering applicable. Abel and Imray, London. M. Bals and E. Gurovits, Vienna. Eng. Pat. 4714, March 2, 1896.

SULPHUR is melted and mixed with amorphous phosphorus, or sulphur and phosphorus are mixed and heated to the melting point of the former. On cooling, the compound can be pulverised without danger. For igniting masses, 100 parts of sulphur are mixed with 50–150 parts of phosphorus. The mixture burns slowly with an inextinguishable flame, and is adapted for signalling purposes; mixed with "chloride of potash" (chlorate?), glass, and other igniting and binding materials, it ignites by friction on any surface, without noise.—A. C. W.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Fractionating Column. G. W. A. Kahlbaum. Ber. **29**, 71–73.



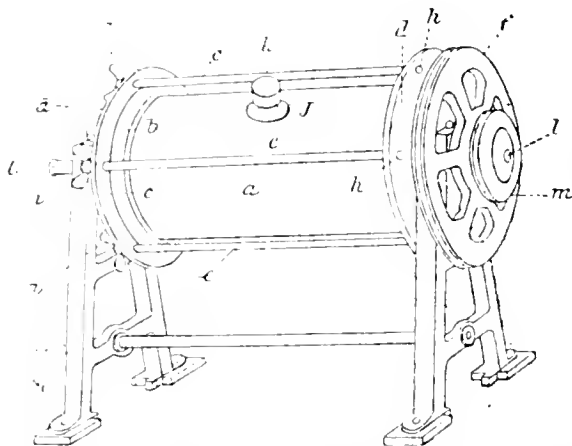
THE apparatus described consists, as will be seen from the figure, of an outer tube which fits into the distilling flask and carries the thermometer. The latter is suspended inside a narrower tube which communicates at its lower end with the condenser. By this arrangement the thermometer is surrounded by a double envelope of vapour and the bulb is protected from splashes.

—T. A. L.

Mixing Apparatus for Accelerating Chemical Reactions.
V. Markovnikoff. *Annalen*, 1895, **269**, 254—257.

The apparatus consists of a cylinder of copper (2 mm. thick) *a* (Fig. 1) open at both ends. At each end a band

Fig. 1.



b (Fig. 1 and 2) is fixed outside, to which iron bands *c* (Figs. 1 and 2) are soldered. As the hermetic closing of the apparatus depends on these iron bands, they must be perfectly even, and sufficiently thick (4–5 mm.). The cylinder is closed, at both ends, by perfectly flat brass plates *d* (Fig. 1) about 3 mm. thick, which are screwed to the iron rings *c* by seven or eight iron rods *e* (Fig. 1), which are fixed at one end (at *h*) to the brass disc *d* employed as fly-wheel and pass through the holes *g* (Fig. 2) at the

Fig. 2.

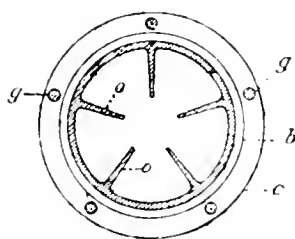
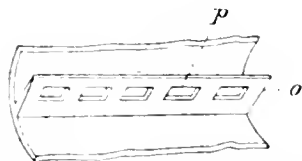


Fig. 3.



other end. A layer of lead, or asbestos, is inserted between the iron rings and the brass plates. There is one opening, *J*, in the cylinder, which is closed by the screw *k*, or by a tap, for letting off pressure if required.

The cylinder is rotated by means of a handle fixed to the fly-wheel *f*, or it may be connected with a turbine or other motor. For varying the speed, when a motor is used, there are two wheels, *f* and *m*, of different diameter, to take the connecting cord.

For mixing liquids in the cylinder there are five lead or tin plates *o o* (Figs. 2 and 3) soldered to the inside of the vessel. They are nearly as long as the cylinder, and their width is three-quarters the radius of the cylinder. The plates are provided with openings *p*.

The inside of the apparatus is well tinned, but for some purposes a porcelain cylinder may be used. The advantages

of the apparatus are its lightness, and the fact that it can readily be heated by placing a burner underneath, or cooled by running water over it. A convenient sized apparatus is one which holds about 1½ litre. It should not be more than three-quarters full.—N. H. J. M.

PATENTS.

[Pyrometers], *Improvements in or connected with Appliances for Testing the Range of Heat in Furnaces, or Recording other such High Temperatures.* G. Watson, C. W. James, R. L. Bullock, all of Leeds. Eng. Pat. 3379, Jan. 16, 1895.

THE system used is that of suspending a number of discs of materials having different melting points. The latter are previously determined and marked upon the discs. The principle followed is that of exposing to the heat to be measured, a successively graduated and temperature-stamped series of test-pieces of metal or alloy, systematically arranged to melt in their successive order up to the point reached by the temperature in question. On melting, the pieces fall off a wire, till at length a point is reached at which a particular test-piece refuses to melt. Various arrangements are described and illustrated.—R. B. P.

Gases, Specific Gravity of; Apparatus for Ascertaining. A. Custodis, Düsseldorf, Germany. Eng. Pat. 7791, April 18, 1895.

THIS invention consists in enclosing two light bodies of equal weight and volume, attached to the arms of a balance, in separate chambers (discharging into a common outlet) into which the gases to be compared are introduced. The difference in density between the contents of the chambers destroys the equilibrium and is indicated by the pointer and scale of the balance. The apparatus is also suitable for ascertaining the effects produced on a gas by mechanical or chemical treatment, or for indicating alterations in the air of coal mines, and the movements of the indicator may be automatically recorded at a distance.—C. S.

Gases, Weight of; Apparatus for Indicating and Registering. M. Arndt, Aix-la-Chapelle. Eng. Pat. 8615, May 1, 1895.

THE registering appliance consists of a swinging body suspended from the beam of the gas balance and pressed by suitable means (electrical, compressed air, or clockwork arrangement) at desired intervals against a rotating drum carrying the paper on which the register is drawn, the marking being effected by an inked or dyed paper covered with a protective sheet of india-rubber, or the like.—C. S.

Gas, Sampling, for Analysis; Improvements in Apparatus for. B. L. de Ridder, Amsterdam. Eng. Pat. 10,905, June 1, 1895.

THE apparatus consists of a bell-shaped or similar receiver with a tap at the top connected to a flexible tube, in a water vessel deep enough to allow the bell to be totally immersed to the tap. Inside the bell is a circular float just small enough to prevent friction against the sides thereof, and having its upper surface corresponding to the top of the bell. This float prevents the gas to be sampled from coming in contact with a large surface of water.—L. T. T.

INORGANIC CHEMISTRY.— QUANTITATIVE.

Hydrogen, On the Quantitative Determination of, by Means of Palladium Chloride. E. D. Campbell and E. B. Hart. *Amer. Chem. J.* 1896, **18**, 294—298.

THE authors have devised a method for the direct determination of hydrogen by the use of a dilute solution of palladium chloride, as recommended by F. C. Phillips (this *Journal*, 1894, 840—841) for the detection of hydrogen. The solution is prepared by dissolving 5 grms. of palladium wire in 30 c.c. of hydrochloric acid with 1—2 c.c. of nitric acid, evaporating to dryness on the water-bath, and redissolving in 5 c.c. of hydrochloric acid (sp. gr. 1·20) and 25—30 c.c. of

water, with warming, until solution is complete. The solution is made up to 750 c.c., and then contains 1 per cent. of palladious chloride.

The gas to be analysed, previously freed from gases other than nitrogen and paraffins, is then passed on to a single Hempel absorption pipette (after the amount of solution necessary to fill the pipette has been introduced in the usual manner). The pipette is then placed in a water-bath for two hours, when absorption is generally complete. The hydrogen absorbed is determined in the usual manner. The analyses appended by the author indicate great accuracy. The palladious solution, after use, is evaporated with hydrochloric acid as before, for use over again.—O. H.

Potassium, Estimation of; Notes on. F. T. B. Dupré. Chem. Zeit. 1896, 20, 305.

With regard to the suggestion recently made that Fresenius's well-known factor of 0.3056 for the calculation of the potassium chloride contained in the double platinum salt should be altered to 0.304, the present author remarks that already in 1882 Dittmar and Arthur proved that potassium platinochloride, as obtained in an ordinary analysis, is not constant in composition. The same conclusion is arrived at by noting that if the coefficient 0.3069, based on Seubert's determination of the atomic weight of platinum, which is undoubtedly the correct figure, be employed, the results of an analysis are by no means so satisfactory as when making use of Fresenius's value. The author has attempted to identify the cause of this variation in apparent composition, but without success; the amount of impurity present being extremely small.—F. H. L.

Potash, Estimation of, as Potassium Platinochloride. E. Bauer. Chem. Zeit. 1896, 270.

INSTEAD of weighing the platinochloride on a tared filter, it has been proposed to redissolve the precipitate in water, evaporate the solution to dryness in a platinum dish, dry at 120°, and weigh in the dish. The trouble of weighing a filter twice is thus avoided, and also the danger of reducing the salt by careless drying on the filter. It is, moreover, unnecessary in filtering, to remove the last traces of the precipitate from the dish, as it is simply dissolved in hot water and added to the rest. After washing the precipitate with 96 per cent. alcohol, it is dissolved in water, and the filter carefully washed out. For this purpose, 80—90 c.c. of water suffice, and this amount can be evaporated off on a water-bath in 25—30 minutes. The residue is absolutely pure.—N. H. J. M.

Potash, Estimation of. A. Prager. Chem. Zeit. 1896, 20, 269.

THE following modification of Fresenius's shortened method of estimating potash, when present as sulphate only, is said to give very concordant results. An aliquot portion of the potassium sulphate solution is precipitated, in the usual manner, by a very slight excess of barium chloride, the filtrate made up to about 75 c.c., treated with platonic chloride, and slowly evaporated down on a water-bath (not boiling). This, and subsequent operations, must be performed in an atmosphere absolutely free from ammonia. As soon as crystals form on the surface of the liquid, it is cooled, then slowly evaporated down to about 5 c.c. When cold, 20 c.c. of 96 per cent. alcohol are added, the solution stirred and allowed to stand for some time. The crystalline precipitate is washed on a filter (previously extracted with 80 per cent. alcohol and hot water) with 80 per cent. alcohol, dried at 110° in a Hoffmeister oven (Zeits. Anal. Chem. 1894, 437), and weighed. The purity of the precipitate may eventually be established by treating it with a little water in a platinum dish.—N. H. J. M.

Lead, Colorimetric Determination of. M. Lucas. J. de Pharm. et de Chim. 1896, 3, [9], 459.

THE sulphide was found to afford a more sensitive method than chromate or iodide, its coloration is, however, modified by the presence of alkalis or neutral salts and varies with lapse of time owing to agglomeration of the particles. The following example is given:—1 grm. of bronze is treated

with nitric acid, after filtering, 1 c.c. of sulphuric acid added, the liquid evaporated to 7—8 c.c., diluted and electrolysed. The lead is deposited as dioxide on the positive pole; this is rapidly washed, dried and weighed. If the lead exceed 5 mgrms. it should be determined as sulphate; if less, the dioxide is dissolved in 1 c.c. of nitric acid containing nitrous (prepared by electrolysis of nitric acid), the solution neutralised by caustic soda (300 grms. to the litre), diluted to such an extent that 50 c.c. contain about 1 mgrm. and mixed with five drops of ammonium sulphide. Quantities of lead nitrate solution (1 grm. to the litre) are mixed with as many c.c. of sodium nitrate solution (640 grms. to the litre) as were added c.c. of soda, and diluted to the volume of the solution to be tested. Thus the solutions for comparison contain equal amounts of sodium nitrate. Then five drops of ammonium sulphide are added and the colour compared with that of the solution under examination. For quantities between 0.0001 and 0.001 grm. the process is accurate to within 10 per cent.—A. C. W.

Lead, Quantitative Electro-Deposition of, as Peroxide. O. von Giese. Zeits. f. Elektrochem. 1896, 586—588.

THE author has repeated Kreichgauer's work on this subject (this Journal, 1894, 547), and contests some of the conclusions arrived at. The following points are to be noted:—(1 per cent. solution of $Pb(NO_3)_2$; current density, N.D. 100 = 0.1 ampère):—

1. The proportion of free nitric acid that must be added to prevent separation of metallic lead depends on the temperature of experiment. At 15°—50° C., at least 8 per cent. by volume of HNO_3 (sp. gr. 1.4) should be present; at 80° C., 5 per cent. suffices.

2. At temperatures above 70° C. (and using 0.1 ampère per 100 sq. cm.) the separation of the PbO_2 is hardly ever complete, owing to the solvent action of the decomposition products of nitric acid on the precipitate. Apart from this the separation proceeds very slowly.

3. The separation of 1 grm. of PbO_2 is complete at 15°—20° C. in about 12 hours (current 0.1 ampère); at 50°—55° C. in about six hours.

4. The time required for precipitation is not materially diminished by increasing the area of the electrode surfaces.

5. According to Kreichgauer; the liability to separation of metallic lead is peculiarly increased by the use of a rough-surfaced cathode (Pt. roughened by a sand-blast). This statement the author fails to confirm. Equally good results are obtained with highly polished or roughened plates.—H. T. P.

P perchlorates, Quantitative Estimation of. D. A. Kreider. Zeits. anorgan. Chem. 1895, 10, 277.

THE author recommends the fusion of the perchlorate in a current of carbon dioxide. The oxygen which is evolved is collected over potash and transferred to a burette containing hydriodic acid and nitric oxide. The liberated iodine is then titrated with decinormal arsenious acid. Free oxygen in mixtures can also be determined by this method.—J. S.

Aluminium Sulphate. Papier Zeit. 21, 1896, 599 and 794.

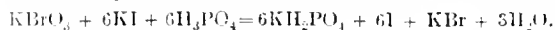
THE first of the articles referred to, deals with aluminium sulphate as required for dyeing purposes, and specifies as maximum iron percentage 0.001, higher proportions being distinctly prejudicial. For determining these fractional proportions the following process is given:—

1—2 grms. of the salt are dissolved in a few c.c. of water, 1 c.c. of pure concentrated HNO_3 added, warmed a few minutes, and diluted to 50 c.c. 5 c.c. of the solution are transferred to a stoppered cylinder graduated to 20 c.c.; 5 c.c. of a 10 per cent. solution of potassium sulphocyanide are added. Ether is then added to the 20-c.c. mark, and the cylinder is then shaken. In a second cylinder 5 c.c. of the sulphocyanide solution are diluted with 5 c.c. of water containing one drop of HNO_3 ; after adding ether, a standard solution of iron (1 c.c. = 0.00001 grm. Fe) is run in and shaken with the mixed liquids until the ethereal layer develops an equal colour to that of the first cylinder. The calculations to be made are obvious.

In the second article a correspondent (R. S.) calls attention to undue refinement in this matter of the iron impurity of aluminium sulphate required for paper-making. After a careful discussion he arrives at the following conclusion:—For all ordinary purposes buyers should specify a percentage of Al_2O_3 not less than 15, free acid not exceeding 0.8, and iron not exceeding 0.2. For high-priced papers only, is it possible or expedient to use the purer varieties, and in this case the maximum of iron may be reasonably specified at 0.005 per cent.—C. F. C.

Phosphoric and Arsenic Acids, Accurate Methods for the Volumetric Estimation of. A. Christensen. Nordisk. Pharm. Tidsskrift. 1896, 3, 77.

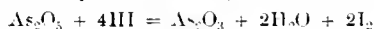
By using bromates instead of iodates in iodometric titration, the author is enabled to obtain sharp indications and accurate results, but the reaction takes place more slowly, requiring half an hour at $40-50^\circ C$, or a day at the normal temperature. The reaction is—



The volume of solution must always range from 100 c.c. to 120 c.c., excessive dilution giving low, and undue concentration, high results. By Emmerling's method of estimating phosphoric acid in phosphates, more lime was always found in the precipitate than would correspond to the formula $Ca_3(PO_4)_2$. The lead method offered no advantage over the molybdate; but the silver process for estimating phosphates of the type R_2HPO_4 gave good results. Arsenic acid, however, gave results, generally 1 per cent. too high by this latter method; but more accurate results followed precipitation by means of the ammonium magnesium double salt, especially when Puller's correction for the solubility of the arsenic precipitate in ammonia water is applied. In the case of the arsenic acid, the substitution of titration for ignition of the precipitate to pyroarsenate is specially advantageous.—W. G. M.

Arsenates, Estimation of Arsenic Acid in. A. Williamson. J. of Soc. Dyers and Col. 1896, 12, 86-89.

The method proposed by the author is similar to the one described by Younger (this Journal, 1890, 158-159). It consists in reducing the arsenic acid in strong acid solution, to the arsenious condition by means of hydriodic acid (potassium iodide and hydrochloric acid)—



titrating the liberated iodine with standard thio-sulphate, and subsequently oxidising the arsenious acid by standard iodine solution in the ordinary manner. Two results for the arsenic are thus obtained, the former records that present as arsenic acid, and the difference between the two gives the arsenious acid present in the sample. If the reaction take place in dilute acid solution, then the liberated iodine acts on the arsenious acid, converting it into arsenic acid again. The process is then reversible.

Tin, if in the lower state of oxidation, may be estimated in presence of arsenious acid by oxidation in strong hydrochloric acid solution with standard iodine, the arsenic being unaffected. The solution is then mixed with Rochelle salt, neutralised, and the arsenite titrated with iodine in the usual way.

If both are present in the higher state of oxidation, as, for example, in a mixture of sodium arsenate and sodium stannate, the arsenic may be reduced with potassium iodide and hydrochloric acid as before, and the arsenite estimated in neutral solution, as usual. The stannic compound is unaffected.—H. I.

Mortar Analysis, [Time] Precipitation Process of. J. Patchett, Birmingham. Eng. Pat. 16,089, May 22, 1895.

The mortar or cement is agitated with about 40 volumes of a 2 per cent. solution of saccharose, to dissolve the lime, which is thereafter precipitated from an aliquot part of the filtered liquid by means of oxalic acid or, preferably, ammonium oxalate, the volume of the precipitate being read off after a certain interval of time, say, half an hour. Determinations made in this manner with material of known constitution serve as a basis for comparative estima-

tions. When no spent lime, Bath stone, or old mortar is present, an alternative method of dissolving the lime in dilute (circa 15 per cent.) hydrochloric acid, making up the filtrate to 500 c.c., and throwing down the lime as before, may be pursued.—C. S.

Mortar Analysis, Measure Process of. J. Patchett, Birmingham. Eng. Pat. 16,090, May 22, 1895.

The method consists in agitating about 4 c.c. of mortar in a 100 c.c. flask (the neck of which is 1 c.c. in diameter and 8.5 c.c. long, graduated in cubic centimetres from a zero mark coinciding with the base of the stopper), along with a $1\frac{1}{2}$ per cent. aqueous solution of saccharose, and titrating the lime with a solution of oxalic acid (6.3 grms. per 100 c.c.), using phenolphthalein or other suitable indicator. The amount of freed sand is read off in the neck of the inverted flask. For cements, a 5 per cent. solution of, preferably, nitric acid is used.

Comparison is made with a standard mortar or cement, either with regard to the ratio of lime to sand, or the relative proportion of waste, higher or lower than the standard.

—C. S.

"Available" Phosphoric Acid in Basic Slag, Estimation of, by Direct Precipitation with Magnesia Mixture. W. Hoffmeister. Chem. Zeit. 1896, 20, 305.

The filtered Wagner extract of the slag is treated with 5 c.c. of strong sulphuric acid for every 1 gm. of the sample exhausted, the mixture being evaporated till it is of a syrupy consistence, and yellow in colour. It is then washed into a graduated vessel, made up to the mark, filtered, and a volume corresponding to 0.5 gm. of slag, heated with 10 c.c. of fuming nitric acid in a covered beaker until all action has ceased. 50 cc. of Wagner's solution and 10 c.c. of magnesia mixture are next added, and the phosphoric acid finally precipitated by the addition of a suitable quantity of ammonia. Twelve hours must elapse before filtration. The results agree closely with those of the molybdate method.

—F. H. L.

Fluorine in Phosphates, Superphosphates, Bonemeal and Guanos, Determination of. Braun. Chem. Ind. 1896, 181-185.

SOME agriculturists, however wrongly, object to the presence of fluorine in manures, holding it to be injurious to the crops. Useful information may be obtained by qualitative observation of the behaviour of the phosphatic material when treated in the presence of SiO_2 with sulphuric acid in the usual way; some approximate estimate of the amount of fluorine present may be made by means of the appearance and quantity of the silica precipitated on condensing and decomposing the liberated silicon fluoride in a drop of water hanging from the underside of a cover glass closing the beaker in which the reaction is proceeding. For the quantitative estimation of fluorine the author has used Fresenius's well-known method with the following modifications, rendered necessary by the condition of the fluorine in certain of the samples examined. Raw mineral phosphates should be evaporated with acetic acid to decompose carbonates, and the resulting mass washed, dried, ignited, mixed with powdered quartz, and decomposed with strong sulphuric acid for the liberation of silicon fluoride which is condensed in the manner prescribed by Fresenius.

In superphosphates both free hydrofluoric acid and fluorides are present. The latter can be estimated by the process already described, and the former can be arrived at by making the superphosphates alkaline with milk of lime, evaporating to dryness, treating with acetic acid, and proceeding as before, the value required being ultimately found by difference between the result of this determination and that of the determination of fluorine as fluorides.

Many analyses of raw phosphates and prepared manures containing from a small fraction of 1 per cent. up to 6.97 per cent. of F. are quoted. It appears that, on an average, about half the total quantity of fluorine in the raw phosphate is evolved in the ordinary process of making superphosphate. The author appends a caution to the effect that the presence of chlorides in the material analysed, may give an unduly high result for fluorine, and is careful to

explain that many of his figures for manures containing only small quantities of fluorine are vitiated by this circumstance.—B. B.

Mercury Salts, Estimation of, by Means of Sodium Peroxide. M. C. Schuyten. *Chem. Zeit.* 20, 1896, 239.

EXPERIMENTS having proved that sodium peroxide reduces mercury salts rapidly and completely to metallic mercury, the author has based on this fact the following process: The weighed quantity of the substance is placed in a porcelain basin, which can be covered with a funnel, having its stem bent at right angles, and some water is added, and then little by little, sodium peroxide, until no more precipitate forms, when the basin is covered with the funnel and gently warmed until steam condenses in the tube. After cooling, the funnel is well washed and the metallic mercury brought on to a filter, dried in a desiccator in the dark and weighed. In test experiments with mercuric chloride the mercury found was 73.54–73.61 per cent. as compared with 73.92 per cent. theory. The filtrate from the mercury, after neutralisation, can be used for the titration of the halogen by Volhard's method.—C. A. M.

ORGANIC CHEMISTRY.—QUALITATIVE.

Alloxantin, A reaction of. H. Ritthausen. *Ber.* 29, 1896, 892–893.

ALLOXANTIN contains only two molecules of water of crystallisation, which can be completely expelled at 107°–110° and not three molecules as is stated in Beilstein's *Handbueh* (2nd Ed.).

The author also directs attention to the following reaction of alloxantin:—1–2 mgrm. of the powdered crystals are wetted with a drop of nitric acid (sp. gr. 1.4) and carefully heated in a watch glass to expel the excess of acid. On adding a drop of ammonia, and a little water, a beautiful permanent purple coloration is produced, which disappears on drying but reappears on again adding water. Less than 1 mgrm. of the substance can be recognised in this way.

—J. S.

Acids contained in Vegetables, Detection and Separation of the Principal. L. Lindet. *Comptes rend.* 122, 1135–1137.

TARTARIC acid is readily isolated on account of the insolubility of its potassium salt in a mixture of alcohol and ether, but the other acids occurring in vegetables, notably malic and citric, are troublesome to detect and separate. The author finds that the quinine salt serves to separate citric acid, and the cinchonine salt similarly serves for malic acid on account of the sparing solubility of the acid salts in methyl alcohol. The bases are added gradually, in powder, to avoid formation of the normal salts. The cinchonine can be added after the quinine, excess of the latter not interfering with the reaction. The acid can be liberated from the quinine (or cinchonine) salt by adding ammonia, filtering, precipitating with subacetate of lead, and decomposing with sulphuretted hydrogen.—V. C.

Linseed Oil, Linseed Oil Varnish, and Oil Colours; Simple Method of Testing. R. Hefelmann and P. Mann. *Pharm. Central H. N.F.* 1895, 16, 685.

THE authors have found that the presence of resin oil can be more easily detected in linseed oil and linseed oil varnish by means of the butter refractometer than by other methods. Even small additions of resin, resin oil, the salts of the metallic oxides with resin oil acids, and mineral oil, can be detected by the increase in refraction, as is shown by analyses furnished by the authors.—J. S.

Varnishes, Notes on the Drying of. L. E. Audés. *Chem. Zeit.* 1896, 20, 307.

See under XIII. B., page 461.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Paraffin, Pine Resin in, Detection and Determination of. J. Klimont. *Chem. Rev. ä. d. Fett- u. Harz-Ind.* 1896, [38], 76–77.

ONE method is to heat about 10 grms. of substance with some 50 c.c. of 10 per cent. alcoholic potassium hydroxide

to boiling on the water-bath, then add an excess of water and shake up with ether. The paraffin is obtained by evaporating the ether, and the resin by decomposing the aqueous solution by means of sulphuric acid. The estimation of the paraffin may be better effected by evaporating off the alcohol after the treatment with potassium hydroxide and extracting an aliquot part of the residue with ether in a Soxhlet tube.

A rapid and approximate estimation may be made by determining the acid number of the substance. For Austrian resin this averages about 170, and, as paraffin is neutral, the percentage of the former may be determined by the formula—

$$x = \frac{100s}{170m}$$

wherein m represents the quantity used for the titration, and s , the acid number of the mixture. By this method 13.72 per cent. of resin was found in a trial mixture containing 14.42 per cent.—C. S.

Indigo, Valuation of. Chr. Rawson. *J. Soc. Dyers and Col.* 1896, 12, 82–86.

THE author remarks on the discrepancies noticed in the determination of indigotin and indirubin in samples of indigo taken at various times from the same stock. These are due to the hygroscopic nature of indigo. A "table showing the variations in weight of samples of indigo under different atmospheric conditions as regards temperature and humidity," is given in the paper. The author recommends that dealers and buyers should insist upon having the water determined at the same time as the colouring matter, which should be calculated on the *dry indigo* and stated, in addition to that present in sample *as received*.

In the discussion following the paper, J. Grossmann stated that he found that a sample of indigo lost water in grinding.

A. G. Green pointed out that almost all colouring matter had the power of absorbing 5–10 per cent. of water without apparently becoming moist, and it was due to this fact that so many disputes arose about the variations in strength of the colour on keeping, or during long voyages.

In reply, Chr. Rawson said that he had used the permanganate and thio-sulphate (gravimetric) methods for the purpose of estimating indigotin and indirubin in the analyses given in the paper. Potash salts might have something to do with the absorption of moisture by the indigo, but pure indigo itself was hygroscopic.—H. J.

Oils, Oxidation of: Researches on the Determination of the Degree of. M. W. Bishop. *Monit. Scient.* 1896, 259–264.

THE experiments of Chevreul on the influence of metallic surfaces in promoting the oxidation of oils were first extended and made the basis of a quantitative method by Livahe (this *Journal*, 1883, 349), whose process consists in spotting 0.5 grm. of the oil on to the surface of 1 grm. of dry finely divided metallic lead (precipitated from a solution of lead by means of zinc) contained in a watch glass, and observing the increase of weight. But the absorption of oxygen, even in the case of linseed oil, requires from two to five days to reach the maximum, the less strongly drying oils, such as poppy-seed and nut oil, require at least as long, whilst the feebly drying oils must be left for fully seven days before any useful result can be obtained; and even then, as Livahe has more recently shown, the final result is far from representing the maximum absorption. In fact, if we divide the iodine value and the oxygen absorption respectively, of linseed oil by the corresponding values of other oils, the two series of ratios show such a want of accordance as to throw doubt upon the completeness of the oxidation even in the case of nut and poppy-seed oils.

In the case of linseed oil the maximum absorption is obtained, for this oil oxidises rapidly, without the help of any drier, if sufficiently sub-divided by means of a neutral body. Thus, 1 grm. of linseed oil, intimately mixed with

1 gram. of precipitated ignited silica, and exposed in a thin layer to the air at 20–25° absorbed—

	Oxygen per Cent.
In 1 day	0.89
In 2 days	7.31
In 3 days	15.00
In 4 days	16.49

This result suggested the following general method, in which silica is used as the absorbent, and resinates of manganese as the drier.

The Method.—Purified manganese resinate is prepared by digesting the commercial article in ether, filtering, distilling off the solvent, and powdering the dry residue. 5–10 grms. of the oil are weighed in a beaker, 2 per cent. of the dry resinate is added, the oil is heated on the water oven, with occasional agitation, until solution is complete (which takes from 5 to 10 minutes), and is then allowed to cool.

1 gram. of precipitated ignited silica is weighed into a flat bottom capsule of 5.5 cm. diameter, containing a small glass rod, and as nearly as possible 1.02 gram. (1 gram. oil + 0.02 gram. resinate) is distributed from a fine pipette in small drops all over the surface. The whole is then weighed. The oil and silica are next intimately mixed by means of the glass rod, spreading the mixture in a layer of uniform thickness all over the bottom of the dish, and the dish is then exposed to the air at 17°–25° for drying oils, and at 20°–30° for other oils, and weighed at intervals of six hours. After each weighing the contents are stirred afresh.

With linseed oil, the maximum oxidation occurs in from 24 to 30 hours, after which there is a gradual loss of weight, confirming Cloez, Mulder, and others, that, besides linolein, volatile products are formed. By adding 4 per cent. instead of 2 per cent. of the resinate, oxidation is more rapid, but the increase of weight is less, owing to an increased proportion of volatile products. The influence of temperature is most important. The results obtained appear to show that for the most rapid oxidation of linseed oil the temperature should not fall below 17° nor rise above 28°. With the oils of hemp seed, poppy seed, nut and cotton seed, the maximum increase of weight was reached in from 24 to 18 hours at 28°–22°. Sesame oil at the same temperature required 72–96 hours. Arachis oil absorbed 6.7 per cent. of oxygen in 96 hours, at a temperature fluctuating between 32°–18°–34°–11°; but another sample, tested at 23°–17°, only absorbed 4.8 per cent. in 144 hours.

The oxidation of colza, and especially of olive oil, cannot be easily effected in a short time. Thus, with colza oil, although a marked increase of weight is perceptible in 24 hours, which steadily augments, the results recorded show that at the end of 11 days it had not passed the maximum. With olive oil, an increase of weight is perceptible in 24 hours; but one sample took 16 days at 31°–11° to increase 5.3 per cent., and two other samples absorbed, respectively, 5.7 per cent. in 36 days at 34°–18° and 6.0 per cent. in 50 days at 23°–17°. Results obtained and tabulated, show that the adulteration of olive oil with oils of more strongly drying character causes the most marked effect in the first 24 hours, provided the experiment be made at a suitable temperature.

A summary of the author's results is given in the table.

Description of Oil.	Specific Gravity.	Oxygen Absorption.	Mean Value.	Ratio.
Linseed oil (indigenous) ...	0.9327	17.79 to 16.40	17.05	..
" " (La Plata)	0.9304	15.45 to 15.00	15.20	1.12
Hempseed oil	0.9287	11.55 to 11.30	11.40	1.18
Poppy-seed oil (indigenous) ...	0.924	11.50 to 13.30	11.20	1.20
Nut oil (commercial)		13.70	13.70	1.25
Cotton-seed oil ("chilled") ..	0.923	9.60 to 9.30	9.45	1.80
" (ordinary) ..	0.924	8.60	8.60	1.98
Sesame oil (Senegal)	0.9215	8.95 to 8.50	8.70	1.96
" " (Indian)	0.921	7.40	7.40	2.30
Arachis oil (African)	0.916	6.70	6.70	2.54
" " (white)	0.916	6.50	6.50	2.62
Colza oil (indigenous)	0.9142	6.40	6.40	2.66
" " (Indian)	0.9137	5.90 to 5.80	5.85	2.91
Olive oil	0.9155	5.30	5.30	3.21

—L. A.

Wax, Analysis by Cold Saponification. R. Henriques. *Zeits. angew. Chem.* 1896 [8], 221.

In a former paper (this Journal, 1896, 299) it was shown that all fats and fatty oils can be completely saponified by treating their solutions in petroleum spirit with alcoholic caustic soda in the cold. The alcoholic standard solution of soda should be prepared with alcohol of not less than 96 per cent. strength. This method of saponification may be employed for the analysis of beeswax, in the following manner:—3 grms. of wax are dissolved in 25 c.c. of warm petroleum spirit, and this solution is titrated with half-normal solution of alcoholic soda, using phenolphthalein as indicator. This titration being completed, 25 c.c. of the half-normal solution of alcoholic soda are added, and the mixture allowed to stand for 24 hours, when the remaining free alkali is titrated back in the usual manner. Thus, the following results were obtained:—

Description.	Acid Number.	Ester Number.	Total Saponification.	Huldt's Ratio.
Yellow beeswax R.	29.6	76.5 76.0 76.8	97.1 96.6 97.4	3.72
" " I.I.	29.4	73.9 72.9	94.3 95.3	3.85
" " L.II.	29.6	73.6 75.1	94.2 95.7	3.76
White beeswax R.	22.4	76.1 76.5 76.9	98.5 98.9 99.3	3.41
" " L.	28.4	76.6 77.1	105.0 105.5	2.71

These figures leave no doubt that the cold saponification process is very well adapted for the analysis of beeswax. The advantages of the new method become even more apparent in its application to adulterated beeswax, mixtures of beeswax with ceresin or paraffin wax which offer exceptional resistance to saponification by the ordinary process. By this cold process such mixtures are as readily saponified as the pure article, owing to the complete solubility of the above-named adulterants in petroleum spirit. In its application to the analysis of Carnauba wax, Japan wax, and spermaceti, the new method yields equally satisfactory results. Another class of bodies said to be saponifiable with great difficulty, *viz.*, seal and fish oils, are also readily saponified by this process, which, however, *failed altogether in its application to wool fats.*—C. O. W.

Liquid Fats, The Saponification and Saponification Number of. D. Holde. *Mitt. aus der k. k. tech. Versuchsanst. zu Berlin*, 1896, 14, [1], 82–86.

In proposing his method of cold saponification (this Journal, 15, 299), Henriques asserted that in the ordinary method of saponification there were certain sources of error which often rendered the results inaccurate and variable, especially in the case of castor and cod-liver oils. The author now replies to this criticism after a comparative examination of the two processes. He shows that when the determinations are made on the same day, the figures obtained, either by cold saponification or by heating for 15 minutes or for an hour (with or without the aid of a reflux condenser), are concordant to within 1 unit of the saponification number. Out of 35 duplicate estimations, the difference only exceeded that amount in five cases, the maximum being 3 units = 1.5 per cent. of the saponification number. When the determinations were made at different times (*e.g.*, after intervals of several weeks) the figures obtained, with the exception of four, referring to isolated cases, showed as the highest deviation in 70 experiments, 1 per cent. of the saponification number in the case of castor and cod-liver oils, and 1.5 per cent. with fish oil (dark coloured soap solution). It is suggested that the somewhat greater differences obtained when the saponification is made on different days may be attributed to the varying amounts of carbonic acid in the soda solutions employed. The author's general conclusion is that the mean results of all the modifications of warm saponification agree so well among themselves and with those of cold

saponification, that Henriques' objections are groundless; and that when a speedy result is required, perfectly accurate figures may be obtained in the case of fluid fats (including castor and cod liver oils) by the ordinary methods of warm saponification. At the same time he considers the process of cold saponification a valuable and trustworthy modification.—C. A. M.

Basic Lead Acetate, Behaviour of, towards Sugar Solutions.
H. Svoboda. Zeits. d. Ver. Rübenzucker Ind. 1896, 46, 481.

It is known that basic lead acetate, on account of its basic properties, decomposes solutions of sugar. The author found that when 20 per cent. solutions of the under-mentioned sugars were mixed with one volume of basic lead acetate and allowed to stand 24 hours, they underwent the following alterations in colour:—maltose, rose; galactose, orange; levulose, yellow; dextrose, bright yellow; and milk sugar, golden. The solutions exhibited, moreover, a decrease in opticity, which was least in the case of maltose, and most in that of galactose (53 per cent.). Solutions of cane-sugar and raffinose underwent no change; they remained colourless, and, after slight acidification, possessed their original specific rotation. Raffinose is precipitated from its aqueous solution by highly basic lead acetate. Since the action of lead acetate is dependent on its basicity, that is, on the amount of lead oxide dissolved in neutral lead acetate, it is necessary to titrate, and estimate its activity according to known methods. With regard to the alteration of specific rotatory power in aqueous sugar solutions, the author states that increasing quantities of basic lead acetate at first produce with cane-sugar a slight reduction, then an increase, and finally a diminution; with dextrose a small reduction followed by an increase; with maltose a moderate, with raffinose, milk-sugar, galactose, and levulose a very marked lowering which is proportional to the amount of basic lead acetate added. When lead acetate, slightly acidified with acetic acid, is added to sugar solutions, irregularities in rotatory power are observed. These divergencies are ascribed to the formation of soluble lead saccharates possessing a rotatory power different from that of the sugar. From solutions containing salts, which latter lead to the formation of difficultly soluble lead compounds, basic lead acetate precipitates sugar. That in sugar solutions containing sulphates, chlorides, &c., insoluble saccharates are formed, is probably due to the fact that basic lead acetate forms various saccharates with difficulty soluble in water, but readily soluble in a solution of lead acetate. Basic lead acetate does not usually precipitate sugar, on account of its content of neutral lead acetate, but when the solvent for the difficultly soluble lead saccharate is removed or diminished in quantity, it does. This takes place when the salts contained in the sugar solution react with the neutral lead acetate so as to form insoluble lead salt, and an alkaline acetate.—J. L. B.

Sugars in Fruit Essences, Syrups, Liqueurs, Preserves, and Honey, Estimation of. De Raczkowski. Monit. Scient. 1896, 19—28.

FULL details are given in this paper of the usual modes of analysis by means of the polariscope, and for the calculation of results. The changes in rotation of saccharose (cane-sugar) and of dextrose (glucose) are so small within moderate ranges of temperature that they may be neglected. For invert sugar and levulose correction is necessary. When the concentration does not exceed 14 per cent., the correction for temperature may be found by the formula:—Invert sugar $[\alpha] = -27.9^\circ + 0.33 t$; levulose $[\alpha] = -101.22^\circ + 0.56 t$, where t = degrees C. above 0° C. The ordinary chemical tests are recommended for the detection of tartaric acid, gelatin, dextrin, &c.

—L. T. T.

Fusel Oil, Quantitative Determination of, in Alcohol.
M. G. Kutscherow. Chem. Zeit. Rep., 19, 2082.

THE alcohol is mixed with a saturated solution of common salt and to it is then added a small quantity of amyllic alcohol, equal in amount to about 4 per cent. of the alcohol

being dealt with. An oily layer separates, and is transferred to a graduated tube for measurement. When the volume of the oily layer, which separates out when absolutely pure alcohol is treated in precisely the same way, is known, the difference between the two is an index of the fusel oil present in the alcohol, and is calculated into fusel oil according to a given table.

The method is the same in principle as that of Rose, in which chloroform takes the place of amyllic alcohol. Two modifications of the process are given, one for use in works, with an accuracy of 0.1 per cent. for every per cent. of fusel oil present, and the other for the laboratory yielding results to within 0.017 per cent.—J. G. W.

Hops, The Tannin of. J. Heron. J. Fed. Inst. Brewing, 1896, 2, 162—185.

Estimation of Tannin in Hops.—For this purpose the author recommends Löwenthal's process (Zeits. anal. Chem. 16, 33—48), to which he has added some improvements. 10 grms. of the hops are introduced into a flask graduated to 1005 c.c., 900 c.c. of boiling distilled water are added, and the contents well shaken. The flask is then placed in a bath of boiling water and digested for one hour; it is cooled to 60° F., made up with water to 1,005 c.c., the flask and contents are well shaken, and the extract filtered. The liquid is made up to 1005 c.c. instead of 1000 c.c. in order to correct for the volume occupied by 10 grms. of hops. The author considers that this procedure gives more correct results, since, by the continued successive boiling of Löwenthal's method, a portion of the soluble tannin becomes converted into more or less insoluble phlobaphen, which behaves differently to the tannin, with the permanganate.

For the determination of the tannin in the hop extract the following solutions are required:—1. Permanganate of potassium, prepared by dissolving 1 gm. of the pure salt in a litre of water. 2. Indigo solution: 5 grms. of pure indigo carmine are dissolved in 500 c.c. of water, 50 c.c. of concentrated sulphuric acid added, and the liquid diluted with water to a litre; 20 c.c. of this solution should require 20 c.c. of permanganate. 3. Gelatin solution: 25 grms. of Nelson's gelatin are soaked in 250 c.c. of water for six hours, heated on the water-bath until the gelatin is dissolved, then saturated with sodium chloride and made up to a litre with a saturated solution of the same, well shaken, allowed to stand for a few days, and filtered bright. 4. A solution of dilute sulphuric acid consisting of 50 grms. of concentrated acid in a litre of water. For the determination, 50 c.c. of the hop extract are introduced into a shallow white porcelain basin of 1 litre capacity, 20 c.c. of indigo solution are added, and 500 c.c. of water; the permanganate is run in whilst the liquid in the basin is vigorously stirred; towards the end of the reaction the blue colour produced by the indigo changes first into a light yellowish-green and finally into a golden-yellow. When this point is reached, and a faint pinkish tinge round the edge of the basin is observed, the titration is finished. Two such determinations should be made, and from the mean of them the number of c.c. of permanganate required by the 10 c.c. of indigo solution are subtracted; the remainder, multiplied by 2, represents the total oxidisable bodies in 100 c.c. of the extract.

100 c.c. of the hop extract are poured into a wide-mouthed 16-oz. flask, 100 c.c. of gelatin solution are added, the mixture shaken, and 50 c.c. of the dilute sulphuric acid run in, the flask again shaken, and a teaspoonful of kaolin added, and, after thorough shaking, the contents of the flask are filtered. 100 c.c. of this filtrate, together with the indigo solution and water, are titrated as before with permanganate; the mean of two experiments, less the amount of permanganate required for the indigo, multiplied by 2.5, represents the amount of oxidisable substance in 100 c.c. of the extract after the tannin has been removed; therefore the difference between the former and latter titrations will equal the number of c.c. of permanganate required to oxidise the tannin in 100 c.c. of extract. The author considers it advisable to express the number of c.c. of permanganate required to oxidise the tannin in terms of oxalic acid, since tannins derived from different sources vary

considerably in their properties and give different values when acted on with permanganate. Since, however, the amount of permanganate can be measured by means of oxalic acid, the results by this method are comparable for each individual tannin-containing substance. If a and b represent the number of c.c. of permanganate used in the first and second titrations, c the quantity of permanganate required to oxidise 10 c.c. of $\frac{N}{10}$ oxalic acid, and 10 grms. of hops have been used in making 1000 c.c. of extract, then $\frac{a-b}{c} \times 6.3 = x$, where x is the percentage of tannin expressed in terms of oxalic acid. A correction is sometimes necessary for a slight reducing action of the gelatin solution towards the permanganate.

In order to see what alterations occurred in the tannin when the hops were kept, the author made analyses of the same samples four and eight years after the first analysis, and from the results it appears that the tannin is diminished to a certain extent in kept hops, and probably is first oxidised to the insoluble phlobaphen and thence passes, through a form somewhat allied to gallic acid, into lower derivatives, which are not acted on by permanganate.

Influence of Hop Tannin on Wort.—The author considers that the tannin of hops does not precipitate albuminoid matter from the malt wort in the copper; but there is evidence that it unites and forms a definite compound (tanno-peptone) with certain nitrogenous matters derived from the malt. As this is soluble in the wort, its presence is accounted for in the finished beer. The author concludes that the hop tannin is of no value in the copper, but is a valuable index of other constituents; for hops which have a good percentage of tannin possess *pro rata* resins and bitter substances; hence the determination of the amount of tannin is an indication of the brewing value of any sample of hops.—J. L. B.

Beer Wort, Products of the Fermentation of. A. Straub. *Forschungsber.*, No. 2, 382.

The total acid produced, calculated as lactic acid, increases with the temperature at which the fermentation is conducted, irrespective of the presence or absence of air. Fermentation in the presence of air produces a very much greater proportion of volatile acids than does fermentation in the absence of air. The formation of glycerin decreases with a rise of temperature and with the increase in the total acidity. Between the maltose present and the glycerin formed, no relationship exists. The formation of succinic acid is in no way dependent on the production of glycerin, nor on the maltose present, this being a further proof that Pasteur's theory of the ratio of formation of glycerin and succinic acid can no longer be maintained.

To obtain satisfactory results in the estimation of succinic acid the dextrin present must be removed by conversion with sulphuric acid. The resulting solution is evaporated down to one-third of its volume, neutralised with barium carbonate and then made slightly alkaline with soda. The whole is then evaporated to a thick syrup, 1 per cent. nitric acid added to strong acid reaction, and the whole extracted with alcohol. The alcoholic extract is evaporated down, one and a half times its volume of ether added, and the ether extract filtered off at the end of an hour, evaporated down and the residue taken up with water. In the aqueous extract the succinic acid is estimated as the silver salt, according to Ran's method. The author found in this way from 0.00264 to 0.00392 per cent. of succinic acid in beer.—J. G. W.

Morphine, Estimation of, in Opium. G. Loeff. *Apoth. Zeit.* 1896, 11, 192.

The author has found that sodium salicylate removes those substances which prevent the precipitation of morphine in opium products, and on this fact bases the following process:—5 grms. of the finely powdered opium are triturated with water, and the mixture is made up to a total weight of 44 grms. in a tared flask, which is then closed and well shaken for 15 minutes. 1 gm. of sodium salicylate is added, the shaking repeated for a few minutes, and the liquid filtered. 25.8 grms. (=3 grms. opium) of the filtrate are well shaken for 10 minutes with

3 grms. of ether and 1 gm. of ammonia solution, and the separated morphine collected on a small filter, washed with water, dried, washed with benzene, again dried, and weighed.—C. A. M.

Cinchona Bark, Estimation of the Total Alkaloids in. C. C. Keller. *Schweiz. Wochenschr. Chem. Pharm.* 1895, 33, 149.

The author recommends the following method, which can be completed in a few hours, and which furnishes the alkaloids in as pure a condition as they can be obtained in by any other process:—12 grms. of finely powdered dry cinchona bark, contained in a dry flask of 200 c.c. capacity, are digested with 90 grms. of ether and 30 grms. of chloroform, and frequently agitated during five minutes. 10 c.c. of 10 per cent. ammonia are then added, and the mixture is well shaken. The shaking is continued at intervals for half an hour, when 10 c.c. of water (12–15 c.c. in the case of calisaya barks) are added, and the shaking continued until the liquid has become clear. 100 grms. of the chloroform-ether extract, after standing for 1–2 hours to allow of the separation of water and powdered bark, are carefully poured into a separating funnel and extracted with 30, 20, and then 10 c.c. of 1 per cent. hydrochloric acid. The acid solution is then collected in a separating funnel, made strongly alkaline with ammonia, and again extracted three times with a mixture containing in all 10 grms. of chloroform and 90 grms. of ether. After filtering the solution of the alkaloids into a tared flask through a small filter wetted with ether, the chloroform and ether are distilled off, and the residue dried at 80°–90° and weighed. The weight of the residue corresponds to 10 grms. of cinchona bark.—J. S.

Cacao Leaves, Estimation of the Alkaloids in. C. C. Keller. *Schweiz. Wochenschr. Chem. Pharm.* 1895, 33, 153.

12 grms. of the powdered cacao leaves are treated in a 250-c.c. flask with 120 grms. of ether. After 15 minutes 10 c.c. of 10 per cent. ammonia are added, and the mixture well shaken. Precipitation is effected half an hour later by the addition of 20 c.c. of water and continued violent agitation. 100 grms. of the dark green ethereal solution are then poured off, and, after standing some time to clarify, extracted with 50 c.c. and afterwards with 25 c.c. of 0.5 per cent. hydrochloric acid. The acid solution, filtered if necessary, is made alkaline with ammonia, and extracted twice with 40 c.c. of ether. The residue, on distilling off the ether in a tared flask, represents the amount of alkaloid in 10 grms. of the cacao leaves. The alkaloid is thus obtained as a colourless varnish, which crystallises after standing some time.—J. S.

Nux Vomica Seeds, Estimation of the Alkaloids in. C. C. Keller. *Schweiz. Wochenschr. Chem. Pharm.* 1895, 33, 152.

The following method is recommended by the author for the estimation of the alkaloids in the seeds of nux vomica:—12 grms. of the powdered substance are mixed with 80 grms. of ether and 40 grms. of chloroform in a dry flask of 200 c.c. capacity. After half an hour, 10 c.c. of 10 per cent. ammonia are added and vigorously shaken at intervals during an hour. 15–20 c.c. of water are then added in 2–3 portions to precipitate the drug. When the solution becomes clear after continued shaking, 100 c.c. are poured off and extracted in a separating funnel, first with 50 and then with 25 c.c. of 0.5 per cent. hydrochloric acid. The acid solution is then extracted three times with a mixture of 30 grms. of chloroform and 10 grms. of ether. The united extracts are evaporated in a tared flask, and the residue, which often retains chloroform, is repeatedly treated with 5 c.c. of ether, which is then boiled off, until this residue is obtained in the form of a white crystalline powder. The weight of the residue then represents the amount of alkaloids in 10 grms. of the seeds.—J. S.

ERRATUM.

This Journal, 1896, page 296, col. 2, line 31 from bottom:—After "furnace" add the words "till the copper fuses."

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Nitrogen Sulphide. R. Schenck. *Annalen*, **290**, [2], 171—185.

SULPHUR dichloride (250 grms.) is dissolved in dried benzene; the solution is cooled by iced water, and thoroughly dried ammonia gas carefully led in till no further evolution of heat takes place, and the mass becomes bright orange-red. The precipitate is quickly filtered, adhering benzene evaporated, ammonium salts washed out with water, and the residue crystallised from carbon bisulphide or tetrachloride. The benzene mother-liquor is concentrated by distillation to one-third of its bulk, when a further quantity of the substance crystallises out. In this way 33 grms. were obtained—about 45 per cent. of the theoretical yield. That still remaining in the mother-liquors is very difficult to separate from associated sulphur.

The nitrogen sulphide so obtained has the properties described by former observers—crystallises in fine orange-red needles, melts at 178° (earlier observers gave 160°), and explodes very readily on heating, friction, or percussion. Observations of the lowering of the freezing point gave a molecular weight agreeing with the formula N_2S_8 .

A constitution of nitrogen sulphide is given. The author regards it as a member of a new group of diazo bodies, containing pentad nitrogen, derivatives of the hypothetical compound $H_2N:NH_2$.—J. T. D.

Sulphoarsenates. R. F. Weinland and O. Rumpf. *Ber.* **29**, 1896, 1008—1012.

With a view to ascertain, if possible, the constitution of the sulphyarsenates the authors have prepared and described in this preliminary communication several sulphyarsenates. The sodium salt, Na_3AsSO_3 , is easily obtained by boiling a moderately concentrated solution of sodium arsenite with the calculated quantity of precipitated sulphur for half an hour, filtering from a slight excess of sulphur, and crystallising. The potassium and ammonium salts are prepared in a somewhat similar manner, the latter under pressure. Selenium can be added on to the ortho-arsenites just as readily as sulphur, whilst tellurium dissolves in a very concentrated solution of sodium ortho-arsenite, forming a red liquid which crystallises in a vacuum desiccator. The crystals could not be recrystallised from water, however, and there seems to be some doubt whether the substance so obtained was pure.—J. S.

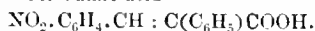
Hypochlorous Acid, Reaction with Cobalt and Manganese Chlorides. Enthyme and B. Klimenko. *Ber.* 1896, **29**, 478.

The amount of Co_2O_3 produced in the reaction between hypochlorous acid and cobalt chloride is smaller when the relative quantity of hypochlorous acid is increased—the quantity of cobalt chloride remaining constant—than when the cobalt chloride is increased in proportion to the hypochlorous acid, and in the first case the most favourable ratio is expressed by $2CoCl_2 : 3HClO$. In the reaction with $MnCl_2$ the reverse is the case, more MnO_2 being produced when the oxidising agent is increased in proportion to the salt, the ratio $MnCl_2 : 2HClO$ giving the best result.

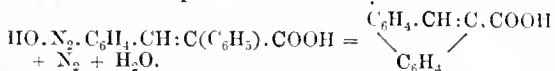
—A. C. W.

Phenanthrene and its Derivatives, New Syntheses of. R. Pschorr. *Ber.* 1896, **29**, 496.

o-NITROBENZALDEHYDE condenses with sodium phenylacetate in the presence of acetic anhydride to form a phenyl-*o*-nitrocinnamic acid—



This is reduced by ferrous sulphate in ammoniacal solution to the corresponding amine, which, when diazotised and shaken with copper powder in sulphuric acid solution, is transformed into β -phenanthrene carboxylic acid—



By using derivatives of *o*-nitrobenzaldehyde and phenylacetic acid, corresponding derivatives of phenanthrene will be obtained.—A. C. W.

Orthobenzoylphenol. P. Cohn. *Monatsh. für Chem.* **17**, 1896, [1], 102—109.

On heating phenylindoxazene with excess of fuming hydriodic acid and phosphorus in sealed tubes at 140° — 160° C. for 6—7 hours this substance is formed. The tubes were opened, the contents diluted with water, and the product shaken out with ether, which on evaporation left the impure ketone. To obtain it in a state of purity the liquid was dissolved in alcohol and sodium ethoxide added, when the sodium salt of orthobenzoylphenol separated. On decomposing this with hydrochloric acid, the *o*-benzoylphenol was obtained as a colourless oil, afterwards solidifying to crystalline plates, m. pt. = 36° . It is insoluble in water, but soluble in alcohol, ether, and acetic acid. Its composition is represented by the formula $C_{10}H_8O \cdot C_6H_5O(1:2)$.

—H. I.

Tartaric Acid, Levo-rotatory, Preparation of. W. Marckwald. *Ber.* **29**, 42—43.

THE method depends upon the fact that the cinchonine salt of levo-rotatory tartaric acid is more sparingly soluble in alcohol than that of the dextro-rotatory acid. In order to carry out the separation, a boiling aqueous solution of racemic acid has mixed with it, in small quantities, half the amount of cinchonine necessary to form the acid salt, sufficient water being added to give a clear solution. After standing one day the levo-rotatory salt crystallises out and is filtered off. The yield is about two-thirds of the theoretical. The filtrate, after standing two days, deposits the acid cinchonine salt of dextro-rotatory acid. The mother-liquor from this is halved, one part being exactly neutralised with caustic soda, the other with ammonia. The precipitated cinchonine is filtered off, the filtrate concentrated, and the sodium ammonium salt of dextro-rotatory tartaric acid crystallises out on cooling. The separation is carried on until the solution is inactive or faintly levo-rotatory. Unaltered racemic acid is separated by means of the lead salt, and the separation is then carried on anew as above. The levo-rotatory bitartrate of cinchonine can also be employed for the precipitation of pure levo-rotatory tartaric acid by decomposing the lead salt with sulphuretted hydrogen or sulphuric acid.—T. A. L.

Organic Acids; The Action of Light on, in the Presence of Uranium Salts. H. Fay. *Amer. Chem. J.* 1895, **19**, 269—289.

THE author has investigated the products of decomposition induced by the action of sunlight on certain organic acids in the presence of the uranyl salt of the respective acids. The following is a brief summary of his results:—

Oxalic Acid.—With oxalic acid and uranyl oxalate a precipitate is produced in two stages: (1) formation of uranous oxalate; (2) formation of the purplish-brown precipitate from the uranyl oxalate left in solution. The nature of the latter has not yet been determined, but it has been shown to contain carbon, and consequently cannot be a hydrated oxide as supposed. The formic acid observed when oxalic acid is decomposed must arise from the oxalic acid itself, since all attempts to build it up from water and carbon monoxide in presence of uranium salts have failed.

Tartaric Acid in presence of its uranyl salt forms an insoluble precipitate with uranium, the nature of which is not yet determined.

Acetic, Propionic, and Isobutyric Acids under the above-named conditions decompose into the hydrocarbons corresponding to the acids, and into carbon dioxide.

Malonic and Succinic Acids.—No satisfactory or definite results were obtained by the author in the case of these acids.—O. H.

Phenols, Toxicological Action of the. P. Binet. *Chem. Zeit.* 1896, **20**, 92—93.

From his experiments on the toxic action of the phenols, the author draws the following conclusions:—

Poisoning by phenol produces first a period of excitement, followed by one of collapse, accompanied by feeble spasmodic convulsions. Most substances belonging to the same chemical group act in a similar way. This action is not specially characteristic of the phenol hydroxyl groups, as it is also to

be met with in the benzene molecule, although to a less extent and with weaker poisonous effects.

The *Dihydroxyphenols* (*Pyrocatechol*, *Resorcinol*, and *Hydroquinone*) are much more irritant and in general more poisonous than phenol. In contradistinction to these the

Trihydroxyphenols (*Pyrogallol* and *Phloroglucinol*) have a much weaker action. *Pyrocatechol*, *hydroquinone*, and *pyrogallol* cause the formation of methæmoglobin.

The *Homologues of Phenol* (*Cresol*, *Thymol*, and *Orcinol*) are less active and in general less poisonous than the corresponding phenol, and this occurs to a greater extent the higher the molecular weight or the number of substituting alkyl groups; on the contrary, however, their action on the intestines is more powerful. Of the

Isomers of the Hydroxyphenols and Cresols, the meta-derivatives are least poisonous. The first esters of phenol (*anisol* and *phenetol*) produce trembling; in the case of *guaiacol* (methyl ester of *pyrocatechol*) the intense excitation of the hydroxyphenol has entirely disappeared. The presence of an alcohol or aldehyde group in the phenol molecule lessens the irritant and poisonous action.

Saligenin.—With the aldehyde of salicylic acid, the trembling greatly increases, in contradistinction to the corresponding alcohol (*saligenin*).

Benzyl Alcohol.—In the case of benzyl alcohol the convulsions and trembling disappear and the poisonous action is very slight. The isomerism with the cresols, the action of which is so different, makes the importance of the function of the hydroxyl groups evident.

The presence of an acid group in the phenol molecule lessens the poisonous action, but changes its properties.

Salicylic Acid.—Like *o-cresol*, salicylic acid shows critical stages of contraction and the difficulty in breathing which occurs in the case of benzoic acid.

Gallie Acid.—Gallie acid, like *pyrogallol*, produces no convulsions, but the deleterious effects on the blood are diminished.

Para-amidophenol is less irritant and also less poisonous than phenol, but it produces profound changes in the blood. The poisonous effect of the substitution products, diminishes, if the substituting groups are not in themselves poisonous.

—J. S.

Lanolinum Anhydricum, *Adeps Lane* and *Wool-Fat*. Von Cochenhausen. *Dingl. Polyt. J.* 1896, 299, 256.

The author, in a lengthy article, gives the results of tests on a sample of "*Lanolinum anhydricum*," two samples of *adeps lane*, and three samples of *wool-fat*.

The three samples of *wool-fat* were prepared from a large quantity of *wool-washing water* (from Australian wool). The wash water was treated with a solution of calcium chloride, and the precipitate formed filtered off and treated with pure acetone in a Soxhlet's extractor. The acetone solution was distilled and the residue treated several times with boiling water to remove the last traces of acetone. The *wool-fat* thus obtained was separated into three portions, viz.:—*Wool-fat I.*, about 70 per cent. of the total, the portion most soluble in acetone; *wool-fat II.*, about 20 per cent., the less-soluble portion; and *wool-fat III.*, about 10 per cent., the least soluble portion.

Wool-fat I. was of a faint yellow colour and of the same consistency as the *lanolinum anhydricum* and the *adeps lane*. *Wool-fat II.* was somewhat darker and thicker and more sticky than *wool-fat I.* *Wool-fat III.* was hard and solid at the ordinary temperature, and could be kneaded between the fingers without melting.

The author gives the figures obtained in tabular form, the following being of interest.

	Acid Value.	Saponification Value.
<i>Adeps lane I.</i>	0.67	..
" II.	0.88	82.43
<i>Lanolinum anhydricum</i> ..	1.81	89.97
<i>Wool-fat I.</i>	1.96	92.46
" II.	3.74	..
" III.	19.32	129.81

—A. S.

New Books.

UNSERE KENNNTNISSE IN DER ELEKTROLYSE UND ELEKTROSYNTHES ORGANISCHER VERBINDUNGEN. VON DR. WALTHER LÖB. Verlag von Wilhelm Knapp, Halle a. S. 1896. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 2s.

This work is published in pamphlet form, and contains preface and 42 pages of subject-matter. The text is subdivided as follows:—I. ELECTROLYSIS AND ELECTROSYNTHESIS OF ALIPHATIC COMPOUNDS. a. Hydroxyl Compounds. b. Ketones. c. Acids. II. ELECTROLYSIS AND ELECTROSYNTHESIS OF AROMATIC COMPOUNDS. Phenols; Acids; Aniline; Goppelsröder's Researches. ELECTROLYTIC REDUCTION OF NITRO COMPOUNDS. ELECTROLYSIS OF ALKALOIDS, OF BLOOD, AND OF EGG ALBUMIN. ELECTROLYSIS AND ELECTROSYNTHESIS WITH ALTERNATING CURRENTS.

L'AMMONIAQUE, LES NOUVEAUX PROCÉDÉS DE FABRICATION. Par P. TRUCHOT. Bernard Tignol, 53bis, Quai des Grands-Augustins, Paris. H. Grevel and Co., 33, King Street, Covent Garden, London. 1896. Price 6 frs.

This work on Ammonia is a small 8vo volume in paper cover, containing 367 pages; which include preface, text, and table of contents. The subject-matter is illustrated with 31 woodcuts, and following it are:—1. A Classified List of Patents; and 2. A Bibliographic Index of Works and Researches on Ammonia. The text is sub-divided as follows:—I. Ammonia and Ammonium Salts. II. History of Ammonia and Ammonium Salts. III. Chemical and Physical Properties. IV. Manufacture of Ammonia. V. Working up Gas Liquors. VI. Manufacture of Liquor Ammoniac and Ammonium Salts. VII. Analysis of Ammonia and Ammonium Salts. VIII. Applications of Ammonia and Ammonium Salts. IX. Economics.

LES MÉDICAMENTS CHIMIQUES. Par LÉON PRUNIER, Professeur de Pharmacie Chimique à l'École Supérieure de Pharmacie, &c. Première partie. Composés Minéraux. Masson et Cie., 120, Boulevard Saint-Germain. 1896. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 15 frs.

LARGE 8vo volume in paper cover, containing an introduction, table of contents, and text covering 623 pages. There is no alphabetical index, this being probably deferred until the appearance and completion of Part II., which is to appear about the end of 1896. The work is illustrated with 136 wood engravings. The individual treatment of the chemical substances described in the work may be illustrated by one example, viz., PHOSPHATE OF LIME:—1. Natural State; 2. Preparation; 3. Properties; 4. Analysis and Tests; and 5. Uses. The work is sub-divided as follows:—I. Monovalent Metalloids. II. Oxygen, Ozone, Sulphur. III. Nitrogen, Phosphorus, Arsenic, and Antimony. IV. Carbon and Charcoals. V. Aluminium, Zinc, and Iron. VI. Other Metals. VII. Distilled and Oxygenated Water. VIII. Potable Waters. IX. Mineral Waters. X. Iodides of Sulphur, Oxides of Nitrogen, Phosphide of Zinc. XI. to XVI. Various Acids. XVII. Carbonic Acid, Carbon Bisulphide, &c. XVII. to XX. Alkalies and Alkaline Earths. XXI. Magnesia, Zinc, and Manganese Oxides. XXII. to XXIV. Metallic Oxides. XXV. Sulphides. XXVI. Metallic Sulphides. XXVII. to XXXII. Chlorides, Bromides, and Iodides. XXXIII. Hypochlorites and Hypobromites. XXXIV. Chlorates, Bromates, and Iodates. XXXV. Hydrosulphites, Hyposulphites, and Sulphites. XXXVI. to XXXVIII. Metallic Sulphates, Alums, &c. XXXIX. and XL. Nitrites, Alkaline and Earthy Nitrates. XLI. and XLII. Hypophosphites and Phosphates. XLIII. Arsenites, Arseniates, Antimonites, Antimonates, and Borates. XLIV. to XLVI. Carbonates and Silicates. XLVII. Chromates, Permanganates, and Molybdates. XLVIII. Hydrocyanic Acid. XLIX. and L. Cyanides and Double Cyanides, Ferrocyanides, Sulphocyanides, and Nitroprussides.

PATENT OFFICE: THIRTEENTH REPORT OF THE COMPTROLLER-GENERAL OF PATENTS, DESIGNS, AND TRADE MARKS, with Appendices, for the Year 1895. (C. 8090.) Price 2½d.

This Annual Report is issued by the Comptroller of the Patent Office in pursuance of the requirements of the 102nd section of the Patents, Designs, and Trade Marks Act, 1883 (46 & 47 Vict. c. 57).

The following statement shows the total number of applications for patents, designs, and trade marks, and amount of gross receipts and expenditure in the years 1894 and 1895:—

Years.	Patents.	Designs.		Trade Marks.	Gross Receipts.	Gross Expenditure.
		Single.	Sets.			
1894	No. 25,386	No. 21,230	No. 1,025	No. 8,013	£ 181,855	£ 266,092
1895	25,065	20,507	910	8,272	187,012	260,671

* Including expenditure on account of new offices and buildings.

It is stated in the Report that in 1895, for the first time since the year 1885, the number of applications for patents showed no increase upon that of the preceding year, but, on the contrary, a decrease of 321. This decrease, however, was entirely due to a falling off of 676 in the number of applications accompanied by provisional specifications, those accompanied by complete specifications having increased in even more than the usual proportion, by 355. (See also this Journal, 1895, 702.)

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

PORTUGAL.

Tariff Modifications.

A despatch has been received at the Foreign Office from Her Majesty's Minister at Lisbon, transmitting copies and translation of a law, dated 27th April last, which imposes taxes on raw sugar, oils for food, artificial butter, clarified sugar, refined sugar, vegetable concrete oils, and candles, as follows:—

Art. 1. The "manufacture" and "consumption" taxes are levied on the products as specified in the law, made in the continental part of the kingdom and in the adjacent islands, and intended for consumption in the country.

Art. 2. Similar products to those taxed in virtue of this law, coming from foreign countries and cleared for consumption in this country, will pay the same taxes on clearance, saving any express provision to the contrary.

Art. 3. The following articles are subject to the taxes on manufacture and consumption, to which reference is made in Article 1:—

- Raw sugar.
- Fixed liquid oils for food.
- Artificial butter.
- Sugar clarified, sugar refined, whether it be amorphous or crystallised.
- Vegetable concrete oils.
- Candles of any kind or shape for lighting purposes.

Alterations in the Import Duty on Paraffin.

A despatch, dated 25th May last, has also been received, enclosing copy and translation of a new law regulating the import duty on paraffin, as follows:—

Art. 1. The words "paraffin purified" are struck out from the text of Article 149 of the Import Customs Tariff for Portugal and the adjacent islands, and these words are inserted in Article 99 of the said tariff, so that paraffin, either purified or not, presented for clearance after the publication of this law, will have to pay an import duty of 2 reis. (0.10d.) per kilo.

Art. 2. Any laws contrary thereto are hereby revoked.

RUSSIA.

Tariff Modifications.

Note.—Poud = 36 lb. avoirdupois. Gold rouble = 3s. 2d.

The Russian Department of Customs, under order dated the 7th (19th) May 1896, has notified the following classification of goods under the Russian Customs tariff:—

1. Glass powder (sparkling flakes of thin white glass or of glass coloured in the mass) approaching in character to enamel to be cleared under section 68. Duty, 3 roubles gold per pond.

2. Evaporating bowls of copper, lined with tin, used for manufacturing processes, to be cleared as worked copper ware under section 149. Duty, 4 roubles 32 copecks gold per pond.

3. Forks of aluminium, to be cleared under point 1 of section 158. Duty, 13 roubles 60 copecks gold per pond.

UNITED STATES.

Customs Decisions.

The following decisions relating to the classification of articles in the Customs tariff and the application of the Customs laws of the United States have recently been given by the Customs authorities in that country:—

Domestic coverings (carboys, iron drums, &c.) containing foreign goods, if of American manufacture, are free of duty as American manufacture, under paragraph 387.

Lanoline is dutiable at 25 per cent. *ad valorem*, under paragraph 58, as a medical proprietary preparation, non-alcoholic.

Chemical glassware, viz., Kjeldahl flasks, Norry flasks, Leyden jar, test tubes, Chevallier's creamometers, and other vessels of glass, some with glass stoppers and others without the same, are dutiable, if holding more than 1 pint, at three-fourths of one cent per pound. Articles of the above description holding less than 1 pint, including chemical thermometers, are dutiable at 40 per cent. *ad valorem*, under the respective provisions of paragraphs 88 and 90 of the Act of August 28, 1894, as other bottle glassware (than vials holding more than 1 pint) and articles or vessels of glass, engraved.

Soda-ash mixed with soap, soda-ash being the component material of chief value, is dutiable, under paragraph 67, at one-fourth of one cent per pound, the rate provided for soda-ash.

SWEDEN.

Tariff Modifications.

A despatch has been received at the Foreign Office from Her Majesty's Secretary of Legation at Stockholm, reporting the following changes in the Swedish tariff which have just been sanctioned by the Chambers.

Dextrin or Dextrin Gum (Dextrin och dextrin gummi).—The increase of the present duty of 17 ore per kilo. to 20 ore per kilo.

Platinum.—Certain articles used for technical purposes in which platinum is exclusively employed, hitherto charged an *ad valorem* duty of 10 per cent. under No. 362 of the tariff, to be admitted free under No. 428.

A communication has been received at the Foreign Office to the effect that the above changes will, probably, shortly come into effect.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

DEVELOPMENT OF SWEDISH MANUFACTURES.

In a report to the Foreign Office, dated 31st March last, Her Majesty's Consul at Stockholm gives interesting information respecting the development within recent years of the native manufacturing industries.

A considerable increase in production of iron and steel has occurred since 1891, the total value for the year 1893 being calculated at 2,777,777l.

The number of sawmills in Norrland is estimated at 225.

The wood-pulp industry has been increasing rapidly of late years. At the end of 1893 there were 93 factories in operation, producing in that year 96,000,000 kilos.

The development of the beet-sugar industry has been very rapid and successful. In the year 1890 there were only four factories in existence, but others have been set up each successive year, so that at the present time there are 18 in operation, producing nearly 50,000 tons of raw sugar annually.

GENERAL TRADE NOTES.

COMPULSORY CHARGES ON GERMAN WORKS.

Engineering and Mining Journal, May 30th, 1896, 519.

The reports and balance-sheets of the leading iron and coal companies published in the German technical journals clearly show how severe is the burden of taxes and contributions to compulsory benefit funds on German industry. In the case of the Gütehoffnungshütte, says the *Colliery Guardian*, one of the principal coal and iron companies, the taxes amounted last year to 5.08 per cent., and compulsory contributions to 1.62 per cent. on the capital.

This interesting subject has been studied in great detail by Mr. R. Effertz, director of the Königsborn Works, who has published some valuable statistics showing the tendency of these charges to increase year by year. He has selected for comparison three years, which appear to be well adapted for illustrating this increase. The year 1878 was the lowest point of the period of depression of the Rhenish-Westphalian coal trade, which extended from 1875 to 1889. The year 1885 was at the beginning of the growth of compulsory charges, while the year 1894 shows the full results of the innovation. For these three years the statistics are as follows:—

Year.	1878.	1885.	1894.
Output	Tons		
Cost of production..	£ 11,148,700	19,108,700	32,422,354
Cost, per ton	48. 11/2	48. 10/2	68. 5/2
Wages, total.	£ 1,571,540	2,719,863	5,912,597
Wages, per ton	2.750	2.846	3.665
Wages, proportion Per cent.	55.628	59.120	57.433
Wages, per man per shift.	2.703 to 3.771	2.225 to 3.118	2.890 to 3.791
Public charges, total	£ 133,051	227,808	501,400
Public charges, per Shillings ton.	0.232	0.238	0.557
Public charges, pro-Per cent.	1.760	1.652	8.740
Public charges, per Shillings man per year.	29.51 to 113.760	31.75 to 200.700	64.80 to 261.9

Under the head of public charges are included State taxes, local taxes, and mining taxes, the works, contributions to miners' fund, insurance fund, sick and pension fund, and contributions to benevolent funds, schools, and church. It will be noticed that the cost of production in 1878 and in 1885 was practically the same, the working efficiency being greater in the latter year than in the former. The annual output per miner is shown by the following figures published by the Society for Promoting Mining Interests:—

Year.	Output.	Number of Men employed.	Annual Output per Man.
	Tons.		Tons.
1878.....	19,208,942	71,364	258.3
1885.....	28,970,568	101,829	284.5
1894.....	40,613,973	154,136	263.5

The year 1894, however, showed an increase in the cost of production of nearly 33 per cent. compared with 1885, and of nearly 30 per cent. compared with 1878. The wages paid per ton increased in 1894 about 33.3 per cent. compared with 1878, and more than 28 per cent. compared with 1885. The average wage per man per shift in 1894 was 3.75s., that is, 35 per cent. more than in 1879, and 19 per cent. more than in 1885.

We now come to the ratio of the public charges to the cost of production. Calculated on the basis of a ton, these

charges in 1894 were 110 per cent. greater than in 1878, and 134 per cent. greater than in 1885.

Mr. Effertz's statistics are undoubtedly most suggestive, and cannot fail to throw doubt on the suggestion contained in the report of the Delegation of Employers and Workmen, organised to investigate the German iron trade, that the Continental employer has a fair equivalent for the burdens placed upon him by the State. In that report it is acknowledged that the serious increase of the cost of the accident assurance and other special workmen's funds has led to several proposals being considered with a view to either diminishing the amount of the indemnities and pensions, or to so altering the law itself as to reduce its pressure on the industrial works of Germany. The opinion is, however, expressed that the existence of these funds, involving, as they do, the care and protection of the employed by their employers, appears to secure harmonious relations between them.

SOAP AND ARSENIC IN TURKEY.

Chamber of Commerce Journal, May 1896, 88.

The *Bulletin* of the French Chamber of Commerce at Constantinople states that the consumption of soap in Constantinople is very considerable, and European towns of the same importance (nearly a million of inhabitants) would probably show a much smaller consumption. According to an estimate, the yearly consumption of soap in Constantinople amounts to between four and five million kilos. A German Consular report gives the following details respecting importation, viz.:—From Crete, 2,500,000 kilos.; from Metelin, 1,300,000 kilos.; from Aivali, 500,000 kilos.; from Marseilles, Trieste, and Italy 70,000 kilos. Several countries have endeavoured to enter into the trade, but without success, and it is stated to be impossible to compete with Crete and the islands of the Archipelago, which produce gigantic quantities of olive oil, and whose populations are regularly initiated in this industry. Although the celebrated Marseilles soap is sold, the quantity consumed is but trifling, as only Europeans (not Turks) use it.

The Ministry of Agriculture, Mines, and Forests has granted a concession for 99 years to Marshall Fuad Paeha for an arsenic mine discovered in the neighbourhood of Gulbachi, Sandjak of Bordour. The mine covers an area of 390 djirids (hectares).

PRODUCTION OF BASIC STEEL, 1878-93.

Engineering and Mining Journal, May 30th, 1896, 518.

Since the close of 1893, when the patents ran out, no figures of the output have been systematically collected, though it has been ascertained by the British Iron Trade Association that 415,917 tons were made in Great Britain in 1894. Some endeavours have been made to collect the statistics for foreign countries since 1893, but these have not as yet met with success. The figures given below, however, are complete up to 1893. There is good reason to believe that a considerable extension of the manufacture is going on abroad, now that no royalties have been paid, and the demand for steel is rapidly increasing with the revival of trade.

Year.	England.	Germany.	Luxemburg.	Austria.
	Tons.	Tons.	Tons.	Tons.
1878.....	20	..	..	..
1879.....	1,150	.. 50	..	..
1880.....	10,000	18,180	..	13,754
1881.....	46,120	200,090	..	54,700
1882.....	109,364	235,132	..	64,214
1883.....	122,380	328,909	..	85,593
1884.....	179,000	440,000	..	80,300
1885.....	145,797	518,252	..	69,262
1886.....	258,466	767,054	..	99,647
1887.....	435,946	1,005,429	..	142,409
1888.....	608,594	1,039,317	..	138,438
1889.....	963,919	1,209,327	..	175,755
1890.....	503,400	1,390,289	..	202,315
1891.....	436,261	1,654,109	..	221,212
1892.....	493,839	1,884,801	..	228,122
1893.....	378,036	2,218,014	..	314,392

Year.	France.	Belgium.	Russia.	United States of America.
	Tons.	Tons.	Tons.	Tons.
1878	..	..	..	..
1879	..	..	..	..
1880	4,771	3,295	..	..
1881	10,180	14,204	10,590	..
1882	12,306	16,672	12,312	..
1883	38,229	27,399	31,853	..
1884	113,000	31,709	28,000	..
1885	130,582	21,956	30,458	..
1886	122,711	27,938	20,657	..
1887	210,301	50,777	17,896	..
1888	222,333	31,937	14,300	..
1889	222,392	47,037	29,562	..
1890	240,638	46,445	33,340	77,779
1891	255,491	38,796	38,973	110,116
1892	287,528	56,274	58,454	91,723
1893	363,017	69,475	71,970	116,312

RAMIE CULTIVATION IN JAMAICA.

Imperial Institute Journal, June 1896, 215.

From the statement of a correspondent writing to the *Textile Mercury* from Kingston, regarding the efforts of Sir Henry Blake to introduce the cultivation of ramie or rhea fibre into Jamaica, it appears that the difficulty of separating the fibre economically has been overcome with some degree of success. Without the aid of machinery, and simply by a process of hand labour, after the dried plant had been treated by a chemical solution, 732 lb. of fibre were produced. The labour used was that of the boys of the Government Industrial School, which is in close proximity to the Botanical Gardens. In a working day of eight hours the average amount of wet fibre separated by each boy was 27 lb., or $4\frac{1}{2}$ lb. of dry ribbon, and, of course, with practice the amount would be materially increased. The cost of boy labour in Jamaica is 6d. to 9d. per diem: female, 9d. to 1s.; and men's, 1s. 3d. to 1s. 9d. The ramie ribbon so decorticated was sent to Messrs. Dunlop, merchants, London, who stated that all the experts declared unanimously that the samples were the best ever sent to London. Messrs. Dunlop further reported that in the state in which the ribbon was sent over they could find buyers of from 60 to 100 tons per month. They had sold part of the sample at 36l. per ton, and could have realised 10 tons at once. They were convinced that if the growers in Jamaica were in a position to produce large quantities, ample sales at remunerative prices would be made. The demand was great, and they would strongly advise the cultivation of the product in Jamaica. Already, concludes the *Textile Mercury's* correspondent, many of the planters have taken up the ramie culture, and should the project prove successful, a revolution in the fibre market may be anticipated.

THE CHEMICAL INDUSTRY IN GERMANY.

Chemist and Druggist, June 13th, 1896, 839.

The British Consul at Mannheim does not draw a very bright picture of the condition of the chemical industry in his district, which possesses some of the biggest chemical factories in Germany. "The chief feature of the industry in 1895," he says, "has been the continued fall in prices almost all along the line. The break-up of the South German Sulphuric Acid Convention caused a heavy decline in price. Sharp competition set in among the manufacturers. The unfortunate condition of agriculture in general prevented the artificial manure makers from doing a prosperous trade. One factory began making superphosphates simply in order to turn its make of sulphuric acid to account. Trade with Spain, that used to comprise chiefly magnesia and hyposulphite of soda, has ceased almost entirely. In Germany the chemical industry is being overdone and overrun. Many new factories are being opened without there being any field

for their production, and consequently prices of many articles are ruinously low. A number of newly invented pharmaceutical products have been put on the market during the year, but it is complained that most are introduced before being properly tried. The quinine factory at the Waldhof reports a satisfactory year, with extended connections and increased business at home and abroad, but, owing to the Customs war between Germany and Spain, business with the last-named country has fallen off greatly. This was the more felt since the consumption of quinine, owing to the war in Cuba, has greatly increased, and was covered by the French factories. The sale of alcoholic preparations was considerably affected by the changes in the excise impost, and export prices for such products were purely speculative, manufacturers being quite uncertain whether drawback to the full amount would be allowed. The new tax is said to require a revision of the import duties on alcoholic preparations, since, as things are, both foreign countries and the chemical factories in the free-port district of Hamburg can manufacture such products cheaper than Germany itself. Other countries are, therefore, in the position of being able to beat Germany abroad, and to compete with it in its home market." The report may be coloured somewhat too darkly, but it tends to show how exaggerated is the belief that the chemical industry of Germany is made up of factories earning 25 per cent. dividends, and it also confirms, what is generally known to those behind the scenes, that much of the export trade of the country is done without any profit whatever, or even at a loss, in order to get rid of over-production.

NEW RAILWAY REGULATIONS FOR CONVEYANCE OF ETHER, 1896.

Inflammable Liquids.

Ether, in luted and tied-over bottles, packed in sawdust in cases of sufficient strength, or in hermetically sealed tins, packed in sawdust in cases or casks of sufficient strength, each package containing not more than 28 lb. of ether, and the gross weight per package not to exceed 84 lb., minimum charge, 5s.

Specification of Iron Drum for the Carriage of Ether and Gasoline, Contents of which shall not exceed Ten Gallons.

1. The drum is to be not more than 14 ins. in diameter, and is to be made of tinned sheet iron, the body of No. 20 B.W.G. plate, with a sunk longitudinal grooved joint well filled with solder. The ends are to be of No. 19 B.W.G. plate, with a camber of not less than $\frac{1}{4}$ in., flanged at the edges, and let into the body of the drum 1 in., with the bulge outwards and the flange inwards, strongly sweated with solder, and afterwards well floated with solder all round. The drum is to be strengthened by three bands of iron, No. 14 B.W.G. (the ends of which are welded or riveted together), one band $1\frac{1}{2}$ ins. wide round the middle of the drum, and one 2 ins. wide round each end, each band to be firmly secured to the drum by solder. A brass screwed collar and plug is to be let into the top of the drum, and secured by a washer soldered round the collar inside. Painted drums must be white.

2. Each drum, when new, must be tested by hydraulic pressure of 40 lb. per sq. in., without showing signs of injury or leakage, also whenever it shows signs of damage or deterioration, and the test must be repeated at least once every year.

3. When filling the drum, an air space equal to at least one-tenth the capacity of the drum must be left. After filling, and before being hauled to the railway company for conveyance, the senders must test each drum by submersion in a tank of water heated to not less than 130° F., to ensure there is no leakage.

4. The screw plug of each empty drum must be securely fastened in its place before the empty drum is returned.

5. Damaged drums will not be accepted for conveyance.

A further regulation is to the effect that drums must be sent naked—that is, not packed in casks or barrels—so that no risk of bad packing of glass containers in casks or barrels may be possible.

EUROPEAN SUGAR INDUSTRY FOR THE YEARS 1891 TO 1895 AND 1895 TO 1896.

Chem. Zeit. 1896, 20, 137.

Country.	Working Sugar Factories.		Quantity of Beetroot		Production of Sugar of 88 Per Cent. Rendement to be manufactured		
	1891-95.	1895-96.	Used 1891-95. (1,000 kilos.)	To be used 1895-96. (1,000 kilos.)	1891-95. (1,000 kilos.)	1895-96. (1,000 kilos.)	1895-96 compared with 1891-95. (1,000 kilos.)
France.....	369	..	7,137,736	5,295,000	745,973	618,523	- 127,500
Belgium and the Netherlands.....	139	141	2,973,000	2,155,000	277,970	259,530	- 17,540
Germany.....	405	366	14,525,559	10,860,000	1,831,621	1,377,000	- 454,621
Austria-Hungary.....	217	216	8,530,000	5,619,200	1,044,500	716,100	- 328,400
Russia.....	227	230	5,405,780	5,370,000	591,300	695,000	+ 103,500
Total.....	1,357	..	38,572,075	29,600,200	4,189,957	3,366,153	- 823,754

—J. L. B.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st May	
	1895.	1896.
	£	£
Metals.....	1,572,063	1,567,629
Chemicals and dyestuffs.....	552,282	461,232
Oils.....	704,354	581,425
Raw materials for non-textile industries.....	3,471,679	3,183,985
Total value of all imports.....	34,752,086	13,349,988

SUMMARY OF EXPORTS.

Articles.	Month ending 31st May	
	1895.	1896.
	£	£
Metals (other than machinery).....	2,460,717	2,951,548
Chemicals and medicines.....	808,410	707,812
Miscellaneous articles.....	2,830,800	2,804,901
Total value of all exports.....	18,344,744	18,812,927

IMPORTS OF METALS FOR MONTH ENDING
31st MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Copper:—				
Ore..... Tons	2,918	2,596	21,384	26,190
Regulus..... "	5,118	6,955	155,958	177,108
Unwrought..... "	3,029	4,630	127,857	223,705
Iron:—				
Ore..... "	379,278	464,785	260,428	320,031
Bolt, bar, &c..... "	1,168	8,386	32,811	65,036
Steel, unwrought..... "	751	1,684	7,086	12,555
Lead, pig and sheet..... "	16,338	13,069	153,308	110,681
Pyrites..... "	18,752	49,313	80,126	79,731
Quicksilver..... Lb.	814,570	1,661,618	78,035	119,594
Silver ore..... Value £	..	..	147,420	40,303
Tin..... Cwt.	71,465	62,871	236,815	189,316
Zinc..... Tons	6,142	6,341	91,069	103,905
Other articles... Value £	..	..	193,536	179,171
Total value of metals.....	..	..	1,572,063	1,567,629

IMPORTS OF OILS FOR MONTH ENDING 31st MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Cocoa-nut..... Cwt.	58,714	10,156	70,495	11,569
Olive..... Tons	901	2,095	33,697	67,851
Palm..... Cwt.	120,538	109,536	126,224	110,922
Petroleum..... Gall.	13,554,281	11,467,310	309,782	245,882
Seed..... Tons	3,127	2,318	60,090	43,197
Train, &c..... Tons	1,708	870	27,018	16,497
Turpentine..... Cwt.	10,271	11,761	10,982	10,966
Other articles... Value £	..	..	65,853	74,550
Total value of oils.....	..	..	704,954	581,425

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 31st MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Bark, Peruvian... Cwt.	2,901	5,305	5,155	8,804
Bristles..... Lb.	148,482	229,742	61,995	34,330
Caoutchouc..... Cwt.	26,893	29,875	282,517	283,799
Gum:—				
Arabic..... "	5,242	14,652	9,543	39,237
Lac, &c..... "	11,884	14,061	73,807	79,225
Gutta-percha..... "	4,792	2,919	51,153	22,506
Hides, raw:—				
Dry..... "	52,659	30,820	120,373	76,208
Wet..... "	100,930	37,023	263,187	83,063
Ivory..... "	719	624	30,552	25,491
Manure:—				
Ganno..... Tons	6,409	590	56,778	2,344
Bones..... "	4,463	4,727	18,488	18,187
Nitrate of soda..... "	18,364	8,750	158,562	67,842
Phosphate of lime..... "	23,978	21,840	46,270	37,329
Paraffin..... Cwt.	48,575	38,984	66,557	59,671
Linseed oil..... Tons	2,197	1,893	19,834	19,950
Esparto..... "	16,083	9,625	64,396	40,959
Pulp of wood..... "	20,989	29,625	130,261	150,700
Rosin..... Cwt.	111,618	62,202	25,536	16,589
Tallow and stearin..... "	135,782	171,902	161,894	175,899
Tar..... Barrels	262	700	48	413
Wood:—				
Hewn..... Loads	227,295	190,291	408,996	377,526
Sawn..... "	243,312	471,922	553,712	1,086,972
Staves..... "	9,057	12,713	58,363	60,623
Mahogany..... Tons	3,577	3,052	27,791	27,272
Other articles... Value £	..	..	851,132	758,230
Total value.....	..	..	3,471,679	3,183,985

Besides the above, drugs to the value of 100,120*l.* were imported, as against 81,018*l.* in May 1895.

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH
ENDING 31ST MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	22,126	18,134	£ 15,645	£ 8,419
Bark (tanners', &c.) ..	35,454	25,225	13,976	9,731
Brimstone.....	72,185	77,185	13,396	14,739
Chemicals..... Value £	..	..	116,401	110,107
Cochineal..... Cwt.	242	203	1,429	1,258
Cutch and gambier Tons	1,836	1,208	12,093	29,595
Dyes:—				
Alizarin..... Value £	..	..	25,463	17,934
Anilin and other ..	..	..	39,915	11,477
Indigo..... Cwt.	4,337	2,575	59,194	30,784
Nitrate of potash ..	22,302	11,254	29,465	30,264
Valonia..... Tons	3,430	2,871	31,725	29,584
Other articles... Value £	..	..	17,4610	137,917
Total value of chemicals	..	..	552,282	461,232

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 31ST MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,235	3,769	£ 31,661	£ 38,757
Copper:—				
Unwrought....	51,126	50,779	112,597	121,148
Wrought.....	28,305	25,915	72,798	73,639
Mixed metal....	34,973	15,213	70,109	34,297
Hardware..... Value £	..	..	145,319	172,433
Implement.....	..	..	100,352	122,165
Iron and steel... Tons	265,665	304,018	1,633,380	2,051,275
Lead.....	6,124	5,969	65,840	72,339
Plated wires... Value £	..	..	24,144	24,276
Telegraph wires ..	..	..	26,942	112,215
Tin..... Cwt.	10,571	12,597	56,020	49,863
Zinc.....	19,666	16,124	12,059	12,223
Other articles... Value £	..	..	66,496	75,358
Total value .....	..	..	2,490,717	2,951,548

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 31ST MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder..... Lb.	463,200	1,025,500	£ 11,691	£ 17,288
Military stores.. Value £	..	..	204,260	167,813
Candles..... Lb.	2,098,806	2,210,100	35,188	32,787
Caoutchouc..... Value £	..	..	85,582	97,587
Cement..... Tons	40,572	34,527	64,898	55,963
Products of coal Value £	..	..	180,713	150,445
Earthenware ...	..	..	158,715	154,729
Stoneware.....	..	..	14,124	20,121
Glass:—				
Plate..... Sq. Ft.	137,631	161,844	8,009	10,792
Flint..... Cwt.	8,080	7,421	17,627	17,889
Bottles.....	51,220	70,332	25,532	33,526
Other kinds....	23,122	23,238	18,156	18,980
Leather:—				
Unwrought....	18,741	13,168	138,068	118,080
Wrought..... Value £	..	..	20,811	22,007
Seed oil..... Tons	5,539	5,349	111,613	102,290
Floorcloth..... Sq. Yds.	1,906,200	2,050,100	70,031	80,000
Painters' materials Val. £	..	..	144,480	145,668
Paper..... Cwt.	82,854	92,512	125,233	137,530
Rags..... Tons	4,672	4,943	29,335	20,085
Soap..... Cwt.	60,878	68,609	63,505	67,969
Total value .....	..	..	2,830,800	2,804,991

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 31ST MAY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	617,580	374,594	£ 152,688	£ 101,185
Bleaching materials ..	140,001	91,723	51,008	31,151
Chemical manures. Tons	25,787	21,261	368,101	129,577
Medicines..... Value £	..	..	82,658	95,226
Other articles... ..	..	..	353,955	350,673
Total value .....	..	..	808,410	707,812

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

10,763. F. Svoboda. Improvements in and connected with Siemens' regenerative furnaces. May 19.

10,983. J. G. Chamberlain. Improvements in apparatus for softening and purifying water for feeding boilers and for other purposes. May 21.

11,136. E. C. Mills and J. G. Chamberlain. Improvements in filters for extracting grease and other impurities from feedwater for steam boilers. May 22.

11,345. A. Gates. Improvements in apparatus for mixing liquids. May 23.

11,621. H. Maxim. Improvements in methods and apparatus for effecting the separation of gases. May 28.

11,633. S. K. Welch. Improvements in filtering apparatus. May 28.

11,739. O. Guttman. Improvements in apparatus for softening and purifying water. Complete Specification May 29.

11,828. T. Bradford. Improved apparatus for drying fabrics and other materials. May 30.

11,963. H. G. Watel. Improvements in transmitting the indications of thermometric, hygrometric, barometric, or other instruments. June 2.

12,045. H. Seek. Improvements in machines for separating light from heavy substances. Complete Specification. June 2.

12,109. P. Hereng. Carburetting apparatus. June 3.

12,557. S. J. Norton and H. A. Stenning. Improvements in apparatus for compressing air and other gases. June 8.

12,572. S. G. Merrick and H. L. Washburn. Improvements in and relating to vapour condensers, and apparatus for destroying noxious fumes, recovering by-products from distillation, and like purposes. June 8.

12,643. E. Porak. Method of and apparatus for washing and compressing sulphurous acid and other gases or fumes. Complete Specification. June 9.

12,889. W. S. Akerman. See Class IX.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

12,184. A. W. Stokes. Apparatus for determining volumetrically the amount of fat in milk or other articles. June 10.

13,188. A. Barr and W. Stroud. Apparatus for the production of high vacua. June 17.

13,867. Sir W. Arrol and W. Foulis. Apparatus for charging gas and other retorts. June 17.

13,896. F. Barmann-Zix. Method and apparatus for the production of superheated steam. June 3.

14,456. H. R. Chubb. Machinery applicable for filtering, condensing, and absorbing air, smoke, fumes, and other gases. June 17.

14,852. E. Theisen. Apparatus for evaporating or distilling liquids. June 10.

14,971. F. Willis. An improvement in the construction of gas furnaces for enamelling, assaying, milling, &c. June 17.

24,709. J. L. A. Aymard. Improvements in sterilising apparatus. June 3.

1896.

3141. J. M. Boustead. Improved apparatus for desiccating. June 3.

7802. A. T. Pfeiff. Improvements in apparatus for sterilising milk, cream, and other liquids by means of steam. June 17.

7878. W. R. Jones. Improvements in furnaces. June 3.

8198. A. S. Bryce, jun. Improvements in packing for hydraulic apparatus. June 3.

9557. H. Herzel. Improvements in or connected with the overflow pipes of distillation and absorption columns. June 17.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

10,673. C. A. Finch and H. J. Ingle. Improved apparatus for regulating the supply of illuminating gas and enriching the same, and improved composition for such enrichment. May 18.

10,725. G. Webb, jun., and J. W. Kelly. Improved apparatus for automatically generating gas. Complete Specification. May 18.

10,728. J. Swinburne. Improvements in generating acetylene from carbides. May 19.

10,822. H. Kirkham. Improvements in scrubber washers for removing impurities from gas. Complete Specification. May 19.

10,830. O. Knofler. Improvements in or relating to the manufacture of mantles or the like for incandescence gas-lighting. May 19.

10,862. S. Falk. Improvements in the treatment of mantles for incandescence gas-lighting. May 19.

10,965. A. E. Brunne. Improvements relating to the means for preparing or finishing mantles for incandescence gas burners. May 21.

11,109. C. Weygang. Improvements in the application of artificial fuel. May 22.

11,267. T. Thorp and T. G. Marsh. Improvements in apparatus for producing acetylene gas. May 23.

11,268. T. Thorp and T. G. Marsh. Improved treatment of calcic carbide for the production of acetylene gas. May 23.

11,269. T. Thorp and T. G. Marsh. Improvements in the method of and means for charging acetylene gas generators. May 23.

11,350. J. H. H. Duncan and D. W. Sugg. Improvements in the manufacture of incandescence mantles for gas and vapour lamps. May 23.

11,330. The Economical Gas Apparatus Construction Co., Lim., and L. L. Merrifield. Improvements in apparatus for the manufacture of carburetted water gas. May 27.

11,581. G. Moreau and A. Poulhies. Improvements in gas-lighting. May 27.

11,632. J. E. Goldschmid and C. Dellwik. An improved manufacture of water gas. May 28.

11,706. E. F. J. C. Bauweraerts. An improved process and apparatus for purifying acetylene gas. Complete Specification. May 29.

11,707. E. F. J. C. Bauweraerts. An improved burner for acetylene gas. Complete Specification. May 29.

11,708. E. F. J. C. Bauweraerts. Apparatus for the generation of acetylene gas. Complete Specification. May 29.

11,737. E. Claesolles. Improvements in apparatus for the production and storage of acetylene gas for illuminating purposes. Complete Specification. Filed May 29. Date applied for Jan. 24, 1896, being date of application in Spain.

11,938. T. Hawkins, A. Wellby, and J. W. Carr. An improved apparatus to be used for the production of gases to be used for fuel heating and steam engines and driving gas engines. June 2.

11,951. J. Meikle. Improvements in treating peat, coal, and other carbonaceous substances for the obtainment of illuminating gas. June 2.

11,955. W. Young and G. R. Hislop. Improvements in the production of illuminating gas from liquid hydrocarbons, and in apparatus therefor. June 2.

12,016. M. C. A. Fourchette. Improvements in apparatus for generating acetylene gas. June 2.

12,047. M. C. A. Fourchette. Improved method of and apparatus for generating acetylene gas. June 2.

12,055. G. Kern. Improvements in or relating to apparatus for producing acetylene. June 2.

12,245. W. P. Thompson. Improvements in the separation of gases of different specific gravity, and in apparatus therefor. June 4.

12,351. W. W. Baggally. Improved appliances for incandescent gas lighting. June 5.

12,430. A. Arter. Improvements in and relating to the treatment of gas for illuminating and other purposes. June 6.

12,527. D. Hancock, J. B. Craig, and A. H. Hancock. Improvements in or connected with the treatment of carburetted air or gas for heating purposes. June 8.

12,535. O. Imray.—From F. Brunek and Co. Improvements in horizontal coke ovens. June 8.

12,612. J. W. Lea and J. H. Perrius. Improvement in incandescent mantle protectors. June 9.

12,628. A. Bryce. A universal fuel injector. Complete Specification. June 9.

12,662. A. Tobler. Apparatus for the automatic generation and distribution of acetylene gas. June 9.

12,683. H. A. Daroy. Improvements in the manufacture or production of acetylene gas, and in apparatus therefor. Complete Specification. June 9.

12,771. C. Whitfield. Improved process and apparatus for manufacturing producer and water-gas. June 10.

12,788. R. R. Gibbs. Improvements in or relating to the generation and storage of acetylene. June 10.

12,840. H. Hellewell. Improvements in the preparation or manufacture of artificial fuel. June 11.

12,900. S. Earl. An improved apparatus for the manufacture of acetylene gas. June 11.

12,912. T. Thorp and T. G. Marsh. Improvements in and connected with the method of and apparatus for treating acetylene prior to combustion. June 12.

13,115. C. P. Choquette and A. M. Morin. Improvements in acetylene generators. June 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

10,356. J. T. Key and W. S. Key. An improved system for the manufacture of coke, the construction of coke ovens, and the recovery of by-products from same. May 27.

10,917. H. Riché. Manufacture of gas and apparatus therefor. June 3.

12,356. T. Thorp and T. G. Marsh. Apparatus for the production of heating and illuminating gas. June 3.

12,332A. G. A. Cannot. Manufacture of briquettes for fuel from peat. June 17.

13,750. T. L. Willson. Manufacture of illuminating gas. June 3.

13,766. T. L. Willson. Production of illuminating gas. June 3.

14,759. M. G. Sykes. Production of fuel. June 17.

14,855. A. K. Huntington. See Class VII.

14,974. C. Jacobsohn. Improvements in night-lights. June 17.

16,139. J. Laycock. Apparatus for washing and scrubbing gas. June 17.

1896.

7438. E. H. C. Oehlmann. Incandescent gas burners. June 3.

7901. J. M. Mitchell. Apparatus for mixing air and gas. May 27.

8239. C. Gautzsch. Apparatus for producing illuminating gas. June 3.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

10,827. J. Y. Johnson.—From The Chemische Fabrik Griesheim. A process for the manufacture of di-ortho-nitro-toluene, enabling ortho-para-di-nitro-toluene and tri-nitro-toluene to be obtained at the same time. May 19.

11,309. Read, Holliday, and Sons, Lim., and H. Dean. Improvements in the manufacture of basic colouring matters. May 23.

11,370. Read, Holliday, and Sons, Lim., J. Turner, and J. Turner. Improvements in the production of colouring matters. May 26.

12,142. S. Pitt.—From L. Casella and Co. Production of polyazo dyestuffs. June 3.

12,204. W. H. Claus and A. Rée. Production of new colouring matters. June 4.

12,534. H. W. Langbeck. Improvements in the manufacture of materials for indelibly marking paper and fabrics. June 8.

12,556. S. Pitt.—From L. Casella and Co. Production of dyestuffs suitable for dyeing wool. June 8.

12,922. A. G. Green and A. Wahl. The manufacture and production of new cotton colouring matters. June 11.

13,093. H. R. Vidal. An improved manufacture of dyes. Date applied for, June 3, 1896, being date of application in France. June 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,949. C. D. Abel.—From A. Fisches-er and Co. Manufacture of phthaleines by the action of mixed anhydrides. June 10.

14,382. O. Murray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of meta-nitranilino-sulpho acid and its analogues.

14,686. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of anthraquinone derivatives. June 10.

15,242. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. The manufacture and production of black colouring matters of the anthraquinone series, suitable for directly dyeing cotton in the cold bath. June 10.

17,402. W. Clarke. Improvements relating to the treatment of mangrove bark for the obtainment therefrom of pure solid tannin, dye, and cutch. June 3.

1896.

8770. H. Murray.—From The Badische Chemical Works, Bindeschedler. Manufacture of alkyl glycolic acid derivatives of paramidophenol ethers. June 10.

9912. E. Ritter von Portheim. Process for producing black azo dyestuffs on the fibre. June 17.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

10,868. O. A. Berend and the "Lehner" Artificial Silk Co., Lim. Improvements in the production of artificial silk. May 20.

11,371. W. R. Jones.—From T. A. Jones and D. Gibb. An improved machine for scouring wool or other fibrous materials. May 26.

11,892. G. R. Smith. Improvements in the method of impregnating wool and other fibrous material with oil, water, and the like, and in apparatus therefor. May 30.

12,115. W. P. Dreaper and H. K. Tompkins. Improvements in the manufacture of artificial silk. June 3.

12,693. S. Bennett. Improvements in the treatment of wood, paper, fabrics, fibres, and like materials impervious and inalterable by moisture and climate and other influences. June 9.

12,897. L. Frankenstein. Improvements in finishing or ornamenting the surface of waterproof fabrics. June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,453. G. C. Dymond.—From La Société Leblois, Piceni, and Co. An improved process for the treatment of textile and other materials, and apparatus therefor. June 20.

14,781. G. Loppens and H. Deswarte. Improvements in and connected with retting or steeping flax and hemp. June 10.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

10,753. J. D. Asquith. Improvements in washing and scouring machines for washing and scouring textile fabrics. May 19.

10,936. A. F. B. Gomes. Improvements in bleaching certain vegetable fibres, more especially those of the urtica family. May 21.

11,828. T. Bradford. See Class I.

12,500. H. Schirp. Improvements in dyeing, washing, and rinsing apparatus for textile goods. Complete Specification. June 8.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

10,842. J. Y. Johnson. Improvements in the preparation of specially heavy ammonia-soda. May 20.

11,160. S. J. Payne. Improvements in obtaining pure alumina, sulphate of alumina, and silica from clays. May 22.

11,326. E. A. Williams and J. F. C. Williams. Improvements in and connected with the manufacture of cyanides. May 23.

12,104. E. Paul. Improvements relating to heating and evaporating brine. June 3.

12,765. J. Milne. Improvements in dissolving and drying phosphates and other substances. June 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,461. T. T. Best, A. Kayd, and J. Brock. Manufacture of chlorine from hydrochloric acid gas. June 17.

14,122. L. Blackwell. Improved means for treating sodium chloride for the production of bleach and other products. June 3.

14,855. A. K. Huntington. Manufacture of hydrocyanic acid. June 10.

15,966. A. Frank and N. Caro. Production of cyanogen compounds, and to the preparation of materials for use therein. May 27.

15,116. J. Pileger. A process for the manufacture of cyanides. June 10.

1896.

10,222. A. von Ral and J. Rosenfeld. Manufacture or production of cyanogen compounds. March 25.

9544. P. Jensen.—From D. Cappelen and H. Cappelen. Process for purifying chlorine gas. June 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

11,522. H. Hayward. Improved system of glazing. May 27.

11,803. J. E. Heath and J. J. Adams. Improvements in or relating to encaustic or similar tiles. May 30.

11,856. H. Cartledge. Improved construction of potters' kilns. Complete Specification. June 1.

12,923. B. A. Knappett and J. F. Charlesworth. Improvements in and relating to shading and colouring glass and other materials. Complete Specification. June 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

10,911. E. Bohm. Production of plaques and similar articles from glass. June 10.

14,454. H. Sturm. Improvements in or connected with apparatus for moulding and drawing ceramic articles. June 17.

15,139. J. E. Bringley. Machinery used in the manufacture of ceramic tiles. June 3.

18,946. A. J. Boulton.—From P. A. J. Gasse. Improvements in or relating to painting or printing upon earthenware. June 17.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

10,815. La Roy Freese Friffin. A new substance especially applicable for making building blocks, slabs, and the like. May 11.

10,841. H. Schneider. Improvements in and relating to the manufacture of paving material and slabs. Complete Specification. May 19.

11,182. W. P. Thompson. Improvements in the method of preparing or treating wood. May 22.

11,212. J. Walker. An improved cement. May 23.

11,682. J. Dixon and A. Reynolds. Improvements in the manufacture of silica bricks, or other highly refractory bricks. May 29.

11,738. H. H. Lake.—From M. Friedheim. Improvements in plastic substances used for building and decorative purposes. May 29.

11,847. J. E. Brindley. Improvements in the manufacture of tiles and quarries. June 1.

12,116. C. Mason. Improvements in the construction of asphaltic pavements. June 3.

12,135. E. Nelson. Improvements in the manufacture of damp-proof material applicable for roofing and for other purposes. June 3.

12,169. A. J. Boulton.—From M. Thys. Improvements in or relating to the manufacture of artificial stone. Complete Specification. June 3.

12,368. W. Owen. An improved manufacture of artificial stone, marble, and the like. June 5.

12,425. L. Mack. Improvement in the proceeding for the production of quick-setting (hardening) mortar of hydraulic gypsum. Complete Specification. June 6.

12,673. C. Marson. An improved cement for plastering on walls or ceilings. June 9.

12,674. C. Marson. An improved material for covering walls or any other article with glass in place of ordinary plastering. June 9.

12,693. S. Bennett. See Class V.

12,889. W. S. Akerman. Improvements in kilns for burning cement, lime, and other materials. June 11.

12,925. J. Russell. Improvements in or relating to blocks suitable for paving and other purposes. June 11.

13,077. H. Wood. Improvements in the preparation of material suitable for use as cement, mortar, or in the manufacture of bricks or blocks for building purposes. June 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7591. W. Jones and H. Jones. Construction of fireproof tile ceilings, partitions, and the like. March 4.

15,283. J. H. Lester and T. E. Thomlinson. Improvements in treating certain waste materials to produce valuable products, such as plaster or stiffening, weighting, and whitening materials therefrom. June 17.

1896.

7032. A. M. Clark.—From The Electric Fireproofing Co. Method and apparatus for treating wood. June 17.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

10,797. A. E. Woodhouse. An improved method of heating steel bands or strips and wires in the processes of hardening and tempering them. May 19.

10,864. B. Politzer. A process for protecting metallic surfaces against chemical and atmospherical action. May 19.

11,048. H. V. Holden. Improvements in casting armour plates and moulds therefor. May 21.

11,241. W. Preston and F. D. Docker. An improved method of preventing iron and steel from rusting. May 23.

11,245. Davies Bros and Co. Lim., E. A. Davies, and S. T. Thomas. Improved means for use in preparing metal sheets for the purpose of galvanising them or otherwise coating them with metal or metallic alloy. May 23.

11,464. S. O. Cowper-Coles. Improvements in and apparatus for the treatment of ores and the separation of the metal or metals therefrom. May 26.

11,465. S. O. Cowper-Coles. Improvements in or connected with means for separating metals from cyanide solutions. May 26.

11,555. D. A. Peniakoff. A process of manufacture of sulphide of aluminium which may or may not be combined with other sulphides (or sulphurets). May 27.

11,717. W. T. Lougher. The Swansea process of covering steel and iron plates with copper sheeting. May 29.

11,718. O. Imray.—From Oberschleische Eisenbahn-Bedarfs Actien Gesellschaft. Basic lining for mixing apparatus for pig iron or steel. May 29.

11,833. R. A. Hadfield. An improved method of toughening or softening manganese steel castings. May 30.

11,839. A. S. R. Robinson. Improved method and machinery or apparatus for extracting gold from crushed ore or material containing it. May 30.

11,848. J. H. Gartrell. Improvements in nickel muffles. June 1.

11,927. J. B. Torres. Improvements in and connected with the reduction, manufacture, and refining of metallic compounds, metals, and alloys. June 2.

12,053. H. R. Angel. Invention for the recovery of zinc up to a high grade from refractory ores. June 2.

12,056. M. L. Ross.—From E. Oberle. Improvements in or relating to the manufacture of refractory metallic threads. Complete Specification. June 2.

12,106. E. Govett. An improved process for treating refractory ores. Complete Specification. June 3.

12,200. A. Trenk. A new or improved process and apparatus for extracting gold. June 4.

12,255. M. B. Zerener. Improvements in or relating to the precipitation of precious metals from their cyanide solutions. June 4.

12,287. W. Van Wart, F. W. Popp, and J. J. Bradley. A certain new or improved metal or admixture of metals. June 5.

12,328. J. C. Bull. Improvements in alloys. June 5.

12,396. E. A. G. Street. Improvements relating to the fusing of chromium and similar metals, and to the manufacture of alloys of such metals. June 6.

12,467. E. A. G. Street. Improvements in the manufacture of alloys. June 6.

12,591. J. B. Torres. Improvements in and connected with the treatment of gold and other ores, and in apparatus therefor. June 9.

12,782. A. Wilson and F. Stubbs. Improvements in carbonising iron and steel. June 10.

12,905. A. Wilson and F. Stubbs. Improvements in hardening armour plates, and in apparatus therefor. June 11.

12,933. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 12.

12,934. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 12.

12,935. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 12.

13,034. J. B. Torres. Improvements in or relating to the extraction of gold and other metals from ores and the like. June 13.

13,111. E. A. G. Street. Improvements in the manufacture of chromium and similar alloys. June 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

10,671. J. C. Bull and R. E. M. Lagerwall. Manufacture of metal alloys. May 27.

11,894. F. S. D. Scott. A gold-saving machine, suitable for the treatment of auriferous sand, alluvial deposits, pulverised ore, and the like. June 3.

12,174. M. Gledhill. Manufacture of steel plates. May 27.

12,455. A. A. Dickson. Improvements in the reduction of metallic sands and pulverised ores. June 17.

13,537. M. Crawford. A process for precipitating gold and other precious metals from solutions used for extracting such metals from their ores. May 27.

15,959. W. L. Wise.—From the Aluminium-Industrie Actien Gesellschaft. Manufacture or production of granulated aluminium and magnesium. June 10.

20,342. R. Maclaren, D. Hughes, and W. Davies. An improvement in apparatus or machinery for coating metal sheets with tin, lead, or other coating metal or alloy of metals. June 17.

23,414. H. Langen. An improved process of separating metals having different melting points. June 3.

23,707. H. S. Blackmore. Process for producing decomposing, converting, or transforming compounds, and reducing metallic compounds so generated to metallic state. June 17.

1896.

7358. H. L. Haas. Process of nickel plating. June 17.

8072. W. T. Whiteman.—From the Compagnie Générale L'Alumine Exploitation des Brevets F. Raynaud. A new or improved process for the treatment of aluminous ores and silicious matters. May 27.

8368. T. Doherty and P. D. Crear. Process of melting iron. May 27.

8946. H. H. Lake.—From Hawkins' Steel Co., Ltd. Purifying and refining iron and apparatus therefor. June 3.

8959. J. D. Grey. Improvements in the method of and apparatus for preparing sheet iron and steel in the manufacture of tin andterne plates, or for galvanising. June 3.

9552. W. P. Thompson.—From W. E. Harris. A new or improved method of and apparatus for treating and annealing sheet metal. June 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

10,718. H. O. Tudor.—Improvements in the manufacture of positive lead electrodes for electrical accumulators. May 18.

10,811. A. J. Marquand and E. Hancock. Improvements in the production of electrodes suitable for secondary batteries. May 19.

11,133. G. Bell and G. W. Bell. Improvements in or connected with apparatus for the electrolytic decomposition of liquids. May 22.

11,212. T. Clark. Improvements in dry cells for galvanic batteries. May 22.

11,338. E. A. G. Street. Improvements in electrodes for electrolytic purposes. May 23.

11,627. E. J. Clabbe, A. W. Southey, and The Electric Motive Power Co., Ltd. Improvements in secondary batteries. May 28.

11,730. W. P. Thompson.—From The Elektra Galvanoplastische Anstalt, H. Teith, and A. Floeck. An improved apparatus for producing galvanic or electrolytic depositions. May 29.

11,732. E. Grunwald. An improved plate for storage batteries. May 29.

12,149. T. J. Holland. Improvements in electrolytic apparatus. June 3.

12,227. L. Epstein. An improvement in secondary voltaic batteries. June 4.

12,250. C. Marsehner. Improved plates for secondary galvanic batteries and a method of producing the same. June 4.

12,312. J. L. Dobell. A new or improved apparatus for electrically smelting metals, and for other purposes. June 5.

12,398. L. Davis. A flexible crystal covering for electrical conductors. June 5.

12,549. D. G. Fitzgerald. Improvements in and in the manufacture of elements for secondary batteries. June 8.

12,983. R. N. Lucas. An improved grid or plate for secondary batteries. June 12.

13,079. W. P. Thompson.—From C. C. Lesenberg. Improvements in or connected with dry batteries and the like. Complete Specification. June 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 10,951. E. Freund. Secondary batteries. June 10.
 11,944. C. Raleigh. Electrolytic deposition of metals and means applicable therefor. June 17.
 14,312. J. Kolb and A. D. A. Lambert. An improved electrolysis apparatus. June 10.
 17,825. W. H. Beck.—From J. Johnson, J. H. Robertson, J. H. Cro-man, and W. H. Jewell. A new or improved porous plate, body, or electrode. May 27.

1896.

719. B. Wilcox.—From La Société L'Accumulateur Fulmen. Improvements in electrical accumulators or storage batteries. June 10.
 1054. D. G. Fitzgerald and W. C. Bersey. Improvements in voltaic batteries. March 25.
 1238. P. A. Newton.—From C. Willms.
 4434. F. King. Improvements in or connected with moulds for use in the manufacture of secondary battery plates or supports. May 27.
 5506. P. F. Ribbe. Improvements in electric accumulators. June 17.
 6981. J. Entwistle.—From S. N. Smith and E. S. Baring-Gould. Electric batteries. June 17.
 8660. F. U. Schneider. Construction of cells for electric accumulators. June 3.
 8695. W. Majert. Electrodes for accumulators. June 3.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

- 10,681. J. Aseough. Improvements in the manufacture of soaps and saponaceous compounds. Complete Specification. May 18.
 10,837. J. Glatz and O. Lugo. Improvements in the production of glycerine and caustic soda from soap lyes. Complete Specification. May 19.
 10,955. C. Drummond. An improved soap composition for washing flannel and the like. May 21.
 11,112. A. Beveridge and J. Pursell. An improved method for the rendering and clarifying of fats. May 22.
 12,073. J. M. C. Grierson. Improvement in soaps. June 3.
 12,166. R. Haddan.—From J. Muss. A dry lubricant and method of producing the same. June 3.
 12,228. F. J. Reinisch and H. Lesser. The manufacture of an improved lubricant. June 4.
 12,953. H. W. Wilson. An improved soap or cleansing agent. Complete Specification. June 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 11,972. J. Peters. A mixing and purifying machine for the manufacture of hot neck grease. June 17.
 14,978. F. N. Turney. Improvements in degreasing and cleansing wool cotton waste, and like materials, and in apparatus therefor. June 17.
 17,239. G. Mitchell. Process and apparatus for separating and otherwise treating oils and like liquids. May 27.
 19,163. R. E. Green. Manufacture of soap. June 10.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

- 10,639. A. Hobbs. Improvements in the manufacture of india-rubber, vulcanite, and other products wherein india-rubber and vulcanite are employed. May 18.
 10,890. T. H. Cobley. Improvements in the manufacture of white lead and other compounds of lead. May 21.
 10,925. T. B. Rawlins. Improvements in anti-fouling and anti-corrosive compositions. May 21.
 11,138. L. Grote. Process for the manufacture of plastic objects from fibrine or fibrous produce. May 22.
 11,210. H. L. Haas. Improvements in polishing compositions. Complete Specification. May 22.
 11,328. D. Urquhart and J. M. Small.—From L. H. Despeissis. Improvements in the manufacture of white lead. May 23.
 11,967. T. Turabull. An improved paint or varnish for damp-resisting and other purposes. June 2.
 12,451. E. Cadoret. An improved plastic and incombustible material, textiloid, to be used as a substitute for india-rubber, celluloid, leather, oil cloth, linoleum, mother-of-pearl, tortoise shell, amber, ivory, and the like, and capable of being moulded, drawn, or made into threads, and in the form of plates, tubes, cylinders, or soft or silky threads resembling silk in appearance. June 6.
 12,958. S. S. Hazeland. Improved method of increasing the elasticity of compressed rubber. June 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

8267. E. W. Barnsley. Improvements in varnish and in the mode of manufacturing the same. May 27.
 8706. W. I. Grylls. Furniture polish. June 3.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

- 10,752. G. E. Wright and W. Monk. Improvements in the method of and machines for degreasing leather. Complete Specification. May 19.
 11,695. K. Moller. Process for hardening chrome dressed leather. Complete Specification. May 29.
 13,096. T. H. Cobley. Treatment of waste substance for the production of leather board and material suitable for being pressed into form for decorative and other purposes, or for use in substitution for leather floorcloth and the like. June 13.

COMPLETE SPECIFICATION ACCEPTED.

1895.

- 17,402. W. Clarke. See Class IV.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

- 10,715. F. W. Saatmann. Improvements in the manufacture of manures. May 18.
 11,716. F. E. Rutland. An improved fertiliser and insecticide. May 29.

COMPLETE SPECIFICATION ACCEPTED.

1895.

- 12,471. H. Mehner. Method for producing nitrides and ammonia. May 27.

XVI.—SUGARS, STARCHES, GUMS, Etc.**APPLICATIONS.**

11,364. J. D. Scott and A. Smith. Improvements in the purification and decolorisation of sugar liquids and syrups. May 26.

11,790. G. Ranson. Process for the complete refining of sugar. May 30.

11,976. J. Werner. Improvements in machines for mixing syrup. Complete Specification. June 2.

11,977. J. Werner. Improvements in machines for cooling syrups. Complete Specification. June 2.

12,447. A. J. Boulton.—From C. M. Higgins. Improvements in or relating to flour and starch pastes and processes of making the same. Complete Specification. June 6.

COMPLETE SPECIFICATION ACCEPTED.

1895.

13,851. W. R. Hutton. Alkaline saccharates. June 3.

XVII.—BREWING, WINES, SPIRITS, Etc.**APPLICATIONS.**

11,164. A. A. Hollander. An improved method of fining and clarifying beer and other fermented liquors by means of diatomaceous earth. May 22.

11,197. J. E. Lang. Improvements in materials for debasing alcohol. May 22.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

3098. A. J. Boulton.—From the Pabst Brewing Co. Improvements in or relating to the collection and utilisation of air-free carbonic acid gas from fermentation, and apparatus therefor. May 27.

9740. H. Gronwald. Process for preventing the escape of carbonic acid and other volatile matters from beer in casks. June 17.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.**APPLICATIONS.****A.—Foods.**

10,921. F. T. Bond. Improvements in the sterilisation of liquids by heat, and in appliances therefor. May 21.

11,060. J. Davidson. Improvements in the manufacture of products from tea. May 21.

11,637. A. J. Vause. An improved process and apparatus for preserving milk and certain other classes of fresh foods by sterilisation. Complete Specification. May 28.

11,878. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brünig. Manufacture of new albuminous compounds. June 1.

12,094. T. Drewery.—From M. Vander Hagen. A substitute for human milk. June 3.

12,150. F. O. Jacob. An improved process for preserving solid organic alimentary substances. Complete Specification. June 3.

12,283. W. Poole. Poole's improved method for the manufacture of bread. June 5.

12,523. T. F. Garrett and W. M. Spouse. Consolidated soups and vegetable juices. Complete Specification. June 8.

B.—Sanitation.

11,236. S. S. Allin. An improved system of sewer ventilation and of utilisation of town refuse. May 23.

11,243. E. W. T. Jones and J. Garfield. Improvements in the purification of sewage and other liquids. May 23.

11,599. G. T. Gillespy. Improvements in the method of and apparatus for mixing liquids and solutions as in treating and purifying water, impure effluents, sewage, and other liquids. May 28.

12,593. R. Johnston. Improvements in and relating to the disposal of sewage. June 9.

C.—Disinfectants.

11,103. W. S. Duff. The manufacture of an improved solid disinfectant. May 21.

11,557. S. Pitt.—From the Société Anonyme de l'Institut. R. Pictet. Process and apparatus for producing gaseous mixtures, mainly formic aldehyde, for disinfecting purposes. Complete Specification. May 27.

11,716. F. E. Rutland. See Class XV.

12,317. H. H. Perkes. An improved disinfecting or deodorising fluid. June 5.

COMPLETE SPECIFICATIONS ACCEPTED.**A.—Foods.**

1895.

11,613. J. H. Hooker. An improved alimentary liquid. May 27.

15,885. E. Kressel. The manufacture of a new alimentary extract. June 17.

1896.

7894. J. H. Kellogg. An improved alimentary product and process of making the same. June 3.

8152. A. Huber. Process for preserving eggs. June 17.

B.—Sanitation.

1895.

13,857. W. Birch. Improved apparatus for separating solid or semi-solid substances from sludge or other fluid or semi-fluid matters. May 27.

14,727. W. Y. Hardie. Hardie's high pressure blast furnace for destroying towns' refuse and the gases and fumes emitted therefrom, also for preparing and utilising the residuals and by-products for commercial purposes. June 10.

C.—Disinfectants.

1896.

8236. C. H. Higbee. An improved composition or material for destroying insects. May 27.

XIX.—PAPER, PASTEBOARD, Etc.**APPLICATIONS.**

11,961. T. C. Cadogan and The O. S. Kelly Co. Improvements in devices for handling and feeding paper stock. Complete Specification. June 2.

12,682. W. A. Kershaw and The Medway Paper Mills Co., Lim. Improvements in and connected with the manufacture of multiple pulp papers. June 9.

12,693. S. Bennett. See Class V.

COMPLETE SPECIFICATION ACCEPTED.

1895.

15,783. The Kellner Partington Paper Pulp Co., Lim.—From N. Pedersen. Improvements in the method of and means for separating knots and other matters from wood fibre in the manufacture of wood pulp. June 17.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

10,689. O. Imay.—From The Farbwerke vormals Meister, Lucius, and Brünig. Manufacture of aromatic aldehydes. May 18.

11,961. J. Turner and Co., Ltd., and P. Schidrowitz and O. Rosenheim. Manufacture of derivatives from piperidine tetra-hydro-quinoline, and their homologues. May 21.

11,975. H. Rasch. Process for the production of tartaric acid from wine lees and argols. May 21.

11,166. J. C. Mewburn.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. A new perfume or odiferous principle and process for the manufacture of the same. Complete Specification. May 22.

11,458. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of pharmaceutical compounds. May 26.

11,538. A. Krefting. An improved method of treating seaweed to obtain valuable products therefrom. Complete Specification. May 27.

12,431. W. P. Thompson.—From Ludwig, Sell, and Co. An improved process for making a compound of good keeping property of salicin, saligenin, glucose, and free hydrochloric acid. June 6.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,949. C. D. Abel.—From A. Fischesser and Co. Manufacture of phthalicines by the action of mixed anhydrides. June 10.

14,886. W. L. Wise.—From The Chemische Fabriken vormals Hoffmann and Schotensack. Improvements in the manufacture or production of nitrile of mandelic acid and mandelic acid. June 10.

1896.

8151. J. C. Mewburn.—From The Chemische Fabriken von Heyden Gesellschaft mit beschränkter Haftung. A new product, being pyrocatechin-anhydro mono acetic acid, and a process or processes of manufacturing the same. June 10.

9521. S. S. Bromhead.—From Gretsch and Mayer. Improvements in the process of making artificial musk. June 10.

XXI.—PHOTOGRAPHY.

APPLICATIONS.

11,262. C. E. Elliott. Improvements in connection with artificial light photography. May 23.

11,306. J. Hauff. Improvements in photographic developing solutions. Complete Specification. May 23.

12,615. J. W. McDonough. Improvements in and relating to colour photography. Complete Specification. June 9.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

10,703. J. House and A. Gillingham. Improvements in the manufacture of gunpowder and in making up charges. May 18.

11,916. R. H. Courtenay. Improvements in rockets for signalling and other purposes, with pyrotechnic compounds for same. May 21.

11,275. T. Hawkins, J. W. Carr, and A. Wellby. An improved smokeless gunpowder to be used for small arms and projectiles, mining and blasting, &c. May 23.

11,716. S. A. Rosenthal.—From S. J. von Romoeki. Improvements in the manufacture of high explosives from nitro-carbohydrates and nitro-hydrocarbons. May 29.

11,842. G. G. André and C. H. Curtis. Improvements in the manufacture of explosives. June 1.

12,220. J. W. Swan. Improvements in or connected with the manufacture of nitro-cellulose or gun-cotton. June 4.

13,065. A. A. Brown. Improvements in and relating to matches. June 13.

COMPLETE SPECIFICATION ACCEPTED.

1895.

8556. J. D. Kendall. Improvements in or connected with detonators and fuses. June 10.

XXIII.—ANALYTICAL CHEMISTRY.

APPLICATION.

10,627. R. Wells. Improvements in and relating to apparatus for testing butter, margarine, and the like, and in the method of employing such apparatus. May 18.



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A collective index, embracing the whole Journal from the Proceedings of the first Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready about the end of the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

The prices will be as follows:—

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LIST OF MEMBERS ELECTED 15th JULY 1896.

- Downan, Prof. Walker, Ohio University, Athens, Ohio, U.S.A., Professor of Chemistry.
 Crowder, Hedley D., The Lodge, Grove Park, Chiswick, W., Student, R.S.M.
 Dick, Frank B., 39, Queen's Road, Richmond, Surrey, Chemist.
 Foreman, Dr. Chas. A., 59, West 51st Street, New York, U.S.A., Professor of Chemistry.
 Harris, H., c/o Straits Trading Co., Ltd., Pulau Brani, Singapore, Metallurgical Chemist.
 Matsui, G., Sakuranomiya, Osaka, Japan, and 76, Gower Street, W.C., Chemical Engineer.
 Mell, D., 47, St. Bees Street, Moss Side, Manchester, Commercial Traveller.
 Plaut, Albert, 128, William Street, New York, U.S.A., Wholesale Druggist.
 Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
 Robinson, D., Montrose and Seneca Avenues, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
 Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
 Serel, Ernest, 93, Avenue d'Orleans, Paris, Engineer.
 Taylor, Edw. R., Cleveland, Ohio, U.S.A., Manufacturing Chemist.

LIST OF MEMBERS ELECTED 23rd JULY 1896.

- Erd, Arthur W., 26, Westbourne Terrace Road, London, W., Works Engineer.
 Magden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.
 Broadhurst, W. Homer, 294, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.
 Clark, Donald, Bairnsdale, Victoria, Australia, Director of School of Mines.
 Hollings, J. Spencer, Brymbo, North Wales, Works Manager.
 Porter, Herbert, 16, Prince's Road, Crumpsall, Manchester, Alkali Inspector.
 Smith, W. Stanley, Nag's Head Brewery, Wrexham, North Wales, Brewer.

CHANGES OF ADDRESS.

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- Forrester, Albert; Journals to Ranipetta, North Arcot, Madras, India.
 Gardiner, H. J., 10 Glasgow; 1, Albert Villas, Northumberland Park, Tottenham, N.
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 Whitaker, Thos., 10 Hampstead; Newlay Hall, near Leeds.

Deaths.

- W. A. Rowell, Newcastle-on-Tyne.
 T. Shimidzu, Woodlawn Avenue, Chicago, Ill., U.S.A. May 8.

PROCEEDINGS OF THE FIFTEENTH ANNUAL MEETING.

PRESIDENT:—THOMAS TYRER.

The Annual General Meeting of the Society was held on Wednesday, 15th July, in the Hall of the Worshipful Company of Carpenters, London Wall, a large number of members being present.

The PRESIDENT took the chair at 10.30 a.m.

The Master of the Carpenters' Company (Mr. EDWARD SMITH), in welcoming the meeting, said that the Company were no strangers to the work in which the Society of Chemical Industry was concerned. They were in the midst of one of the centres of chemical industry, and had an institution of their own at Stratford where they laid themselves out to do some little work for the good of the community. Some years ago, Lord Beaconsfield had stated that an improvement in the value of chemicals indicated an improvement in trade generally. In his then untutored condition the connection between the two things was not

quite clear to him, but he had no doubt it was perfectly understood by the experts before him, and he now began to see that there was much truth and insight in those memorable words. He felt much interest and sympathy in the work of the Society, which in 15 years had opened out a new world of knowledge and progress, and had made a name for future generations to revere. He cordially welcomed the Society to Carpenters' Hall, and hoped that their meeting would be very useful and successful.

The PRESIDENT having thanked Mr. Edward Smith for his kindly welcome.

The GENERAL SECRETARY read the minutes of the last General Meeting, and these, being approved, were signed by the President.

On the motion of Mr. R. Forbes Carpenter, seconded by Mr. D. Herman, Messrs. J. C. Quinn and A. J. Greenaway were appointed scrutators of the ballot for the election of officers.

Mr. E. C. C. STANFORD asked if it were really necessary to go through this form every year, when, as usually happened, there was no contest.

The PRESIDENT replied that while the rules remained as at present it was necessary. It was open to Mr. Stanford, at the proper time, to give notice of amendment in the sense indicated by his question, but in the meantime the rules as they stood must be adhered to.

The GENERAL SECRETARY then read the

REPORT OF COUNCIL.

WE have the honour to report that the number of members on the register is 2,971, as compared with 2,895 at the last Annual Meeting. During the year 237 new members have been elected, as compared with 229 last year; while the loss has been 161, as compared with 160 last year.

During the past session 92 papers have appeared in the Journal, as compared with 85 last year. The excess of revenue over expenditure, as may be seen from the Treasurer's Statement just published, amounted last year to 162*l.* 3*s.*, as compared with 178*l.* 10*s.* 2*d.* the year before. It will be noted that in the statement entrance fees (168*l.*) and life composition fees are placed to capital account, and not to revenue; and the year is debited with 361*l.* 2*s.* spent on the Collective Index. The Publication Committee has given great attention to effecting economies in the production of the Journal, as urged by Dr. T. E. Thorpe in his presidential address last year at Leeds.

The Collective Index is now approaching completion, and will be delivered to members as soon as possible, in two volumes—one containing subject matter and the other authors' names. Arrangements are also already being made to facilitate the production of future Indexes at regular intervals. The number of applications already received for copies at 5*s.* each exceeds 1,400.

The President has visited all the Sections of the Society, including New York, during his year of office, and has in every case been received with the utmost cordiality.

Mr. J. Stanley Muir, late Secretary of the Scottish Section, has accepted an appointment in America, and is succeeded by Mr. Thos. Gray. The following Chairmen of Sections retire this year:—Mr. B. E. R. Newlands, Dr. G. Schack-Sommer, Mr. G. T. France, Mr. C. F. Tetley, and Mr. A. H. Mason. The thanks of the Society are due to them, and the Council hopes to be able to utilise their services in other capacities. The following have been elected to succeed them:—Dr. R. Messel (London), Dr. Chas. A. Kohn (Liverpool), Mr. F. S. Newall (Newcastle), Mr. Thos. Fairley (Yorkshire), and Prof. C. F. Chandler (New York).

The Council has decided to award one of the recently instituted medals at intervals of not less than two years. It is to be given for conspicuous services rendered to applied chemistry by research, discovery, invention, or improvement in processes. The recipient need not be a member of the Society, and may be of any nationality. The first award has been made to Mr. John Glover, inventor of the tower which bears his name, and from which chemical industry has derived enormous benefit. Thanks are due to Sir John Evans and Dr. T. E. Thorpe for their exertions in selecting the design and superintending the production of the medal.

The Society's thanks are due to the members of the various committees, who have so freely given their services to the Journal and other departments, both local and general, of the Society's work. Though the Journal as a rule bears testimony to the work of those engaged upon its production, yet the following instance of otherwise unrecorded work should be mentioned. In August last a sub-committee of the Publication Committee was appointed to consider whether information should be given in the Journal on foreign and colonial chemical patents. Many meetings were held, and, with the assistance of the Editor, trial abstracts of French, German, and United States patents were drafted for the consideration of the Publication Committee. In view of the inherent difficulties of the question and the great cost, the sub-committee had to report unfavourably on the proposal; but the mass of information collected was of such interest that it was ordered to be filed for future use in any enquiries upon the subject.

The proposal to erect a memorial to Pasteur has given the Council an opportunity of testifying its respect towards one who, among the many benefits which he conferred upon his age, rendered great services to industrial chemistry.

Mr. HENRY BRUNSER, in moving the adoption of the Report, said that it appeared to him to be a thoroughly satisfactory one, and he hoped it would commend itself to the meeting.

Mr. F. J. R. CARULLA seconded the motion, which was carried unanimously.

The Hon. Treasurer (Mr. E. RIDER COOK) then formally presented the accounts for the year 1895 (see, *ante*, p. 399). In doing so, he said that just as a nation whose annals were uninteresting was a happy one, so was a society fortunate when its treasurer's report might be taken as read; and that was their position. The published accounts showed a balance of income over expenses of 162*l.* 3*s.*, and that balance would have been larger but for the necessity of providing for the cost of the Collective Index.

Mr. E. C. C. STANFORD moved a hearty vote of thanks to the Hon. Treasurer for his Report and for the great trouble he took in guarding the finances and interests of the Society. He felt sure that those interests were in first-rate hands, and it afforded him the utmost pleasure to move this vote and the adoption of the accounts as published.

Col. D. GAMBLE seconded the motion, which was carried unanimously amid much applause.

PRESIDENT'S ADDRESS.

So much has been recorded about the Society of which, for a brief period longer, I am the official head, especially by my able predecessor, that I do not purpose saying more than that its foundation was fully justified, and the need for its continuance and vigorous sustenance was never greater than at the present time. The report of your Council deals with all necessary points, but I venture to express the opinion that the Council may well consider in what direction the Society's usefulness may be made still more available for the benefit of applied chemistry.

Chambers of Commerce exist in all the large centres of trade and manufacture, and to most, if not all, is attached or affiliated a chemical section or committee. These committees generally have, through their councils, done excellent work in purely trade matters, and in influencing local authorities in regard to river pollution, smoke abatement, and sanitation. Their influence has extended even to Government Departments; and in recent legislation and trade regulation through the Home Office and Board of Trade a restraining and guiding influence has been exerted without, I believe, in any case interfering with the accomplishment of the ends desired by the authorities.

The recent regulations for the safety of workers in works and factories in which chemical operations

are conducted, particularly white lead, bleaching powder, pottery, matches, &c., have been made practical and reasonably free from inconvenience largely by the aid of the committees referred to, and in cases within my knowledge, notably Manchester and London, members of our Society have been most useful in giving practicality to the regulations desired. In London your President, Past Presidents, a Past Chairman and Member of Council, and the Chairman-Elect of the London Section met the Home Office Committee after its conference with alkali manufacturers, and suggested modifications which permitted their application to conditions outside the alkali manufacture. Again, too, a member of your Council and working committees was able to render practical the regulations as to white lead, which otherwise would have been greatly in restraint of trade.

The performance of such beneficial functions relieves our Society from what would otherwise be its imperative duty. Nevertheless, the attention of the Council should ever be directed to the general interests of chemical industry, and its influence maintained as being by no means trivial or insignificant, and as representing, probably, a wider range of interests over a larger area than in any other existing society.

Watchfulness over patent law, trade and merchandise marks, pollution of rivers, noxious vapour, secondary education, endowment of research, &c., is a duty our Council has to some extent performed hitherto, and must, notwithstanding the existence of commercial bodies referred to, continue to perform, chiefly by strengthening the action of these other bodies when possible. In the recent inquiry into the working of the "Sale of Food and Drugs Act," our Society should have had a place. I intend asking the Council to appoint an "Advisory Committee" to watch matters in the general interest.

I think I may venture to give instances of good work done for trade by intelligent pressure brought to bear upon a public department. In 1889, during the time when one of our past presidents, Mr. Howard, was Chairman of the London Chamber of Commerce and I was Chairman of the Chemical Section of that Chamber, it was thought incongruous that British exporters of tinctures and medicinal preparations containing spirit should buy in Germany and export in bond to our colonies. A careful presentation of the matter was made to the excise authorities, with the ultimate result that British manufacturers can now make these spirituous medicinal preparations in the ordinary way with duty-paid spirit, and when exportation is required, give notice to the district supervisor, whose officer inspects the package, takes samples, seals the case, and signs the form. In due course, without locking up the room or premises or needless interference with business, exportation takes place, and in a month or so the manufacturer receives a cheque for the "drawback" or "rebate" at duty rate per proof gallon, with an allowance for waste of 4d., and another 2d. or 4d. as the case may be for additional expense of manufacture, caused by excise regulations, &c.; or because foreign spirit has been used, which bears an extra duty of 4d. per proof gallon as against 10s. duty on British spirit. This drawback amounts to a capital sum returned to British manufacturers by the State. By permission of the Chairman of the Board of Inland Revenue I am enabled to give figures up to the end of 1896 financial year, in tabular form, prepared by the Accountant-General's Department, as below:—

Tinctures—Essences—Perfumed Spirits.

Statement of the number of proof gallons of spirit contained in spirituous preparations exported, and on which "drawback" was allowed in the United Kingdom, in the under-mentioned years:—

Years ended 31st March.	England.	Scotland.	Ireland.	United Kingdom.
	Galls.	Galls.	Galls.	Galls.
1889 (3 mths.)	1,596	..	..	1,596
1890.....	3,715	..	..	3,715
1891.....	13,012	20	..	13,032
1892.....	20,888	7	..	20,895
1893.....	27,410	23	..	27,433
1894.....	11,662	46	..	11,708
1895.....	38,876	..	..	38,876
1896.....	56,963	..	..	56,963
Total	209,832	96	..	209,928

Regulations similar to these were extended to the exportation of essences and perfumes, and I can record that the authorities allow bottles so small as $\frac{1}{2}$ oz. to be exported under drawback. This leads me to say that certain very large perfumers have under "lock and key," so to speak, been allowed to work for exportation under drawback. But the concession referred to is for any who take out the 10l. license and thus get duly registered. These are real concessions on the part of a rightly jealous department of the State. I have no doubt that if it were desired to use undenatured alcohol of any strength to a large manufacturing extent, the Department would be prepared to consider the question with an open mind. But we do not grow or obtain in Britain raw material cheap enough for reasonable competition with Germany or Russia. Land is dear, and the agriculturist has not yet acquired the knowledge for scientifically growing potatoes (or, unhappily, anything else), from which most of the foreign spirit is still made. One point, however, deserves notice: the necessity for alcohol as a solvent in the production of fine chemicals is overrated, and in Britain we are practically confined to one form of "denaturing"—viz., 10 per cent. of wood naphtha—which introduces difficulties, and to another—the further addition of mineral naphtha or petroleum, so as to insure "immiscibility" with water. As it is illegal to "clean" methylated spirit, its use is comparatively limited. I do not think any disadvantage would follow if a wider range of denaturing materials was allowed, as in Germany. I am indebted to Mr. Hugo Lorenz, London, for a synopsis of "denaturing" as practised in Germany.

- A mixture of 2 parts wood naphtha and 1 part of pyridine, which is added in the proportion of 3 to 100 litres.
- For the preparation of alkaloids denaturing is permissible by $\frac{1}{2}$ per cent. of oil of turpentine or 0.025 per cent. of animal oil.
- For extraction of jalap and scammony— $\frac{1}{2}$ per cent. of oil of turpentine.
- For polishers, for polish, and if used in their own manufacture— $\frac{1}{2}$ per cent. of oil of turpentine.
- For the production of aniline dyes—0.025 per cent. of animal oil.
- For chloroform, iodoform, sulphuric ether, anti-pyrin from acetic ether, chloral hydrate—0.025 per cent. of animal oil.
- For collodion, tannic acid, salicylic acid, and salicylates—10 per cent. of sulphuric ether.
- For white lead, acetate of lead—0.25 per cent. animal oil.

Such "denatured" spirit is, however, not saleable, but can only be used after "special permission," which has to be applied for by the manufacturers of the respective articles. Any spirit not "denatured," used as an addition to preparations, such as fruit juices, is allowed on "exportation" in full. As regards duties, a quantity of 45 litres pure alcohol per head of population pays 50 marks per 100 litres of 100 per cent. alcohol. Any larger quantity produced has to pay 70 marks per 100 litres of 100 per cent. alcohol. Thus, there are two qualities as regards excise, which are dealt with "On 'Change'" in Germany.

Alcohol is free of duty for exportation, and if used for technical purposes, such as vinegar-making, for medicinal, scientific, heating, cooking, or polishing purposes, illuminating according to special regulations of the "Bundsrath"; such spirit must be worked off in bond, or "denatured" with the admixtures given above, according to the purpose. By the courtesy of Mr. A. Domeier I have been favoured with copies of the German spirit regulations. These I have had translated, and after comparing the regulations as given in Ham's Year Books, Inland Revenue and Customs, for 1896, placed at my disposal by Mr. E. Grant Hooper, of the Excise Laboratory, have concluded that, broadly, we are not hampered materially, and certainly should not be any more so by our own excise department if we produced alcohol at a price which would enable us to compete with German products. Give us cheap alcohol-producing materials, then! At least beetroot and potatoes, which can be as well grown in Britain as in Germany. I have acquired, for the purpose of this and other inquiries relating to the question of competition such an amount of interesting material that when our London Section has nothing better to listen to I may venture a *résumé* thereof.

But it is pleasant to record such "sweet reasonableness" in departments supposed to be specially oblivious to "commercial" interests. I ought to give credit to the Customs department for the concessions made about 1889-90 as regards "denaturing" tea, of which dust and sweepings and low "drinkable" qualities existed, which because of exigencies of revenue were not available for manufacturers' use. Members of our Society through the Chamber of Commerce obtained these sensible departures in the interests primarily of British manufacturers.

A further instance of "reasonableness" is that the House of Commons, after a short debate, but without a division, adopted the following Government motion:—"That the duty of Customs now payable on cocoa or chocolate, ground, prepared, or in any way manufactured, under the provisions of the Act 42 & 43 Vict. c. 21, s. 3, shall be payable on that product of the cocoa-bean which is generally known as cocoa-butter." As the House of Lords no longer interferes with questions of Ways and Means, the adopted motion has now the force of law, and accordingly a duty of 2*d.* per lb., equal to about 15 per cent. *ad valorem*, will now be levied on cocoa-butter, as it as long been on imported ground, prepared or manufactured cocoa, while the raw cocoa-beans used by British cocoa manufacturers will pay, as heretofore, a duty of 1*d.* per lb.

In Germany there exists a Society for the Protection of the Interests of Chemical Industry. Its functions seem to be a combination of our objects and trade protection. It usefully influences the Government, and has secured for chemical industry an amount of consideration by the State unknown before its existence and quite unknown here. Its statistical reports are abstracted in foreign and

English journals, and the Trade Report of our own Journal has given from time to time such necessary figures as would suggest reference by those interested to the official sources.

There are regulations for factories of soap, explosives, powder, guns or caps, nitroglycerin, fireworks, manure, sulphuric acid, and for cleaning out Gay-Lussac towers, &c., in its official circular.

The decisions of its council are binding upon the members, and the regulations made in co-operation with Trade Associations for control of workmen and technical operations are accepted by State Departments, and in matters relating to accidents, fire, &c., by the insurance companies. Such matters as buildings and internal arrangements, lighting, machinery and gearing, apparatus for working under pressure, elevators, tackle, protective apparatus, as goggles, masks, respirators, and clothing, medical superintendence, date of enforcement, penalties varied suitably for the various manufactures or workers affected, according to the risks, are governed by the society I now refer to. These functions are in some measure effected by our own Home Office and Local Government Board, watched by the Chambers of Commerce and interested bodies. Our Society could and should do something to amend the crude and unscientific classifications of both insurance and railway companies.

A peculiarity of membership is the mode of contribution, which, I fear, would not find favour in Britain. Section 8 of its constitution says: "Every ordinary member shall pay an entrance fee of 20 marks and an annual subscription, the latter in proportion to his 'salary' as manifested in the official statistics relating to accident insurances. The minimum subscription for all 'salaries' up to 20,000 marks shall be 25 marks, beyond that as follows:—

Salary.	Subscription.
Marks.	Marks.
20,000—25,000	25
100,000—200,000	100
200,000—500,000	150
500,000—1,000,000	200
1,000,000—5,000,000	300
5,000,000—750,000	400
Above 750,000	500

"Where there are several ordinary members from one factory, only one is called on to pay the higher subscription corresponding to his 'salary,' the others, as private members, only paying 25 marks."

I think this arrangement would not accord with British notions of a subscription, but the important fact to be noted is the "pulling together" which characterises German technologists, and thus powerfully influences those corporate bodies which may affect trade interests.

Its rules, &c., as made or modified, are duly and officially published after approval by the State Insurance Board. The penalties go to the sick and pension fund. The amount is decided by the Council, by the managers of the sick club, and, failing them, by the police authorities.

I presume it is a matter for congratulation that the scare of three years ago, as to the diseases caused by trades, was found to have little foundation in fact.

Men were not dissolved wholesale in caustic pots, nor boiled in mash tuns or boiling coppers; nor did they fall in alarming numbers into molten metal. Neither did white lead decimate the Tyne, Sheffield, Hull, or even London. Nor did free chlorine or sulphuretted hydrogen in Widnes or elsewhere materially add to the mortality of the locality of the

"White Slaves of England" as a writer, R. H. Sherard, in the current number of Pearson's Magazine suggests. Yet, be it admitted, regulations were rightly called for, if only for the mutual encouragement and protection of the unselfish manufacturer and dependent worker. Incidentally one should remark that the greatest mortality was among the young, due in part to defective food and sanitation, and to hereditary weakness, arising from the too prevalent "drinking" habits of workers. You are well aware that State regulations, as we experience them, have not ruined any industry, nor inflicted more than the most temporary inconvenience or hardship. We have doubtless all heard from time to time how hardly rules and regulations, State or municipal, press upon chemical manufacturers, and the impression exists that the British manufacturer is severely handicapped as compared with his foreign competitor. Our London member, Mr. Oscar Guttman, was so good as to place at my disposal two German books, which proved so interesting that I had them translated by Mr. Chas. Salter and Herr Gustav Naumann.

One is entitled, "The Risks run by Workers in Chemical Manufactures, Protective Measures against Accidents, and Conditions of Labour: A Critical Review of English and German Industrial Conditions, inspired by the English Parliamentary Report, 1893. By Dr. Konrad W. Jurisch, Royal Technical High School, Berlin." The other, "The Factory Acts of Germany; The Licensing of Industrial Concerns in Prussia: A Collection of all the Laws of the Imperial Diet and Prussian Ministerial Decrees and Instructions for Technical Guidance, besides Examples of License Applications and Documents." By Dr. von Rüdiger, Industrial Councillor of the Kingdom of Prussia. I may, prior to considering Dr. Jurisch's book, refer to that of Dr. von Rüdiger.

There are general regulations, and special rules for every industry. Besides those named as purely chemical or allied are, yeast, dye, furriers, tanners, hide strippers, bakeries, mills, aniline, horn, animal oil works, &c. Every condition of security against ill-judged locality, effluvia, and subterranean contamination is defined, and must be carried out to the satisfaction of the police, with power of appeal to the courts. Every piece of apparatus must be provided with protective gearing appliances for safety, such as gauges, manometers, thermometers, &c. Every vessel subjected to pressure, however low, must be certified as having been tested by competent persons. For defects, fines are instituted, and workmen are also involved. They must, subject to fine or summary dismissal, give notice of defects and flaws, and must themselves be co-workers with the authorities. Now, to what serious and interfering extent does any of the State or local control existing to-day in Britain affect any industry? I have compared the regulations for machinery, noxious gases, aniline, white lead, alkali, glass, and general factory rules, and find what would almost lead to a revolution in this country. British industry cannot honestly complain, in comparison of being overdone as yet by interference of this kind.

The defect of English local supervision is the variations in the rules of contiguous local authorities. In London, especially in the east, the building and other regulations of the County Council differ from, and in some cases are opposed to, those of the borough authorities. Sheds or erections which by the latter would be permissible are absolutely refused by the former. An instance occurred in London recently, where, in consequence of the totally unnecessary demand for substantial brick walls, the whole foundations had to be "piled," and there is a forest

buried. No considerations of fire or weight existed in four-fifths of the structure. So as to smoke: in some districts one must scarcely dim the azure sky, but in others one can "go ahead." I do not here discuss which is the better condition of the two economically, but, to say the least, we have, in the matter of economy of fuel, much to learn. This week I have been asked to bring the influence of the Chamber of Commerce, through its Chemical Committee, to bear upon an Act of Parliament—57 & 58 Vict., chapter cciii.—The London Building Act. It is a consolidating Act, but it regulates fees payable to surveyors, among which is 10s. for superintending the erection of every oven, copper, steam boiler, or stove to be used for trade purposes, and not heated by gas. For superintending the fixing of pipes for conveying heated air, water, or steam at high pressure (for each floor of a building in which pipes are fixed), 10s. A manufacturing firm in the colour industry in London complains of such a regulation and fee as unjust, and fairly so. But the regulation itself for security is mild compared with Germany. One difference in favour of Germany exists, however. When the manufacturer is permitted to fit up works he can start, and his license once passed he is safe from constant intrusion and vexatious interference from either neighbours or municipalities.

Broadly speaking, German regulations are far more stringent in every respect, constructional and hygienic, and in no sense are they favourable to German competition with England.

I assume most manufacturing chemists are cognisant of the general contents and conclusion of that British report, 1893, resulting, as I have said, in certain Home Office rules. Eighty pages of deeply interesting excerpts from the English report—perusal of which I commend to the writer in Pearson's *afore-said*—are given in Dr. Jurisch's review. These cover the terms of reference to the Home Office Committee. Dr. Jurisch observes; "Such alterations as would deeply affect the interests of capital and the voluntary action of individuals could only be indicated *as d'sirable*; on the other hand, the adoption of simple precautions having no effect on the manufacture itself could be strongly recommended." "With this," he observes, "every manufacturer would at once agree." "The investigations of the committee are of great technical interest, giving as they do an authoritative report on the actual conditions of English chemical industries." "German industries, notwithstanding variations in the conditions of manufacture, derive benefit therefrom, especially where hygienic and social questions are involved." As you are aware, the British committee was occupied specially with those branches of industry wherein the respiratory organs of the workers were subject to the influence of noxious vapours. Also with those wherein accidents may occur from contact with caustic substances. Industries of necessity involving special precautions were not referred to that committee, since they—for example, the manufactures of arsenic acid, arseniates, artificial manure, cement, explosives—were already more or less regulated. It is pleasing to observe in Dr. Jurisch's work the names of prominent members of our Society, and as pioneers among improvements Past Presidents and officers thereof. I would simply observe that Dr. Jurisch, who himself had experience in English works, makes very interesting comparisons between English and German methods of working, especially in alkali branches. He criticises the obstinacy and perverseness of the British workman in no measured terms—exemplifying this by his refusal to use mufflers or respirators or the "smoke" helmet, even in "bleach" works. I am

afraid most of us have found his independence a vexatious matter. It is evident that the manager of a chemical works, who has to aim at the production of first-class qualitative, quantitative, and economic results, can only devote a fraction of his attention to enforcing regulations of the character referred to. When every appliance and precaution have been provided, more must be left to the intelligence and common sense of the worker. It was a good thing, and without precedent, by the recent English Home Office rules, that in cases of wilful neglect the offending workman became liable to a fine. It may not be without interest to observe that the reduction of hours of labour, notably the introduction in certain chemical industries of the three shifts of eight hours each, has in most cases produced better results than the old. As much money was earned, for better work, with increased interest and care by the workers, and with decided benefit to them physically, as fully proved by the figures given in the report referred to.

Forty-nine pages are devoted by the author to German industries, and it goes almost without saying that the range of regulated industries is greater than in Britain. Considerable divergencies exist between the industries of the two countries, due to the influence of historical, technical, and capital development, geographical and social conditions, and the characteristics of the people. English works are arranged generally for the production of a few articles, and in most industrial and crowded centres, situated closely together, as at Widnes, St. Helens, Newcastle, Glasgow, Birmingham, Manchester, and London, which latter is probably the largest manufacturing place in Britain, including as it does a very considerable number of chemical manufactures which could be classified under our Journal headings. As a consequence, the conditions of labour are fairly uniform.

Dr. Jurisch comments upon the absence of secrecy which results from this proximity of works. He observes that "factories thrive by the proper adjustment of purchase and sale contracts, intelligent management, and prompt application of every improvement brought to notice in such open interchange of experiences." He remarks "that this openness is of great value to the industry as a whole, since the most enterprising may expose themselves to the risk of placing important intellectual and scientific labour at the disposal of less endowed competitors, but they increase their own reputation, influence, and consequently 'pecuniary' position." I am afraid the Doctor's admiration for our "insular" generosity has carried him beyond the limits of agreement with him. Only lately, in a presidential visit to a northern industrial centre, the Chairman of that Section observed to me "that most of the good things had been learned here, and imitated and even improved upon abroad, as a consequence of the generous practice of permitting scientific technologists to inspect, visit, and even work in English works." This quite unnecessary liberality is being discontinued, and not a day too soon. One of the advantages Dr. Jurisch claims for this aggregation of factories is that individual "noxiousness" is lost in the general mass. Herein I think he is wrong, unless inspections under the Alkali and other Acts are a dead letter. Writing of the recently issued 32nd Annual Report of the Chief Inspector under the Alkali Works Regulation Acts, the "Chemical Trade Journal" rightly observes: "It will be seen that in every manufacture the management must ever be in a state of ceaseless activity, and that the public is now protected as it never was before. The report shows how much useful work can be done by a

central authority under which everyone inspected is treated alike. In this respect it contrasts very favourably with the methods employed for the suppression of other nuisances, looked after and inspected by local authorities, every one of which has a code differing from that of its neighbour, and endeavours to ameliorate the conditions by a series of petty prosecutions rather than by the appointment of men who understand their business to see that progress is made in the right direction and at as little cost as possible."

In Germany the factories are widely scattered, from East Prussia and Upper Silesia to the Rhineland and Alsace, from the Bavarian Alps to Bremen, Hamburg, and Stettin. In only a few districts are the factories close together—Upper Silesia, Stassfurt, Elberfeld, Frankfurt-on-Maine, and Mannheim. As most of the German factories were developed from small beginnings, generally for supplying local requirements, they produced a number of articles. One consequence is that processes are not divulged as in Britain. The patent laws have probably had great influence, being stricter in the requirement of novelty than ours, in enforcing secrecy as a means of self-preservation. I may mention it is stated that 25,000 patents are taken annually in America, 13,000 in Germany, and 1,000 in England. Also, that such divergence of opinion exists as to the best Patent Law that our Council has been unable to formulate satisfactory amendments therein. I think the disadvantages of our insular method outweigh those of the secretive method. We may trust to the spread of intelligence, more skilled supervision, and greater scientific management to neutralise the defect of the German system as described by Dr. Jurisch. If my reading is reliable, my inference is the other way, and indeed the present condition of German chemical industry proves it to be so.

"The secretive method produces a dislike to inquiry and interference." But the German manufacturer has enough of it arising from the socio-political legislation so characteristic of that country. There, State regulation prevails in everything. Every manufacturer has to give particulars of rates of wages and hours of labour. Benefit clubs supply complete hygienic statistics; every accident (and rightly) has to be reported. Yet the necessarily voluminous materials so statistically treated, *not* primarily intended for publication, are nevertheless published. "One result of the secretive method is not only the subdivision of factories in Germany, which places difficulties in the way of men changing employments, but has created a different relation between employer and employed." The British workman, even when unable to read or write, has a decided sense of independence which affects materially his daily relations. Oppositely, the German workman, always able to read and write, and altogether better as regards elementary education, is obedient, as a result of military service, to regulations and directions by his superiors, unless spoiled by the social democratic agitator. The relation therefore is more personal; the employer knows more of his workers, and his interest is served by himself instituting social improvements without waiting for legislative compulsion. Nevertheless, German manufacturers *must* promote and institute these benefit societies, which are uniformly regulated by the State through the trade associations. One result of their method is that the more deliberate and careful performance of operations conduces to their efficiency as well as to the greater safety of the workmen. And while the British report of 1893 shows that the accidents and mortality were not greater in chemical factories than in other occupations, the statistics

in Germany show a less proportion of accidents, sickness, and death than in similar occupations in England. The statistics of the two countries are not comparable, being based on different systems; but a perusal of Jurisch's report is very interesting. I give later on one or two from the industries most nearly approaching ours. Most exhaustive reports appear for Germany in Albrecht's "Handbook of Practical Industrial Hygiene," Berlin, 1894; Th. Weyl's "Handbook of Hygiene," Jena; and in the Reports of the Trade Associations of Germany. In these days, when every political party (there used to be only two) bids for the vote of the masses, and social legislation is a matter at least of copious "promises," it may not be amiss to note that the social legislation of the German Empire practically dates from 1883, when the Emperor William I. and Prince Bismarck, with the concurrence of the executive and the Reichstag, instituted laws for insurance against sickness, 1883 to 1886. In 1884 to 1889 was instituted accident insurance. In 1889, Frederick William II. provided the old age and disablement insurance. 1891 saw provisions regulating hours of labour and the employment of women and children. In 1894, prohibitions as to Sunday labour were made (Chemische Industrie, 1894, p. 487; 1895, p. 123). In June 1894 the Eighth Assembly of German Trades Associations in Dresden was satisfied with the social legislation, and appreciated the good influence of the same in pacifying workpeople and producing better relations. The German Society for the Protection of Chemical Industry had drawn up special rules and regulations in conformity with the laws for use in works belonging to its members. The Commissioners of this powerful association and the official factory inspectors travel about and act in concert, and, where necessary, new rules are made and adopted by the trade associations without delay. A valuable report on this matter will be found in the Chemische Industrie, 1894, pp. 269-303; 1895, p. 26. One result is that factory hygiene is in an advanced state, and the percentage of sickness and death much lower than in Britain. I fear the British workman will not take kindly to the system of minute regulations. He thinks he has sense and expects an employer to trust to it. My experience is that, in chemical works at least, one would rather have the sense and a little more obedience. "Oh! leave it to me" is a phrase too often heard at home. Definite results can only be attained by definite means, and this is more likely to result, as indeed it does, when workers, especially officials, are accustomed to obedience. It is convenient to let some do the thinking and let others simply obey orders. Nevertheless, the opinion is steadily gaining ground everywhere that long hours of labour, formerly 12 and 14 per day, now 10 to 12, are subversive of much of the good intended in social legislation. As a consequence the labour rate is proportionately higher, being the same and gradually increasing for the shorter hours. The change here is and must be gradual, since, if shorter hours means higher wages *pro rata*, competition becomes one-sided. There must be time for the introduction of mechanical and other economies tending to equalise commercial conditions.

Thus, equalising forces are everywhere at work which may more speedily than some imagine make the difference in conditions in England and on the Continent less acute than now. Dr. Jurisch observes "that these long hours prevailed among all ranks of assistants—educated or not—until quite recently, and from his own experience points out the destructive effects of such hours upon the "scientific imagination," the tendency being to cripple the intellectual

faculties, through an unnecessary condition of bodily fatigue, practically for the sake of having a condition of military discipline"; and he ventures the remark, "that the habit of whiling away time during the course of the long days of labour, as a consequence of this fatigue, constitutes a 'veritable cancer' in German industries." This will be news to most of us. He quotes the experience of Messrs. Brunner, Mond, and Co. to show the beneficial effect of shorter hours and more continuous and methodical work in making the cost of labour per ton the same with short as long hours. It must be admitted that the conditions of great industries, like soda, iron-smelting, glass, milling works and others, offer special facilities for short shifts. "One chemical manufacturing firm (sulphuric acid) in North Germany sought to impose the following terms on a *chemist* who applied for a situation in 1895. Working hours: daily, 7 to 7; Sunday, 8 to 12. Salary, 1,800 marks (90*l.*), with free lodgings, at a distance from the nearest large town; the engagement to last five years."

It is conceded by all the authorities that I have been able to consult, that in laborious work the British workman has no superior; nor certainly, when he is a man of temperate habits, is he less reliable than the German similarly engaged. But the fact remains that statements in the newspapers and certain magazines have unfortunately a considerable and somewhat humiliating amount of truth.

Personally I prefer the shorter hours, if fitness to employ them fully were gained by a sensible utilisation of the second eight hours in decent recreation or useful occupation for personal improvement. One hopes for an increase in the rational employment of the portion of time free from the obligation of labour. Among these is the use of the evening "continuation school"; but my own observation and official reports go to show that the working classes as a rule do not utilise the privilege. The evils are, that there is no "obligation" to attend, as in the day schools, and the "classes" are chiefly recreative. There is no fear of our doing too little in "recreation." An American professor present, who has crossed the Atlantic many times, observed to me that the change in the matter of recreation and amusement in London was marvellous.

At Meister, Lucius, and Brünning's colour works at Höchst, 6 to 5 are the hours, with the usual half-hour and hour for meals. In those branches where work is continuous the hours are from 6 to 6, 10 per cent. extra being paid for overtime. In addition now to Sundays, the great Church festivals are holidays, and men are given time to record their votes at elections. The technical director is no hard-and-fast 12-hours' man, neither is he blindly in favour of eight hours, and he gives excellent reasons for flexibility in this matter. For the averages in England I refer you to the 1893 report before referred to, but Grandhomme found that the daily wages at the Höchst works ranged from 0.50 to 6 marks (6*d.* to 6*s.*). At the end of 1893, 2,626 workmen were engaged, and the average daily wage per man amounted to 2.86 marks, made up thus:—

Rate per Diem.	No. of Workers.	Percentage of Total.
Marks.		Per Cent.
0.50 to 1.00	34	1.29
1.00 " 1.50	63	2.40
1.50 " 2.00	114	5.48
2.00 " 2.50	372	14.20
2.50 " 3.00	1,136	43.25
3.00 " 3.50	455	17.32
3.50 " 4.00	311	11.84
4.00 " 4.50	99	3.77
4.50 " 5.00	12	0.45
Total.....	2,626	100.00

In addition, premiums are paid by the firm, amounting in 1892 to 22,312 marks among 2,304 workers, making the average earnings per man 1,000 marks 50'1.

Mean Values of Sickness for the Several Departments.

Department.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	Average.
Colour works.....	579	871	1073	873	874	956	778	879	877	1122	872
Alizarin works.....	474	674	779	956	957	1075	878	1177	875	774	874
Acid works.....	474	778	774	677	1077	875	992	974	1176	1176	867
Mechanics.....	871	472	873	672	777	877	779	779	875	872	779
Builders.....	579	577	1171	1075	999	779	771	675	1275	576	878
Labourers.....	674	676	674	772	677	475	876	677	875	679	692
Yardmen.....	675	774	779	679	776	578	971	974	779	679	776
Average.....	579	676	874	876	874	779	874	973	973	873	777

General Hygienic Statistics, as indicated by J. Granthomen.

Year.	Number of Workmen.	Number of Cases of Illness.	Number of Days of Illness.	Percentage of Workmen Sick.	Average Number of Days' Sickness per Case.	Number of Days' Sickness per Head.	Mean.	Mortality.	
								Number of Deaths.	Per 1,000 Men.
1882	1,296	1,103	5,850	78	5'3	4'1	5'77	11	4'2
1883	1,120	1,163	8,716	95	5'9	5'6	7'13	11	7'2
1884	1,542	1,472	12,699	96	8'3	8'6	8'93	14	8'8
1885	1,586	1,525	10,668	78	9'0	7'9	7'13	10	6'5
1886	1,532	1,192	13,150	141	7'7	7'9	8'56	15	8'9
1887	1,679	1,708	11,540	77	7'5	6'3	7'23	16	8'8
1888	1,835	2,051	14,029	107	6'4	7'2	8'10	15	7'8
1889	1,912	2,683	17,291	119	6'4	7'8	8'40	16	8'5
1890	2,213	2,437	20,624	100	8'4	7'4	8'93	17	7'9
1891	2,134	3,095	18,135	144	6'0	7'9	9'10	14	6'1
1892	2,304	..	..	..	..	..	..	..	..

From the Wohlgelegen works (Mannheim) are given figures comparable with those of English works :—

WOHLGELEGEN WORKS (SCHNEIDER AND HASENBACH).

Hours of Labour and Rates of Pay.

Total men, 739; 34'1 per cent. are special-process men. Average wages, 20'37 marks.

	Pyrates Burner-men.	Salt-cake Men.		Soda.		Chlorine Still.		Lime-dressers and Bleach-packers.
		Day.	Night.	Day.	Night.	Day.	Night.	
Sunday.....	10-hours' shift	2 1/2 hours each		10 hours each		10 hours each		6 hours per diem.
Monday.....								
Tuesday.....								
Wednesday.....								
Thursday.....								
Friday.....								
Saturday.....								
Total for the week.....	70	70		70		70		42
Number of men employed.....	8	30		{ Furnace-men 24 Vat-men 7 Salters 4 Finishers 4		4		{ Lime-dressers .. 3 { Bleach-packers.
Weekly wages, Mks. and pf.	18'50	22'50		{ Furnace-men 22'00 Vat-men 24'34 Salters 17'50 Finishers ... 17'50		21'70		28'0

Mortality and Sickness in 1893.

	Vitriol and Salt-cake.	Bleach.	Soda.	Mechanical Department, Cuopage.	Total.
Number of members in Sick Club.....	71	45	54	156	324
Days of sickness.....	1,227	592	229	1,394	3,715
Deaths.....	1	..	..	1	2
Average number of days of sickness per member per annum.....	16'4	11'1	5'4	11'3	11'5
Number of deaths per 1,000 per annum.....	13'3	..	..	6'6	6'17

Of these workmen, 12·03 per cent. were over 40 years of age.

In the Chemische Fabrik Kalk according to a personal communication the following figures were obtained:—

Year.	Number of Workers.			Days of Sickness.		Deaths.	
	Total.	Between 14—16 Years of Age.	Between 16—21 Years of Age.	Total.	Per Head.	Total.	Per 1,000 Workers.
1891	544	15	39	5,014	11·06	4	7·35
1892	551	15	46	6,871	12·47	6	10·89
1893	572	17	54	..	..	6	10·49

The subjoined table, privately communicated, gives particulars of wages at the Chemische Fabrik Kalk, Besch:—

Year.	Number of Workmen.	Total Wages paid per Annum.	Average per Head per Annum.
1891	544	Mks. 546,583	Mks. 1,005
1892	551	542,109	984
1893	572	561,719	982

For convenience, it may be well to give a few British figures for comparison from the report for 1893:—

TYNE AND SCOTLAND DISTRICT.

Average Hours of Labour and Wages per Week.

Name of Works.	Vitriol Burner Men.		Salt Cake, Pot, and Roaster Men.		Revolver Men.		Vat Men.		ALKALI.		Salting.		Carbonating.		Caustic Pots.	
	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
TYNE:																
Allhusen's	56	32 1	56	30 0	56	40 4	84	35 4	..	..	{ Firing Finishing		56	30 6	84	35 0
Hebburn	56	33 10	70	34 6	71	36 0	54	32 0	70	32 6	70	30 6	..	..	..	..
Friar's Goose	56	31 6	71	33 0	70	37 0	58	44 0	70	28 0	70	31 0	..	..	..	..
St. Bede	56	31 6	70	32 6	72	41 7	72	27 0	72	24 0	72	31 0	..	..	..	..
SCOTLAND:																
St. Rollox	56	35 0	70	28 0	70	32 0	56	26 0	70	27 0	70	25 6	..	..	..	..
Eghington	84	34 0	72	38 0	..	..	..	..	..	..	..	..	..	..	..	..
Irvine	84	33 3	70	35 8	70	40 0	54	37 0	..	..	..	..	..	..	72	52 0
Averages	64	33 0	68	33 1	60	37 9	63	33 7	70	28 0	70	29 6	71	50 3		

Name of Works.	BLEACH.		SULPHUR.		Copper	
	Welding Packers.	Dyeing Packers.	Lime Dressers.	Still Men.	Carbonator Men.	Furnace Men.
	Hours.	Wages.	Hours.	Wages.	Hours.	Wages.
	s.	d.	s.	d.	s.	d.
TYNE:						
Allhusen's	42	60 0	..	..	42	50 9
Hebburn	36	60 0	..	..	36	60 0
Friar's Goose	36	55 0	..	..	48	44 0
St. Bede	36	60 0	..	..	36	60 0
SCOTLAND:						
St. Rollox	48	34 0	..	..	54	31 0
Eghington	36	55 0	..	..	48	52 0
Irvine	36	47 0	..	..	36	47 0
Averages	39	53 0	..	..	43	50 3

N.B.—The hours mentioned are the total hours the men are on duty, without deduction for meal times, &c.

Average Death-rate per 1,000 per Annum.

TYNE:	TOTAL.	No statistics.
Alhenson's	11.42	7 years, 1884-90. No separate report on sickness and mortality.
Hebburn		10 years, 1881-90.
Friar's Goose	10.37	8 years, 1884-91.
St. Bees	9.93	
SCOTLAND:		
St. Rollox	5.00	Last 10 years.
Echington	about	No statistics.
Irvine .....	..
Average	9.18	

The "Foresters" sick fund statistics led to an inquiry, and Mr. T. W. Stuart, a past chairman of our Newcastle Section—from a comparison of what are known as Finlaison's figures and those of his firm, Messrs. Chas. Tennant and Co., Hebburn—drew the following:—

First.—The average number of days' sickness per annum per man at the above works was 10.37 days, which is practically the average sickness amongst the working classes of this country, as shown by the returns of friendly societies; whilst the number of days' sickness amongst the men employed in the vitriol, salt-cake, and bleaching-powder departments, was 23 per cent less than this, or only 7.88 days per annum per man.

Secondly.—The annual rate of mortality for the whole society averaged 11.42 per 1,000, and amongst the men in the vitriol, salt-cake, and bleaching-powder departments 12.19 per 1,000, whilst the average rate of mortality experienced by friendly societies is about 12.80 per 1,000.

Finally.—Judging from the figures given, it would appear that in these works—and by analogy in all works where the same operations are carried on: (1) The rate of mortality throughout the works, and in the three departments where gaseous escapes are liable to take place, is slightly less than the average experience of friendly societies; and (2) the number of days' sickness per annum per man in the whole works is about the same as the average of friendly societies, whilst the sickness in the three departments where gaseous escapes are liable to take place is actually about 23 per cent less than the average of the working classes of this country.

The Oldenburger Glashütte paid in 1893, in round numbers, 570,000 marks in wages to 570 men, or an average of 1,000 marks per annum. One at once sees that the price of labour gives advantage to this industry. But the most unsatisfactory and the really deterrent influences in Britain adversely affecting the glass industry is the protective system abroad and, as regards bottles, the influence of the trade unions. It is impossible to get a smooth, even-surfaced, and well blown or moulded bottle for fine chemicals, which in appearance are marred when made and put up by English manufacturers in English glass.

Twenty years ago Britain was the largest producer of plate-glass; then followed France, Belgium, and Germany. Now, mainly in consequence of the action of protective tariffs, the position is reversed, and England takes the last place, the first being taken by the United States of America, followed by Belgium, France, with Germany about equal to England. (See Table III.)

Now, the conclusion I arrive at is that the real cause of the progress and prosperity of German chemical industries in particular is to be found in the superior qualifications of her directing mind. If the workman is more rather than less of a well-drilled machine, then his labour is obviously

more intelligently directed. Enterprises in Britain will occur to you, and in every case their successful continuance and competition is due to the intellectual calibre of the technical directors. I saw it stated in a trade organ the other day that the true reason for the large dividends paid by a well-known "Ammonia-Soda" Company was the possession of "combination" patents and agreements with foreign makers of the same article. This may be true in part, but the chief reason is superior skill, knowledge, and "common sense," and ability in the directing and controlling staff. Germany does not owe her progress alone to protective tariffs; nor to "port bounties," as on sugar, thus crippling—yea, ruining—a great British industry; nor to the superior discipline of her workmen; nor largely to the difference in wages in the great industries; but to her thorough system of education, elementary and secondary.

I quote, by the way, as regards Hungary, from a private correspondent:—

"The Government does all it can to promote industry, and especially chemical industry. It halves the railway rates and gives a free plot of ground to build the 'Fabrik' on, and for five years one is exempt from taxes on chemicals, &c. that are used in the manufacture. It also guarantees to take so much of whatever article (soap, matches, soda, &c.) is manufactured off one's hands at its own risk. Native labour here is also cheap: from 10/-—2s. per day of 12 hours."

In "Nature," 30th April 1896, page 602, occurs this passage: "Virchow visited England four or five years ago, and on his return to Berlin, he reported: 'England is a century before us in sanitation, and a century behind us in education.' This is overstated, but there is too large an element of truth therein nevertheless."

The president of the meeting of Trade Protection Societies lately held at the Westminster Palace Hotel had some unpleasant things to say, and said them. They were none the less unpleasant because they were not new; but I do not accept his pessimistic view to this extent: "Our agriculture is going to the dogs; our iron trade is following it; and what we lose in this branch Germany and Belgium gain." It should be noted that Consul Landenberg, in a recent Foreign Office report, complains bitterly of the state of agriculture in Germany. Also, the 32nd report of the Chief Inspector under the Alkali Act quotes figures as to British manurial products which modify somewhat the colour of the above statement (see this Journal, Class VII., page 541). The tale is told at greater length in the series of remarkable articles contributed to "The New Review," and just published in book form by Heinemann. It is Germany, Germany all through. It says: "Germany is especially beating us in the chemical trade, which Lord Beaconsfield, in what turns out to have been an inspired moment, described as the test of a nation's prosperity. The causes are as clear as the evil. The Germans have more knowledge, and they take more pains, while all our difficulties are evidently of our own making, and would find no panacea in protection. The English drug trade cannot endure the high dock charges of the port of London. We have lost our 'push.' And why? Simply because their chemists are 'ever devising new preparations.'"

High chemistry means "high development"; and it would be well to refer to a paper in our Journal by Dr. H. E. Armstrong (this Journal, 1887, 482—490) on Synthetic Chemistry. We shall all be glad if, even at this distance of time, the worthy professor completes the paper up to date. I make this

suggestion to his intimate friend, Dr. Messel, Chairman-Elect of the London Section.

Protection as a national policy would be a poor remedy, and probably a short way to ruin.

To those to whom Protection is a "hogey," I recommend regarding it as "diaphanous." To those to whom Free Trade is a kind of "fetish," I remind them, we have "free importation," which is not free trade, and in any case "cheapness" for the masses. Possibly there are evils in both, but neither are useful without education.

I refer those interested to the reports of the Science and Art and Education Departments, to the reports of the County Councils, the City and Guilds of London Institute, to the reports of the Board of Technical Education, and to the recent report of the Royal Commission on Secondary Education (1895), to which, by the way, I have referred in my remarks at two of the Sections visited during my year of office. Those remarks may be summed up, in my opinion—(I sincerely hope I may be quite wrong, and shall be delighted to be proved so)—by the phrase "How not to do it."

We will not take pains, and our rivals will. This is the great truth to bear in mind. The danger is that we should be turned aside from the true causes of all these evils and the true remedies for them, as we have already been turned in the case of agriculture.

I may and ought perhaps to note, from a business point of view, that our commercial education, better now than it was—thanks very largely to the Chambers of Commerce, and not least to that of London—is very far from being an effective instrument for "pushing" business. How few know two languages. How few also know anything of commercial geography. Here are some figures from a recent trade journal. It says: "When we have been travelling abroad nothing has struck us so much as the number of German and other continental travellers which are to be met with in every quarter of the globe. English manufacturers have little conception how frequent are the complaints of British consuls abroad that, while other nations employ commercial travellers systematically and in large numbers to push trade, British manufacturers do not. In Switzerland, where a system of licensing commercial travellers exists, comparative statistics have been made accessible, and those for 1894 are published in a recent report by Mr. Herbert, of the British legation in Berne. In 1894, 18,653 permits were issued to commercial travellers, of whom 11,184 were Swiss and 4,469 foreigners. The latter were distributed as follows:—Germans, 3,310; French, 653; Italians, 175; Austrians, 154; Belgian, 70; British, 69; various, 38. On these figures Mr. Herbert remarks that they show the activity of the German trader, and the statistics of the foreign trade of the country, which he gives elsewhere in his report, show that by far the largest share of the imports and exports of Switzerland falls to Germany. Of imports, amounting in value to over 33 millions sterling, Germany sends 29.4 per cent., followed in order by Italy with 17.41, France with 13.35, Austria with 9.72, and Great Britain with 5.22 per cent. The exports amount to nearly 25 millions sterling, of which Germany takes 25 per cent.; Great Britain, 18.93; France, 11.75; the United States, 11.56; Austria, 6.33; and Italy, 6.11 per cent. respectively. It should be added that German trade increased in 1894 in consequence of the Swiss tariff war with France; but the commanding position of Germany in the foreign trade of the Confederation must be in part due to the

3,300 commercial travellers who annually seek to increase it."

There is no doubt we are paying the price of a long, deserved monopoly; our traders have to some extent waxed fat, and do not work so hard as they might. They will wake up soon, when they see where they have got to; and technical schools in England, affiliated to the Universities, as in Germany, will help to keep the traders up to the mark.

I venture to think we have arrived at a critical period in our industrial life. There is, too, a great and increasing dependence upon the function of the State. "Individualism" has hitherto characterised British life, just as now "Industrialism" is characteristic of everything German that is not military. The State executive feels this, and—under the influence of what should be well-considered opinion, but is not—"finkers" with educational and social legislation, handing over to bodies, local, municipal, county, and sectarian, matters of Imperial concern. In a recent discourse Professor Roberts Austen contrasted the readiness with which our Government obtained 18 millions of money on additional armaments, and spent 4,000*l.* only on the endowment of research.

It was reserved for our Honorary Foreign Secretary to devote a magnificent sum to the purchase and equipment of the Davy-Paraday Research Laboratory now attached to the Royal Institution, and equipped, let me say, with the finest "tools," so to speak, obtainable in the world—and so set a brilliant example of unselfish liberality, which, it may be hoped, will in obvious directions be followed by others who, like him, have achieved well-deserved success. As you know, Dr. Mond contributed handsomely to the "Schorlenner" Laboratory in Manchester, said to be the only specially organic laboratory in England. Happy is it in being presided over by the son of our Past President, Dr. W. H. Perkin, F.R.S.

Wherever I went in America evidences of the liberality of successful men were manifest. In Boston, with the noblest public free library in the world, the Massachusetts Technical Institute stands prominent as a finely appointed and equipped institution. In Baltimore the Johns-Hopkins Schools and Hospital boldly point the truth of the blessedness of giving. The Lehigh Valley University is a splendid testimony to foresight, and feeds to-day a district full of magnificent industries and possibilities. It was the sight of one of these—the Bethlehem Iron and Steel Company,—with its overwhelming appliances, and its completed turrets and guns for the United States Government, and its partially constructed ones for that of Russia, that impelled me, on returning to my hotel at night, on reading the telegrams from Britain announcing the strikes on the Clyde and at Belfast, to write a warning and protest to the British press for the benefit of the leaders. No good resulted, so far as I know, and so long as warnings like these, and object lessons such as the newspapers and articles before referred to, go unheeded, so long shall we remain commercially unprogressive. To me it is equally reprehensible whether our educationalists or our leaders of thought or of industry are wrapped in the thick mantle of national conceit. Professor Chandler, who has been elected Chairman of the New York Section of our Society in succession to Mr. A. H. Mason, personally well known to so many in Britain, and Professor Doremus and other American citizens are with us; and I take this opportunity of publicly thanking the New York Section and the members of the American Chemical Society—whose editor, Dr. Hart, of Lafayette College, made your acquaintance last year when over here—for the generous welcome

and hospitality accorded to your President and Honorary Foreign Secretary last year, and I thank our American members for their presence here to-day.

In the United States, educational institutions are divided into two categories—those supported from public funds and those endowed by private liberality.

This applies to schools, high schools, academies, colleges, and universities. In some instances the foundations are of a mixed character.

New York City possesses an extensive system of free schools, and two colleges—one for young men, the other for young women, while the construction of high schools is now being planned.

The college for young men was established in 1817 by a vote of the citizens. Any young man may acquire collegiate training leading to the degrees of A.B. and A.M., or to the degrees of B.S. and M.S. In the latter case, he may pursue one of two courses, in one of which mechanical arts predominate. The study of sciences forms an important part of the curriculum. No student is exempted from the work. It was the only collegiate institution in New York City for many years that insisted on the performance of laboratory work in both physics and chemistry.

Before 1850 no opportunity existed in New York for students to acquire instruction in chemistry by a laboratory practice. Though Torrey, John W. Draver, and Wolcott Gibbs were doing admirable work, they were all hampered by a lack of facilities. The first working laboratory for students was that of the New York Medical College. Here medical students were instructed, and with them the students of the College of Pharmacy, at that time without any laboratory or lecture-room facilities. Special students also received instruction. The establishment of this laboratory was due to the efforts of Professor R. Ogden Doremus, who had been the sole pupil and assistant of Professor John W. Draver for many years. The construction of this laboratory was followed by the establishment of one at the Long Island Medical College in Brooklyn, the Bellevue Hospital Medical College of New York, and the College of the City of New York, with each of which institutions Professor Doremus has been connected.

The latter college is about to secure more commodious quarters, and plans are being drawn for building to accommodate 3,000 students. These buildings will contain thoroughly equipped physical and chemical laboratories. Instruction in these will be imparted to advanced classes, while the youngest class will, as heretofore, have the opportunity of listening to lectures, copiously illustrated by the aid of the best apparatus.

Besides this distinctly free institution, there are several others, some much older, some younger. They owe their existence in a large measure to private munificence, which in two instances has been very lavish of late years.

King's College, now Columbia University, has just laid the corner stones of several magnificent structures, the chief of which—the library building—is the gift of the able and eloquent President, Dr. Seth Low, one of the finest orators in America, and will cost 1,000,000 dols. (250,000*l.*). The physical and chemical departments are to be equipped on the most extensive scale. In these, advanced courses will be given in both scientific and technical education. Beginning in the smallest way as the School of Mines, the chemical department has, under the untiring efforts of Professor C. F. Chandler, been raised to the importance it merits. The donation of 500,000

dols. for a chemical building by Mr. Havemeyer will afford the requisite space, not only for instruction, but for the housing of the Museum of Chemical Technology, probably now the finest in the world.

The New York University is a sister institution that Mr. Havemeyer has not forgotten. The laboratory which bears his name is one of a group of new and imposing buildings which have recently been erected on a site remote from the historic structure in which Draper and Morse made themselves famous by their experiments in science.

There are also several technical schools which form an adjunct to those which have been already mentioned. The Cooper Institute in New York, Stevens' Institute in Hoboken, the Polytechnic and Pratt Institutes in Brooklyn, are among the number.

By a recent enactment, Brooklyn has become a part of greater New York. We shall therefore look for a rapid growth in her institutions of learning. Brooklyn is a city of homes and factories. None appreciate this better than her men of science, and the efforts of those like Professor P. T. Anstett, the President of the New York Section of the American Chemical Society, whose personal kindness to myself I desire to acknowledge, in building up her educational institutions will surely be recognised by all classes of her citizens.

I have received reports from many institutions in the United States of America. From them I note that they are modelling their curricula and equipments upon the best European plans; and it is worthy of note that private munificence is more frequent there than with us or even on the Continent. Dr. Seth Low has enthusiastic praise for our old universities, and he differentiates, I think rightly, between a college and a university. "A college is a place for liberal culture, a university one for specialisation based on liberal culture." This is true certainly of the German high schools and universities, and it should be so in Britain. Therefore the recent movement for a teaching university in London, affiliated to or replacing the London University, is a good thing. Parenthetically I desire to record my opinion that no scheme of education in Britain will be of much practical use which does not provide for the graduated affiliation of the schools, colleges, or high schools and universities. Boys and girls too—"persons"—should be able, with sufficient educational fitness, to pass with ease and economy from the elementary to the secondary, and from the secondary to the high, and from the high schools to the universities, each step being based upon the possession of a sufficiently high standard of knowledge by the student. In Dr. Low's report it was pleasant to see mention of the "John Tyndall" fellowship; and of the "Barnard" medal, in connection with our countrymen, Lord Rayleigh and Professor Ramsay. And, gentlemen, this educational enterprise is going on rapidly and everywhere in the "Britain beyond the sea." Let us beware, and be up and doing before it is too late.

Yet here at home the modern technical schools and colleges so rapidly spreading through the country owe their inception in most cases to the generous impulses of men who felt the great and imperative need of scientific training. Not the least generous donors have been the Companies and Guilds of this ancient City of London, which, besides supporting the City and Guilds of London Institute referred to above, at a cost of 25,000*l.* a year, do liberal work of their own. Primarily trade guilds, the progress of the times and commerce diverted them from their original purposes. Latterly, however, the governing bodies have been inspired with a desire to devote the funds, in some cases magnificently

increased by enhanced values, to educational and public uses. I find, then, that the Corporation of the City of London itself, the Mercers', Grocers', Fishmongers', Merchant Taylors', Salters', Ironmongers', Cloth Workers', Dyers', Armourers', Skimmers', Plasterers', Turners', Leathersellers', Pewterers', Bowyers', Brewers', Cordwainers', Cutlers', Plumbers', Coopers', Painters', Joiners', Fan-makers', Loriners', Shipwrights', Spectacle Makers', Frame Work Knitters', and the Carpenters' have each and all, in various ways and degrees, according to the means at disposal—for the funds of some are very small,—been contributors to some form of general, scientific, or technical education. For instance, the Drapers' Company has practically sustained the People's Palace as an educational institution. The Goldsmiths' Company, whose immediate Prime Warden is our Past President Sir Frederick Abel, has built and maintains that fine institution in the south-east of London—the Goldsmiths' Institute. This Company is pledged to an annual expenditure upon technical education of not less than 11,000*l.* During the past 18 years it has expended for that purpose 200,000*l.*, and all this out of its private funds. The Fishmongers' Company, besides certain sanitary functions, contributes 4,000*l.* a year to the City and Guilds Institute, supports the Plymouth Marine Laboratory and similar objects.

The Carpenters' Company, in whose hall we to-day are welcomed, has done good, practical work, as I can personally testify, in its Institute at Stratford, where, besides baths, recreation ground, and cookery, dress-making, and ambulance classes, it has established handicraft workshops in metal and wood, besides classes in art and science correlated to the handicrafts, where the underlying principles are taught. Its inclusion as an organised science school under the Science and Art Department caused the erection of a very well equipped chemical laboratory and physical lecture rooms. In Great Titchfield Street its technical and handicraft classes are a great success in classes for plumbing, smiths' work, masonry, wood and stone carving, &c., and the Company is obviously doing a great work in true technical education in which they have had the co-operation of the Masons', Joiners', and Painters' Companies. The Company is associated with University and King's Colleges in certain classes. Incidentally, I may mention that now this Company has been made "Trustee" for the administration of no less a sum than 50,000*l.* for a certain benevolent purpose—a mark of confidence worthy of note. The Company has during the last 10 years expended 26,000*l.* upon the Institute referred to, and this year it has spent 3,400*l.* on technical and 700*l.* on general education.

In the towns or cities where our Sections exist institutions of equal importance have been founded, some of them being affiliated to the Durham, Victoria, and Welsh Universities. These have benefited in some cases by the wisdom of the City Companies. When I was the guest of the Society of Dyers and Colourists at Bradford a little while ago, my neighbour was the Prime Warden of the Dyers' Company, by no means a rich company; yet the Bradford Technical College benefits from it in its dyeing department. The Yorkshire College, founded in 1874, where we received the hospitable welcome from our united Section of Leeds and Bradford which we shall long remember, has been materially assisted by the Clothworkers' Company since the commencement of that enterprise in technical education. That Company has taken the whole charge (both of capital and maintenance) for those subjects which it regarded as essential to the industry peculiar to its own origin

and traditions. These subjects are now represented by three departments, viz., textile industries, dyeing, and fine art. The capital outlay in land, buildings, and equipment has been 34,596*l.*, and an annual contribution of 2,300*l.* from the Clothworkers' Company added to the students' fees provides the total cost of maintenance. The Company has evidenced its continued approval by voting, in June of this year, a further capital sum of 10,000*l.* for extensions in the dyeing departments in the form of a research laboratory, and in the papers last Friday we find an additional 5,000*l.*—making 15,000*l.*—that has been voted. This Company has spent during the past 10 years, 1886-95, the sum of 176,791*l.*, or over 17,600*l.* annually, out of its private as distinguished from trust funds. I desire to be understood as making no comparisons between the work of one company or body and another, but merely as illustrating the revived spirit of help for the purposes for which the companies originally existed. A perusal of the published reports will show that large sums have been given; and in addition to special benefactions the City Companies have subscribed through the City and Guilds of London Institute in the past 18 years a sum of 480,000*l.*, of which 150,000*l.* has been expended on buildings and equipment, and the remainder on maintenance, scholarships, prizes, and grants-in-aid. In Nottingham there exist very complete and suitable buildings and equipments, and in chemistry possesses in Dr. Clowes one of our ablest teachers. In Manchester, the Municipal Technical College, now being enlarged, has done splendid work; and in Birmingham, technology takes no second place in Mason's College, the Midland Institute, and the recently opened Municipal Technical Schools.

Now, with the resources of this wealthy country, the practical spirit of its people, the freedom from State interference in any needless degree, and the public spirit of its citizens, we ought to remain very little longer in such a state of backwardness. We should not, if half the exertion and zeal manifested in sport and expended thereon, to the estimated sum of 38,000,000*l.* annually, were devoted wisely to education. With high schools and technical colleges providing instruction in the application of science and art to industrial processes, we are following slowly and tentatively after those in America, as instanced before; the *École Centrale des Arts et Métiers* of Paris, founded in 1829; that of Berlin, founded in 1879; those of Munich, Hanover, Karlsruhe, Stuttgart, and other towns in Germany; of Vienna; and of the *École Polytechnique Fédérale* of Zürich, founded in 1855.

A despatch has just now been received from H. M. Chargé d'Affaires at Berlin, stating that a Government chemical dyeing school has recently been opened at Crefeld, which has cost about 20,000*l.*, exclusive of the machinery and fabrics, which have for the most part been presented by private manufacturers. The school contains laboratories for research and educational purposes, as well as a complete collection of dyeing machinery, and an exhibition showing the result of different processes.

The establishment has been lately visited by the manager of one of the greatest dyeing works in Lyons, who is stated to have expressed the highest opinion of the institution.

It is but necessary that the State shall admit the need for action, define the steps by which that need shall be met, and then resolutely carry them out. It discovers sources of revenue for armaments to protect our trade and manufactures, without which our Empire is a "vain show," but it practically "shuffles the cards" when its citizens are to be

trained for the maintenance and development of that Empire. Mr. Stanford, at Edinburgh, said what my predecessor endorsed and predicted would become "classic," namely, "that we ought to thrust our national head into our national pocket, for it was big enough, if we were not prepared to put our hands there." A member of this Society, a valued friend of mine, says "he regards the payment of 53,000,000/ for our 'defence,' equalling 30s. per head for every person in the kingdom, as an 'insurance fund'; and in like manner money spent on good education is a true 'insurance fund.'" I agree with him; for about 7s. 6/ per head of the population is spent on the "insurance" of education (pp. 517-521). Centralisation may have its defects, but I confess to feeling strongly that the recent Governmental scheme has met a deserved fate. Its policy was allied to a matter—that of aid to denominational schools—which is good and right enough in its way, but which has only a remote relation to the great educational needs of this hour, namely, the preparation of the citizen for earnest and effective competition with our great Continental and even American rivals. I think the power of unlimited and unchecked expenditure by those directing our system of elementary education is most mischievous, and almost the only instance of unchecked expenditure by local bodies. I have given some statistics in tabular form, abstracted by Mr. G. T. Holloway. (See Appendix, p. 520.) The results are disappointing, if not fallacious. I venture the opinion that every child should be taught the elements of knowledge, and taught free of expense; but, because free, therefore economically and effectively. I think that the essentials are reading, writing, arithmetic, elementary geography, first of one's own country, the history of our own land, freehand drawing, drill, one foreign language, and perhaps vocal music. I doubt the wisdom or expediency of going beyond this for 50 per cent. of the children now attending elementary schools, except perhaps one foreign language. Where fitness or desire comes in, secondary education may begin, and State aid and endowment may, and should, largely predominate; but no harm can be done, on the contrary, if at this stage self-help and parental responsibility should be obligatory. Our continuation schools are excellent means of improvement to many otherwise engaged in the day, provided, of course, that they personally desire to improve or learn. Our Polytechnics should be subsidised in all cases by the State, even if a primary condition of such support were the erection of suitable buildings and partial equipment by the locality or by private munificence, and their maintenance placed upon a reliable and practical basis. To my mind one defect of schemes existing and proposed is that their government is handed over to unfit or irresponsible bodies—unfit because either narrow in view or "faddists" in purpose; irresponsible because subject to the caprices of the local taxpayer, and because the "boards" are composed of far too many members. I am aware that to carry out consistently and effectively any connected and systematic scheme of education, primary and secondary, would require a reconstruction of our whole system of local taxation, and a good thing too. But, in my reading of the literature of education and of the report of the Royal Commission on Secondary Education of 1895, I fail to see that the root of the matter is got at, or that any serious attempt is made to devise, much less to carry out, any effective system. What is really recommended therein is a utilisation of existing bodies. The report referred to, p. 326, says: "The 'system' which we desire to see introduced may rather be described as coherence—an

organic relation between different authorities and different kinds of schools which will enable each to work with due regard to the work done by others, and will therewith avoid waste, both of effort and money. Of the loss now incurred through want of such coherence it is impossible to speak too strongly." We may sincerely hope a Bill to meet this will not again be wrecked on a sectarian issue, in my opinion, irrelevant to the need of the hour. As is well known, education in Scotland, and even Ireland, is better than in England. In Scottish high schools the high pass certificate is an entrance to the university. The fees are low and the bursaries or scholarships numerous. Similarly in Belfast and Dublin. Our great rival, Germany, has, we all know, effectively tackled this matter, as she does most things. I must not forget that we are members of the Society of Chemical Industry. Applied or industrial chemistry requires a wide range of knowledge for its successful prosecution, and the classification of subjects in our Journal indicates very fully how wide that is. The engineer and artist, the physicist and mathematician have places; but we naturally and rightly think most of the chemist, and that, too, in the broadest sense. I am not going to discuss who best can manage a factory or most successfully conduct chemical operations, but personally I would entrust the general management to the commercially-minded engineer with a sound knowledge of chemistry than to the profound chemist alone. We have been reminded in every preceding Presidential address of the superiority of German methods. The employment of 40 or 80 chemists here or there has been held up to us as the necessary element of success; so much so has this been the case that there is scarcely a reference to qualifications for management or conduct of business. I strongly commend to your perusal a paper in the June number of our Journal entitled "The Education of Chemists," read by Dr. Duisberg, the technical manager of the great firm of Bayer and Co., of Elberfeld, and discussed in the New York Section. One hundred chemists, all carefully selected from the universities and technical high schools, and 25 engineers similarly selected, are employed.

Dr. Duisberg says "that they give the preference to those who, after passing their examination, have worked one or two years with one of the professors with whom we are associated. When such a chemist joins our service we do not expect—if, for instance, he should enter the department of colours—that he should even know what a colour is. We have found it most satisfactory if we ourselves introduce the young chemist to our special field. For that purpose every chemist must first pass through our experimental dye and print laboratory, so that he learns dyeing and printing and becomes aware of the requirements of the dyers' industry as regards dyeing properties and the fastness of colours. When the chemist has finished in this laboratory he is introduced to the scientific laboratory, the function of which is to keep us and our chemists informed of everything new that appears in the field of our manufactures in literature, patents, &c., and it is at the same time principally the laboratory of inventions. In this our scientific laboratory alone at the present time more than 20 chemists are occupied. Here the young technical chemist must produce a few of the well-known dyestuffs of the greatest variety of groups. He must experiment with those colours of our competitors that we find in the market, and only then he will slowly work and prepare for the field of inorganic chemistry. Inorganic chemistry is, scientifically and technically, the foundation of the whole

structure of applied chemistry, and if the foundation is weak the whole edifice will surely suffer."

I quote a paragraph referring to a statistical enquiry of the author's.

"Of 633 chemists, who find occupation in these 83 works (amongst which are 13 inorganic industries, 11 which manufacture organic intermediate products, 10 wood- and coal-tar distilleries, and nine tar-colour works, as also 10 works for the manufacture of pharmaceutical products and perfumeries), there were 70 per cent. that had passed their examination at a higher German school—the gymnasium or other preparatory school, 45 per cent. that had received their education exclusively at the university, 17 per cent. exclusively at a technical high school, 35 per cent. both at the university and at the technical high school; so that when we divide the two last into equal parts, 65 per cent. had studied at universities and 35 per cent. at technical high schools. Of all these chemists, 68 per cent. had passed the doctor's examination, and only 15 per cent. the diploma examination of the technical high schools, whilst 15 per cent. had passed no examination whatever."

I think our estimate should be affected by the consideration that there are comparatively few industries, possibly none besides the "colour" industry, which demand a "big" scientific staff; most require but two or three, and many only one chemist (I do not mean a "tester"); but there are none which can afford to dispense with "science." Here, on one hand, our critics err, on the other our manufacturers. Nevertheless, I take this opportunity of saying that British "colour" industries have revived considerably, largely owing to a practical recognition of this fact. I would further remind you that the statements as to large profits in German industries are by no means as "rosy" as they are painted.

I am quite sure we shall all agree that accurate knowledge is requisite, based upon accuracy of observation, and, personally, I know no better training for a technical chemist than that for an all-round pharmacist. He must be cleanly in manipulation, accurate in judgment, ready in resource, observant in habit, and prompt in execution. In America, colleges of pharmacy abound, and those I saw in New York, Boston, Philadelphia, and Baltimore are fine and well-equipped institutions. Now, what is our position? First, I believe our elementary training is defective; we "Britishers" succeed often by our instinctive common sense. When our young men go in for the pursuit of science, they generally are in a hurry. Whatever the reason, they rush through the curriculum and go to "business." They want, or their guardians want them, to earn something. Sad economy; when the drudgery is just over, when knowledge and insight have arrived and the learner begins to know the value of his tools; that is the time selected for "nipping the bud." I venture to think that it is then that sacrifice on all sides should be made. The student should restrain his impatience; the guardian, when possible, practice the principle of faith, which is the "substance of things hoped for," and supply the "needful" a little longer. If this were done, and chemists took *five* years in the making instead of *two* (the average) or *three*, the market would be less crowded and the price obtainable for the "better article" much higher. I know a gentleman of considerable ability who asks "what future is there for a chemist?" I fancy none!—for him. He lacks faith in himself.

Depend upon it, in the process of "further study," none but enthusiasts would abide. I honestly believe, gentlemen, that the fault is not in the ability of our professors and teachers—think of

their names!—nor in the equipment of our institutions, although much improvement is possible and desirable; nor even in the natural ability of the students (an eminent professor tells me he has ready 18 or 19 good men, 12 of whom certainly are equal to any turned out of continental laboratories, yet no one wants or asks for such men); but in the inability of the capitalist, broadly speaking, to discern aright true fields for enterprise. I refer not of course to the enterprising citizens of Britain who made her early successes in every field of industrial chemistry, and who still hold high and eminent positions, and among whom some of my predecessors in this honourable office stand out boldly, second to none in their special fields of industry. How many of our young men with advantages in the way of leisure, money, and friends are there preparing to continue the good work of their fathers, and retain the prestige of the names so hardly won in the struggle for existence. Nor do I refer to the difficulties which our fiscal system, our patent laws, or railway and dock administration place in the way of British industrial enterprise. But I do think—and I take entire responsibility for the utterance—that the commercial and scientific education of our business men is such that the capitalist does not "know a bad thing when he sees it." Hence the yards of advertisement about "nothing," the flotation of equally "nebulous" ventures, and the consequent disappointment and discouragement to British industrial and especially chemical enterprises. Dr. Duisberg referred in his paper to the fact of an inquiry as to the examination of technical chemists by the State. I have quoted his figures; but Mr. Robert L. Mond reminded me a little while ago of the results of inquiries as to the kind of men who were technical chemists in Germany which had appeared in the "Chemische Industrie" under the title of the "Education of Industrial Chemists." In Vol. 19, No. 1, 1896, pages 1 to 4, appears an article by Drs. Hempel and Otto N. Witt, to which I refer you for details. Replying to a series of questions put to 187 employers, 123 of them referred to 932 chemists. It appeared that 390, or one-third, were purely university men, 532 being wholly or in part trained at technical high schools, 338 among them having been educated solely at these schools. The estimate of the students themselves as to the respective value of a high school diploma and a university degree is shown by the fact that only 125 of the 338 high school students (or 37 per cent.) went in for a diploma examination, whereas 307 (or 80 per cent.) of the university students went in for the "degree" examination. This evidence of the value set upon a degree is further strengthened by the circumstance that 314 of the high school students afterwards proceeded to take up the university degree, that is, 60 per cent. of the total. It would appear that this State examination of chemists had special reference to a State decision to submit to examination chemists taking up foodstuffs for their speciality. Hempel and Witt pertinently ask "whether it would not be advisable to press for a similar examination in order to stamp the acquirements of a chemist with the authority of State recognition." Let the Institute of Chemistry mark, learn, and inwardly digest this matter. Evidence of training is what it demands of its latest Fellows, and it is evidence of scientific training that we "industrials" want, not only for ourselves, but for those who must in any progressive relation be our allies, counsellors, and assistants. In a word, we may afford to rely largely upon our instincts as "Britishers" for public safety and polity, and the management of our

own affairs. But we cannot fail to note that the legal obligation (so intensely specialised in Germany) to avoid offence to neighbours has been productive of enormous direct financial and economic good, and the scientific aid we need here can be had if we only demand the right article and give the right price. I cannot conclude this reference to training without intimating that the conditions of scientific employment in Germany differ from our own. Here usually a man comes and goes. There, he stays—he must; and whatever his industrial success, the improvements belong to his employers, and rightly he, by deliberate agreement, shares in the profits thereof so long as employed. The need exists for sound men and surely can be satisfied. Let citizens, institutions, professors, and students rouse themselves to supply this great demand, and speedily the State and public bodies must listen to the "call," and here, as in Germany, protect our industries, not by tariffs possibly (undoubtedly the glass, sugar, and other industries owe their present position to the protective system prevailing on the Continent), but by a sound system of education—education even in economies for the leaders of our workmen. The two great obstacles to the development of British industries are, the demands for prohibitive scales of wages, especially in "constructional" fuel supply, and the examinational part of our educational system, which is bad, but there is considerable difficulty in eliminating it altogether. There is an art in "examining"; indeed, as Professor P. T. Austen, of Brooklyn, U.S.A., puts it, "it is part of the science of pedagogy, which so few understand." Few really can "examine," as we know, and the often repeated strictures of Professor H. E. Armstrong are deserved. He says, in a recent address:—

"The students who follow such courses become mere prigs—some few, it is found, can retail more or less of the information imparted to them to an examiner—provided always that he lose no time in interrogating them—but they cannot make any effective use of it. Many, doubtless, are entertained, if not interested, at the time; a few, perhaps, are attracted, but if so, they start with entirely false conceptions of the aims and methods of science, and rarely recover their proper mental balance. The injury that is done when those who have been instructed in such a manner themselves seek to teach is incalculable.

"As have many others, I have long protested against the system, and it is fairly generally admitted to be a wrong one. But yet we do little to get 'forrarder,' the fact being that the deadening effect of our methods of training is such that we teachers too often go forth to our work mere machines, with the spirit of inquiry and adventure crushed out of us—slavish imitators of a long series of misguided predecessors, ever taught to follow with unquestioning obedience. And yet we English pride ourselves on our individuality, forsooth!

"What is the result? Our nation is gradually being beaten in every quarter, in every field. When this occurs in athletics, 'Punch' and the public not only note the fact, but the former advises as to the one and only remedy against future failure—for this week, speaking as Brother Jonathan, he remarks, 'Say, John, you'd better go into training again'; and the lesson will be taken to heart. But in the case of the matters which I have been discussing, there is no question of going into training again; we have not yet even begun to train properly. The nation does not know enough to understand how faulty is our system, and how absolutely we court failure by adhering to the old 'classical' methods,

which experience shows to be unfit methods of teaching classics even. And when, half perceiving this, we seek to change, we jump straight from the frying-pan of blank ignorance into the fire of technical education, where, as a rule, we find but our old foe—the dogmatic teacher—in thin disguise, and consequently are no better off."

The two professors are at one in their belief in the value of what they call manual and sense training; the cultivation of the power of correct observation and proper inference therefrom being the great problem of education. An excellent illustration of this is furnished in the paper read by our Honorary Foreign Secretary in New York, in November last, on "The History of an Invention," where is described how a striking discovery was made, merely as a consequence of systematic observation and consequent research (see *Journal*, 1895, 945–946). I commend to you a perusal of Dr. Armstrong's letters in "Nature" and elsewhere; his address at Toynbee Hall, in October 1895, on "The Useful Study of Science," wherein he regards America as a serious rival; and, still more, his contribution to the memorial lectures on Hofmann in the June number of the *Journal of the Chemical Society*. Everyone should read in the same number the contributions of your Past Presidents Abel and Perkin, the latter of whom to-day maintains his active and keen interest in scientific research, and quotes the following from the "North American Review":—

"It is fair to hold that the country that has the best chemists will, in the long run, be the most prosperous and the most powerful. It will have at the lowest cost the best food, the best manufactured materials, the fewest wastes and unutilised forms of matters, the best guns, the strongest explosives, the most resistant armour. Its inhabitants will make the best use of their country's resources; they will be the most healthy, the most free from disease; they will oppose the least resistance to favourable evolution; they will be the most thrifty and the least dependent on other nations. The education of its people in chemistry and the physical sciences is the most paying investment that a country can make. Competition to-day between nations is essentially a competition in the science and applications of chemistry."

Armstrong says: "Hofmann consistently taught this doctrine when he came among us—but to no purpose; his countrymen were wiser and have proved its truth to demonstration, and the victories won in the fields of pure and applied chemistry are rapidly leading them to introduce scientific method into the conduct of their affairs generally. Shall we ever decline to pay heed to one whom we always admired and whom we venerate?"

I suppose it is "rank heresy" to say so, but the Exhibitions of 1851 and 1892 are largely responsible for subsequent competition. We stood admiring ourselves, while our competitors imitated and improved.

Gentlemen, I must conclude some time, and I may as well do so now. An apology for an address so meagre in technical value and on so sorry a subject as our national deficiencies, is perhaps due to you; but as regards any remarks on the newest developments of technical chemistry, is there not some branch or detail that each knows best? I may be excused from telling the alkali maker what he knows already, and better than I can, although I think the figures given in the tabular Appendix to this paper may be of use. You all have access to the 33rd and latest report referred to above, of the Chief Inspector, Mr. R. Forbes Carpenter, late Chairman of the Manchester Section, and nominated again to

your Council, and there can see that in quantity of salt decomposed in Britain in the alkali processes we have not decreased. In superphosphate we are not behind Germany. The increase in national wealth from sulphate of ammonia he estimates at 1½ millions yearly, and mainly from sources hitherto neglected, and all through there is evidence of increased business as a result of increased scientific economy, and this will continue. (See this Journal, p. 541.)

Reference is made in the above report to electrical processes, and our Journal reports sectional papers of great interest and abstracts in the Journal and Patent literature. One paper may be mentioned—that on the Hargreaves-Bird process, the efficiency of which is given from actual observations as greatly increased since the paper was read. An interesting comparison of this, the Richardson-Holland, and Castner-Kellner processes is given in the "Revue Industrielle," 1197, XXVII. year, No. 1, 7th April, 25—96, and references thereto in "L'Electricien," XI., Nos. 276—282, 1896. Great interest attaches to the production of cyanides, electrically and otherwise. Also to the production of metallic carbides. The energy of M. Henri Moissan in this direction is extraordinary. The contributions of Professor Clowes, in the Nottingham Section, on the explosibility of gaseous mixtures, demand more than a passing notice. The Yorkshire and Liverpool Sections have contributed, as heretofore, exceedingly useful and practical papers. I think Mr. Douglas Herman's suggestion to have ready at hand a bottle of compressed oxygen, for use when "gassing," or even presumptive death, in works has occurred, is most important.

Of the developments of electrolytic processes much can be said and doubtless will be said in the near future, and our Sections should not, so far as I can see, be unable to render an excellent account of their proceedings in the session 1896-97. But one ought not to forget that "natural" sources of water power are denied us. We have no Niagara, nor are we in Sweden or Schaffhausen. We therefore can only hope to compete by a careful study of all the conditions—scientific, topographical, mechanical, and commercial.

I may further be excused from referring to current technology, since Dr. Mond, as President of the Chemical Section of the British Association's meeting at Liverpool in September, will doubtless cover the field in his usual able and exhaustive manner.

I might refer to the inquiry into the flash-point of petroleum which has been discussed again in the Scottish Section, and which a Committee of the House of Commons is now examining most exhaustively. I should like to observe that the thoroughness with which the Petroleum Committee is doing its work, makes one regret that the labours of the Education Committee were not equally thorough.

I cannot conclude without a reference to the work of the Council and its Committees. My predecessor, Mr. Stanford, referred gracefully to their labours in his address in Edinburgh. But I, who have been co-worker with the same men for 14 years, regard with surprise and pride the fact that the regular attendance, or postal criticism in lieu thereof by those who cannot attend, and painstaking enthusiasm, characterise their work now as at first. Surely a journal and a society which prompt such service from men whose "time is money" is worthy of support, and I sincerely hope the annual leakage of members will decrease and that the zenith of our attractiveness has not arrived, as postulated by my immediate predecessor. In the condition of our industries there is to-day greater need than ever for such a journal as ours, and the number of our members should rise rapidly to at least 5,000.

Here are some of the proof-sheets of the Collective Index promised for to-day by the indefatigable indexer, Mr. F. W. Renaut. In my opinion he has done his work nobly and well. The annual indexes were wanting in symmetrical arrangement and uniformity of classification, especially the first five years, with which another indexer had to do, so that practically a re-indexing of the whole was necessary. There are 80,000 references, and these require revision three times before the process of "alphabetisation" is completed. The Collective Index will, as soon as possible, be in the hands of those who have paid for it, and I trust very many more will require it; for no chemist, technologist, patent agent, or professor will be able to afford its absence from his reference shelf. I venture to anticipate your opinion, and to express the Society's thanks to Mr. Renaut for the way in which the work has been done. During my Presidency my efforts to justify your election of me a year ago in succession to the great men preceding me have been seconded most heartily and warmly by your Editor, Mr. Watson Smith, and the General Secretary and Sub-Editor, Mr. Cresswell. More loyal servants no society ever had. To my colleagues on the Council and Committees I say, with gratitude for their constant and courteous support, "Thank you."

I have an honour placed upon me as your President to-day, namely, to hand to Mr. John Glover, of Newcastle-on-Tyne, the medal which your Council has awarded to him for conspicuous service to applied chemistry. Being the first medal so awarded, I am in a unique position, and I appreciate the distinguished honour. John Glover's "Tower" is, or should be, known to everyone. Every text-book describes it. Nearly every sulphuric acid works has it and the Gay-Lussac tower as part of the instalment. A historical account of the tower itself, its utility and functions, is given in Lunge's classical work on "Sulphuric Acid and Alkali," Vol. I., page 421 *et seq.*, and is instructive reading to-day. Our illustrious member, Dr. Ferdinand Hurter, kindly writes the following interesting note and apologises for his absence on this occasion:—

"*Concentration.*—Mr. Glover built his first tower in 1859. At that time most of the English alkali works concentrated such of the sulphuric acid as needed concentration in badly built lead pans, the fumes from which added greatly to the discomfort of their neighbours.

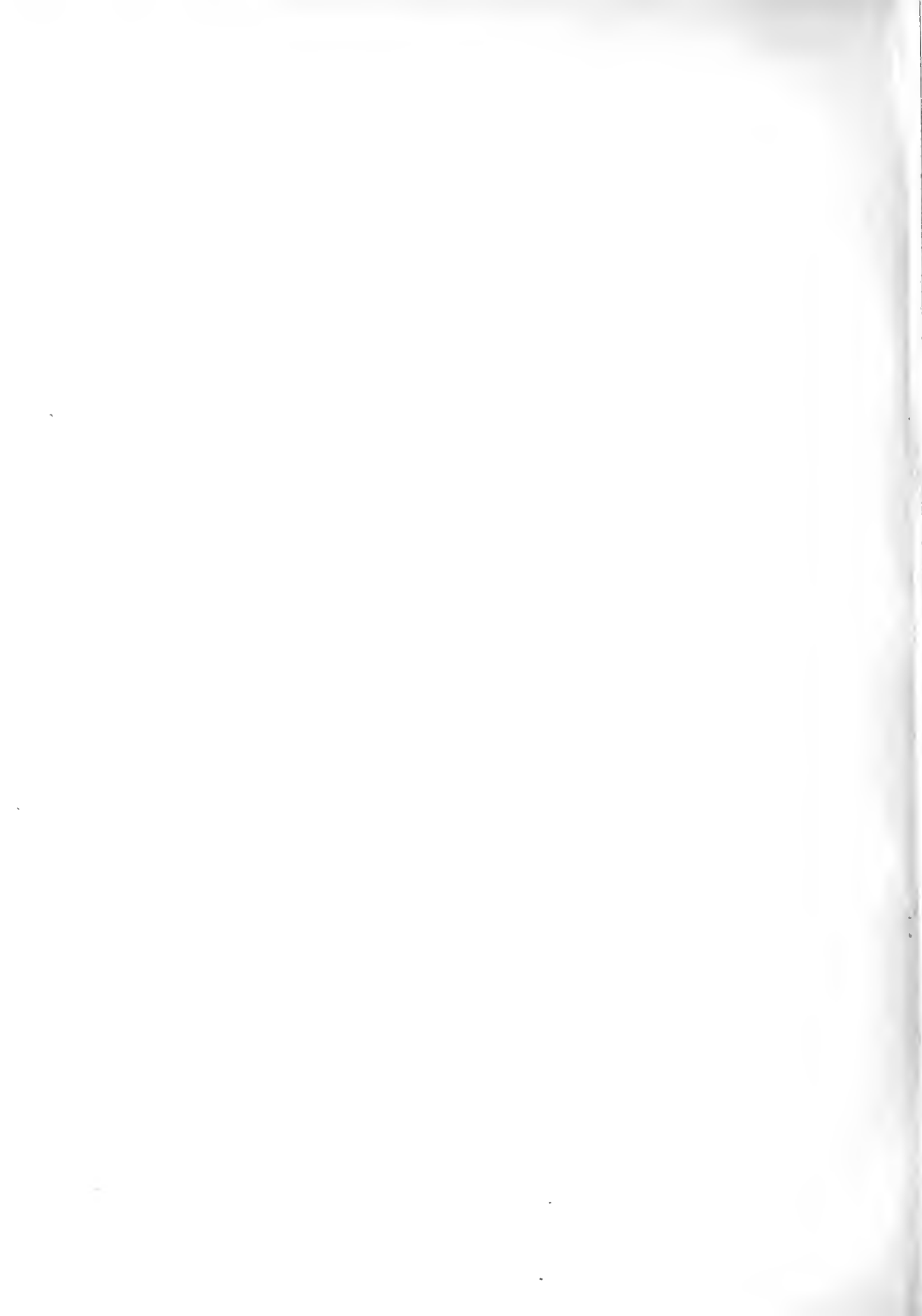
"*Denitration.*—Very few works possessed any apparatus for the recovery of the nitrogen compounds. When I came to Lancashire (1867) there were no works in Widnes which recovered any of the nitrogen compounds.

"In 1863, Mr. Gossage stated that for 1½ tons of Irish pyrites, containing about 30 per cent. of sulphur, 1 cwt. of nitrate of soda was required. He estimated the output of soda as about 200,000 tons per year, and these would require 10,000 tons of nitrate of soda, then valued at 12*l.* per ton = 120,000*l.* For the same production we should require to-day only 2,000 tons of nitrate, so that the improvement in the manufacture of sulphuric acid represents, as compared with those days, and on the production of those days, a saving of nearly 90,000*l.* per annum. When we remember that a very large amount of sulphuric acid is consumed in the manufacture of artificial manures, we might almost double the sum of money which might have been saved annually in those days by a rapid introduction of the Glover tower. It is true that not the whole of this saving is directly due to the work of the Glover tower, but indirectly the Glover tower has been the means of that saving, and



JOHN GLOVER,

BORN 1817.



without it the saving would not have been accomplished. In 1867 there existed no Glover towers in Widnes, and the consumption of nitrate of soda per 100 of sulphur burnt was about 14 to 15. I am proud to say that the first Glover tower introduced in Lancashire started work on the 29th December 1863 under my superintendence, the second on the 21st May 1869, and the third in July 1870, in the works of Gaskell, Deacon, and Co., where I was then chemist. The introduction of the Glover tower alone diminished the nitre consumption from 14 per cent. to 10 per cent. on the sulphur burnt. This is about one-third of the total saving finally accomplished. But the one immediate and great advantage was the possibility of concentrating the chamber acid in this tower, so that the costly lead pans could be dispensed with. The last of these pans vanished at Gaskell, Deacon, and Co.'s works in 1871. The power of concentrating sulphuric acid to 140 and 150° Tw. with ease, is in my opinion the great progress which the Glover tower introduced into the alkali trade. Up to that time (1869) there were not only no Glover towers, but there were no Gay-Lussac towers in the Lancashire works. While it was well known that this apparatus could recover nearly the whole of the nitre otherwise lost with the exit gases of the chambers, it was also known that this saving could only be accomplished by means of large quantities of concentrated sulphuric acid, corresponding in amount nearly to the daily production of the works, and that consequently the employment of the Gay-Lussac tower necessitated fully double the concentrating plant, which was very costly for repairs and fuel. The facility with which the Glover tower permitted the concentration of the sulphuric acid for use in the Gay-Lussac, and at the same time the denitration of the Gay-Lussac acid, soon led to the rapid adoption of the Gay-Lussac tower in every works. Thus the Glover tower, being the concentrator and denitrator, enabled manufacturers to avail themselves of the Gay-Lussac tower, and in this sense we may ascribe the whole of the saving of nitrate of soda to the invention of Mr. Glover. In recent years many observations have confirmed the fact that the concentration of the vitriol in the Glover tower is not so much due to evaporation as to actual formation of a large quantity of sulphuric acid within the tower. Isolated instances have come to my notice where nearly 50 per cent. of the sulphurous acid passing into the Glover tower have been converted into sulphuric acid within the tower, and in most towers which I have examined at least 16 per cent. of the sulphurous acid is arrested as sulphuric acid. Thus the Glover tower has given hints as to further improvements in the manufacture of sulphuric acid, the development of which is rapidly pushed forward. Thus the invention of Mr. Glover has marked an epoch in the development of the manufacture of sulphuric acid; and when we remember that the pyrites consumed in this country for the production of sulphuric acid, for alkali, manure, and sulphate of ammonia, may be roughly taken as approaching a million tons per year, and that to-day no sulphuric acid works is without a Glover and Gay-Lussac tower, the national importance of Mr. Glover's invention will be apparent to all, even to those who are accustomed to no other measure of value than £ s. d. The saving that tower has accomplished, if we compared present-day consumption of nitre with the former practice, must be valued to this country alone as at least 300,000*l.* per year. The

nitrate of soda thus saved has benefited our farmers, and, considering not only Great Britain but the world, the Glover tower must, by diminishing the nitre consumption for sulphuric acid by an enormous quantity per year, have contributed towards the reduction of the price of nitre, which has fallen from 12*l.* in 1863 to 8*l.* in 1895. But beside these very palpable and highly important results which have been accomplished by Mr. Glover's invention, there is a smaller but equally lasting result achieved. The noteworthy discussions by our eminent men of the working of that tower have been the means of greatly improving the analytical methods employed in investigations connected with the manufacture of sulphuric acid, and our knowledge of the working of the process has been greatly advanced by these discussions and the investigations to which they led."

In presenting the medal to Mr. Glover, the President said: Honour to whom honour is due; and if it be any satisfaction to Mr. Glover—who took no patent and had no great reward—to receive this medal in recognition by the Society of Chemical Industry of his great and valuable services to a Fundamental Chemical Industry—it is no less a satisfaction to the members of the Society, whose mouthpiece I am to-day, to hand it to him. We wish Mr. Glover continued length of days in happy retirement, with the satisfaction that he has contributed beyond the ordinary to the well-being and prosperity of his fellows.

Mr. JOHN GLOVER, in reply, said it was difficult for him to express his feelings on receiving this tangible proof of the estimation in which the Society held his work. It was, indeed, a red-letter day in his life. He would not describe the principles embodied in his apparatus, for they were well known to the members, and had been amply described in the writings of Lange and Hurter. He would merely say that the discovery or invention of his tower was by no means accidental. In 1847 or 1848, the idea occurred to him that there would be a great saving of expense and material if he could succeed in breaking up the affinity between the sulphurous and nitrous compounds in Gay-Lussac acid without going through the operations of cooling and re-heating which were then performed. His first experiment was simply to heat the compound, and the result was to confer on the sulphuric acid a greater power of holding the nitre, not a particle of which was evolved. Then the idea of a deoxidising atmosphere occurred to him, and that idea was growing in his mind for fully ten years, during which time he was devoting his whole attention to the erection of a vitriol work for the late Mr. Hugh Lee Pattinson and the working out of that gentleman's patented process. Then he returned to his own experiments, and by using a deoxidising atmosphere succeeded in dissociating the sulphurous and nitrous compounds of the Gay-Lussac acid. The experiments were on little more than a laboratory scale, but they proved the practicability of his idea, and the Glover tower was the result. When it came to be worked on a manufacturing scale, his apparatus proved to have the additional power referred to by Dr. Hurter of condensing, not only the Gay-Lussac acid, but the whole of the acid made in the process. That fact greatly enhanced the value of the invention, which was rapidly taken into use by the trade, not only in England, but on the Continent, wherever sulphuric acid was made. He would not detain them by any further references to his work, but would simply say to the Council and to every member of the Society that he thanked them sincerely for their recognition of any services he had rendered to the science of chemistry and to the technical application of that science to the common purposes of life. He derived great pleasure also from the thought that his name should be coupled with that of one so eminent in the science of chemistry as Gay-Lussac.

APPENDICES TO

TABLE I.—UNITED KINGDOM.

Articles.			1882.	1883.	1884.	1885.	1886.		
Alkali	Quantity	Cwt.	6,735,800	6,917,000	6,562,400	6,661,800	6,242,800		
	Value ...	£	2,667,806	2,124,962	2,089,609	1,955,790	1,788,078		
Caoutchouc, manufactures of.....	Value ...	£	969,529	1,070,965	1,004,730	910,763	971,108		
Chemical products and preparations:—									
Dyestuffs.....	Value ...	£	767,015	730,475	689,230	486,757	483,466		
Sulphate of copper.....	Value ...	£	1,592,678	1,369,778	1,403,794	1,448,817	1,492,574		
Unenumerated									
Products of coal, &c., including naphtha, paraffin, paraffin oil, and petroleum	Value ...	£	781,412	1,017,767	1,068,900	857,243	622,308		
Manure, including sulphate of ammonia and other chemical manures.....	Quantity	Tons	..	..	Value only shown prior to 1889.		
	Value ...	£	2,037,353	2,162,028	2,101,561	1,726,693	1,614,643		
Medicines, drugs, and medicinal preparations .	Value ...	£	965,203	922,649	893,184	842,725	811,213		
Iron:—									
Old, for re-manufacture	Quantity	Tons	132,033	97,475	68,141	85,236	144,860		
	Value ...	£	507,161	337,995	223,422	261,135	388,490		
Pig and puddled	Quantity	Tons	1,758,972	1,564,048	1,266,576	960,931	1,014,552		
	Value ...	£	4,962,185	4,077,156	2,945,225	2,002,816	2,254,497		
Bar (except railroad), angle, bolt, and rod....	Quantity	Tons	313,155	288,271	296,189	264,472	242,947		
	Value ...	£	2,298,533	2,034,667	1,912,294	1,620,484	1,373,971		
Railroad, of all sorts	Quantity	Tons	996,949	971,165	728,540	711,276	739,603		
	Value ...	£	6,387,219	6,014,264	4,142,063	3,905,259	3,687,382		
Hoops, sheets, and boiler plates.....	Quantity	Tons	342,599	347,782	348,298	350,954	397,756		
	Value ...	£	3,943,806	3,899,774	3,663,001	3,268,143	3,063,145		
Black plates for tinning (iron and steel)	Quantity	Tons	..	..	..	..	..
	Value ...	£	..	..	..	..	..
Tinned plates.....	Quantity	Tons	265,039	269,375	288,614	298,386	384,692		
	Value ...	£	4,612,125	4,705,403	4,746,923	4,127,695	4,738,588		
Wire	Quantity	Tons	86,653	62,620	52,968	55,093	40,341		
	Value ...	£	1,330,544	926,797	692,607	689,238	558,383		
Cast and wrought, and all other manufactures ..	Quantity	Tons	328,262	355,842	376,367	347,963	353,923		
	Value ...	£	4,549,860	4,616,960	4,580,671	4,013,108	3,857,043		
Steel, unwrought	Quantity	Tons	172,329	73,131	56,934	69,481	166,367		
	Value ...	£	2,034,339	1,396,556	1,127,481	1,027,490	1,493,669		
Manufactures of steel, or of steel and iron combined.....	Quantity	Tons	18,461	13,599	11,964	12,890	13,453		
	Value ...	£	942,534	580,644	492,380	495,100	403,452		
TOTAL OF IRON AND STEEL			Quantity	Tons	4,353,552	4,043,308	3,496,961	3,130,682	3,388,494
			Value ...	£	31,598,306	28,590,216	24,496,965	21,710,738	21,817,720
Copper:—									
Unwrought.....	Quantity	Cwt.	254,438	338,601	358,478	375,309	380,417		
	Value ...	£	909,241	1,143,031	1,053,135	901,169	833,610		
Wrought or manufactured:	Quantity	Cwt.	362,941	395,077	386,629	418,490	397,150		
								Value ...	£	1,150,622	1,181,956	1,055,576	972,194	813,223
Of other sorts.....	Quantity	Cwt.	313,978	321,340	413,711	421,481	358,909		
								Value ...	£	1,274,215	1,244,773	1,458,318	1,232,504	1,800,608
Tin, unwrought.....	Quantity	Cwt.	110,539	107,437	109,817	93,019	93,877		
		Value ...	£	579,557	524,049	469,210	411,986	472,477	
Zinc or spelter, unwrought or wrought.....		Quantity	Cwt.	171,794	142,132	147,667	153,763	167,634	
		Value ...	£	125,469	98,741	100,356	102,132	113,689	
Oil, seed.....		Quantity	Galls.	14,041,900	20,154,700	16,053,100	16,573,700	17,069,100	
		Value ...	£	1,444,071	1,863,520	1,466,014	1,534,747	1,502,346	

PRESIDENT'S ADDRESS.

EXPORTS, 1882 to 1894.

1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
6,161,900	6,343,000	6,032,200	6,331,700	6,227,400	5,885,600	5,832,700	5,982,200	6,248,800
1,742,771	1,638,770	1,572,922	2,089,295	2,335,284	2,119,440	1,857,928	1,630,948	1,557,533
1,070,311	1,143,271	1,125,555	1,222,400	1,242,794	1,215,307	1,185,307	1,152,854	1,190,885
499,264	468,767	492,137	530,801	523,669	443,437	451,766	414,708	473,546
1,692,651	1,931,694	2,282,064	2,706,625	2,331,561	297,807	419,363	533,959	593,803
717,570	913,440	1,111,825	1,414,677	1,569,914	1,974,518	2,145,652	2,082,805	2,165,873
..	..	328,155	317,596	321,919	339,134	352,588	354,303	323,553
1,640,919	1,849,035	2,050,470	2,072,673	2,111,350	2,137,811	2,309,421	2,329,454	1,949,049
869,083	932,154	971,415	1,060,379	1,053,436	1,013,231	945,483	973,894	1,048,310
280,312	144,972	116,719	149,902	111,068	106,488	118,522	83,256	97,100
827,735	396,981	432,175	502,223	354,369	327,616	334,271	221,316	252,540
1,158,174	1,036,319	1,190,371	1,145,268	840,055	767,053	840,294	830,985	866,568
2,736,806	2,206,373	2,088,324	3,498,568	2,205,567	1,974,745	1,971,518	1,912,958	2,077,073
263,546	297,527	232,382	222,835	217,121	173,114	148,787	129,132	143,900
1,448,839	1,658,308	1,624,576	1,658,800	1,462,900	1,147,682	929,552	823,365	854,017
1,011,779	1,020,002	1,089,892	1,035,431	702,247	468,003	558,375	425,242	457,552
4,617,919	4,669,215	5,330,858	5,981,680	3,852,764	2,247,222	2,511,014	1,885,399	1,897,036
351,041	411,357	385,723	335,592	321,967	297,236	306,038	296,735	307,132
3,314,757	4,046,218	4,133,667	3,840,142	3,500,649	3,340,675	3,264,977	2,982,051	3,014,188
..	..	..	..	..	..	..	..	34,368
..	..	..	..	..	..	..	..	338,346
353,506	391,361	490,650	421,797	448,379	395,149	379,172	333,928	366,120
4,792,854	5,546,228	6,030,005	6,361,477	7,166,655	5,330,216	4,991,390	4,338,786	4,239,193
46,463	64,114	55,806	61,567	67,516	47,350	37,040	34,675	42,220
630,998	863,148	832,229	1,083,175	1,143,127	793,915	647,461	620,536	711,188
369,367	428,112	463,526	454,171	364,903	319,960	280,253	265,883	288,864
4,122,515	4,885,255	5,431,422	5,965,573	4,806,101	4,362,289	3,765,925	3,431,990	3,727,607
286,320	153,250	149,882	149,416	150,452	119,131	169,718	211,495	208,283
2,063,275	1,572,754	1,609,010	1,902,308	1,732,073	1,740,654	1,701,834	1,974,181	1,948,795
13,580	19,549	21,141	25,451	17,698	15,246	18,375	18,667	23,344
406,516	572,186	639,863	771,382	592,495	500,754	475,622	498,181	620,640
4,143,028	3,966,563	4,186,182	4,001,430	3,240,146	2,739,279	2,856,574	2,649,998	2,835,541
24,992,314	26,416,666	29,142,129	31,565,337	26,877,000	21,765,768	20,592,577	18,688,763	19,680,923
427,475	503,932	659,713	900,538	707,182	845,822	566,884	390,717	590,927
967,406	1,956,248	1,536,917	2,629,214	1,964,748	2,061,444	1,367,292	853,755	1,334,913
338,231	150,136	306,459	351,451	281,399	294,582	290,987	315,170	298,233
702,206	494,873	817,430	1,004,830	786,515	729,088	682,174	682,026	629,906
385,551	137,032	309,300	270,017	323,292	324,332	339,996	308,125	313,601
994,974	568,557	932,463	917,510	1,076,849	972,997	972,301	829,247	844,031
98,204	120,836	108,583	102,642	103,307	112,939	134,775	116,992	113,412
537,864	731,771	522,750	503,371	491,492	544,067	606,399	432,917	383,604
210,940	111,768	132,862	164,176	153,485	196,211	194,513	183,077	197,568
146,703	87,653	103,834	162,678	161,733	178,976	158,631	126,505	130,355
Tons 75,098	78,008	68,629	65,118	70,416	67,232	66,193	58,165	49,154
1,567,646	1,593,912	1,490,594	1,499,556	1,535,283	1,322,718	1,438,970	1,219,270	990,311

TABLE II.—UNITED KINGDOM.

Article.		1882.	1883.	1884.	1885.	1886.
Alkali.....	{ Quantity Cwt. 67,019	60,466	66,893	68,503	78,154	
	{ Value ... £ 87,886	81,952	70,175	53,841	55,828	
Caoutchouc.....	{ Quantity Cwt. 181,726	229,101	198,844	180,141	194,748	
	{ Value ... £ 2,754,692	3,652,817	2,272,499	1,981,735	2,222,156	
„ manufactures of.....	{ Quantity Lb. 1,447,739	2,073,874	2,612,740	3,139,632	2,681,210	
	{ Value ... £ 154,924	211,498	262,336	307,739	353,729	
Chemical manufactures and products.....	{ Quantity ..	1,519,201	1,549,929	1,501,021	1,356,291	1,281,537
	{ Value ... £
Drugs:—						
Bark, Peruvian.....	{ Quantity Cwt. 139,285	116,921	105,791	128,104	115,367	
	{ Value ... £ 1,790,220	1,423,516	905,499	874,332	801,353	
Opium.....	{ Quantity Lb. 478,424	774,069	490,675	710,099	521,124	
	{ Value ... £ 359,150	563,410	341,371	456,134	397,666	
Unenumerated.....	{ Value ... £ 856,172	1,123,874	786,306	789,822	662,079	
Dyeing or tanning stuffs:—						
Bark.....	{ Quantity Cwt. 272,145	365,106	433,136	356,828	390,538	
	{ Value ... £ 127,186	180,749	196,845	147,042	173,079	
Cochineal, granilla, and dust.....	{ Quantity Cwt. 26,330	21,440	14,766	14,228	11,941	
	{ Value ... £ 255,568	133,254	81,081	85,380	95,688	
Cutch and gambier.....	{ Quantity Tons 30,048	26,827	32,219	26,312	28,352	
	{ Value ... £ 605,003	710,721	821,918	565,565	654,116	
Dyes obtained from coal-tar.....	{ Value ... £ 415,706	386,623	551,880	497,539	509,750	
Indigo.....	{ Quantity Cwt. 95,272	100,243	104,423	94,314	85,308	
	{ Value ... £ 2,605,841	2,455,968	2,483,031	2,119,849	1,907,555	
Madder, madder root, garancine, and murex.....	{ Quantity Cwt. 23,337	21,769	23,208	24,721	21,395	
	{ Value ... £ 33,207	28,420	31,670	36,858	26,812	
Myrobolans.....	{ Quantity Cwt. ..	..	..	..	..
	{ Value ... £ ..	..	..	..	..
Safflower.....	{ Quantity Cwt. 1,298	980	1,794	715	1,394	
	{ Value ... £ 4,848	3,511	7,109	2,967	5,334	
Sumach.....	{ Quantity Tons 13,365	14,876	11,704	11,157	13,083	
	{ Value ... £ 195,945	215,268	165,651	162,051	178,464	
Valonia.....	{ Quantity Tons 35,604	30,468	34,447	29,487	34,227	
	{ Value ... £ 525,361	484,228	521,621	465,112	483,941	
Substances and extracts, unenumerated.....	{ Value ... £ 749,027	892,797	791,864	752,259	698,705	
Dye-woods:—						
Logwood.....	{ Quantity Tons 41,262	54,842	68,626	68,549	55,598	
	{ Value ... £ 210,005	292,540	384,950	374,373	290,714	
Unenumerated.....	{ Quantity Tons 26,252	36,630	22,929	26,991	22,446	
	{ Value ... £ 192,213	230,499	147,203	157,153	125,177	
Galls.....	{ Quantity Cwt. 30,066	39,552	37,397	83,268	56,222	
	{ Value ... £ 89,712	108,945	87,413	118,908	98,036	
Gum:—						
Gum, kowrie.....	{ Quantity Cwt. 39,621	70,289	62,378	82,266	44,724	
	{ Value ... £ 116,467	217,521	182,633	258,244	133,056	
„ lac, seed, shell, stick, and dye.....	{ Quantity Cwt. 112,025	115,427	112,479	119,511	107,241	
	{ Value ... £ 598,357	490,428	462,372	383,102	305,856	
„ of other sorts.....	{ Quantity Cwt. 108,289	117,945	108,252	104,880	88,317	
	{ Value ... £ 346,420	346,251	321,508	300,969	311,969	
Gutta-percha.....	{ Quantity Cwt. 72,636	63,809	62,713	53,839	40,697	
	{ Value ... £ 539,814	476,884	462,746	347,133	269,808	
Metals:—						
Copper, ore and regulus.....	{ Quantity Tons 152,068	163,781	186,679	189,373	152,415	
	{ Value ... £ 2,660,836	2,936,208	3,175,066	2,883,368	2,116,615	
„ unwrought, part wrought, and old.....	{ Quantity Tons 37,785	38,097	42,235	43,997	45,185	
	{ Value ... £ 2,522,393	2,413,795	2,329,175	2,093,158	1,884,801	
„ wrought, unenumerated.....	{ Value ... £ 80,138	74,546	39,252	43,224	37,462	
Iron, &c.:—						
Iron, ore.....	{ Quantity Tons 3,284,946	3,491,673	2,730,829	2,822,308	2,878,499	
	{ Value ... £ 3,663,091	2,750,870	2,114,600	1,957,199	1,894,626	
„ bars.....	{ Quantity Tons 139,229	122,895	115,486	122,597	105,466	
	{ Value ... £ 1,306,457	1,236,735	1,166,948	1,220,491	957,057	
„ steel, unwrought.....	{ Quantity Tons 5,935	4,517	6,723	11,208	12,682	
	{ Value ... £ 67,172	60,407	88,052	113,057	112,342	
„ and steel, wrought, unenumerated.....	{ Quantity Cwt. 3,444,316	3,880,676	3,792,440	3,474,395	3,537,652	
	{ Value ... £ 2,474,898	2,870,813	2,693,422	2,361,384	2,200,265	
Silver ore.....	{ Quantity Tons 750,079	1,090,542	1,089,768	1,085,227	1,030,488	
	{ Value ... £ 41,876	60,702	67,658	60,129	54,121	
Zinc, crude, in cakes.....	{ Quantity Tons 708,877	640,292	700,154	848,187	774,938	
	{ Value ... £ 563,478	407,394	601,603	803,282	663,629	
„ manufactures.....	{ Quantity Cwt. 396,466	498,206	390,157	590,885	326,004	
	{ Value ... £ ..	..	..	..	..
Oil:—						
Train or blubber, and sperm.....	{ Quantity Tons 15,445	17,156	17,489	18,380	15,384	
	{ Value ... £ 531,663	604,746	550,805	529,412	361,417	
Animal.....	{ Quantity Cwt. 67,877	82,629	95,811	121,498	113,482	
	{ Value ... £ 157,617	193,597	194,636	229,971	188,120	
Coco-nut.....	{ Quantity Cwt. 133,782	210,874	244,399	185,496	156,775	
	{ Value ... £ 210,654	365,716	396,288	276,221	214,346	
Olive.....	{ Quantity Tons 23,450	31,953	17,243	24,227	20,664	
	{ Value ... £ 947,154	1,198,935	715,964	981,348	791,245	
Palm.....	{ Quantity Cwt. 813,870	749,422	841,012	905,139	1,004,419	
	{ Value ... £ 1,249,866	1,315,559	1,408,763	1,217,816	1,050,459	
Seed.....	{ Quantity Tons 14,507	10,524	12,528	12,910	16,315	
	{ Value ... £ 476,807	366,489	388,118	368,130	396,126	
Turpentine.....	{ Quantity Cwt. 358,994	350,138	402,639	398,323	294,451	
	{ Value ... £ 640,939	565,902	590,533	587,927	391,879	
Chemical, essential and perfumed.....	{ Quantity Lb. 695,778	779,844	795,943	805,597	813,405	
	{ Value ... £ 211,428	220,696	219,241	183,488	191,346	
Paraffin.....	{ Quantity Cwt. ..	..	..	..	..
	{ Value ... £ ..	..	..	..	..
Petroleum.....	{ Quantity Gall. 30,685,982	70,526,966	52,975,789	73,873,641	71,125,736	
	{ Value ... £ 1,721,019	2,170,298	1,711,313	2,289,525	2,091,276	
Pyrites of iron or copper.....	{ Quantity Tons 627,709	604,288	563,073	654,521	556,988	
	{ Value ... £ 1,422,684	1,356,083	1,244,871	1,252,623	1,029,839	
Quicksilver.....	{ Quantity Lb. 444,965	1,088,982	4,497,748	4,136,519	4,422,478	
	{ Value ... £ 279,291	269,689	333,918	326,959	369,779	
Gum arabic.....	{ Quantity Cwt. 116,135	80,573	57,529	43,532	75,591	
	{ Value ... £ 222,814	178,902	174,102	326,908	295,464	
Tin, in blocks, ingots, bars, or slabs.....	{ Quantity Cwt. 485,737	521,048	521,491	509,322	484,528	
	{ Value ... £ 2,538,577	2,442,959	2,123,799	2,181,891	2,318,070	

IMPORTS, 1882 to 1894.

1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
64,758	56,793	47,464	37,341	87,168	56,243	87,703	155,641	181,114
46,847	50,687	31,733	29,240	50,403	41,516	73,104	103,824	114,586
237,511	290,350	296,310	264,008	278,837	292,163	295,373	302,451	341,533
2,704,565	2,555,341	2,617,369	3,265,088	3,351,938	2,982,432	3,330,418	3,272,104	3,760,178
2,416,653	3,116,510	3,132,376	3,564,469	3,180,198	3,448,727	3,211,322	3,202,377	3,900,569
317,489	290,373	318,439	360,123	362,384	408,159	375,187	445,327	550,103
1,313,293	1,311,297	1,414,996	1,441,999	1,330,073	1,592,294	1,355,046	1,375,489	1,276,679
143,177	144,820	129,337	116,811	106,551	103,401	77,022	58,352	32,206
661,682	551,568	429,010	341,377	259,697	251,537	149,983	106,527	58,804
654,122	587,365	492,115	451,193	514,274	539,210	568,566	445,582	383,066
422,920	365,518	298,436	282,779	278,565	250,296	184,090	222,501	193,589
646,165	888,241	814,593	803,534	812,351	832,815	803,282	797,312	1,012,468
346,556	330,691	456,344	579,438	489,846	380,337	318,617	320,131	384,959
147,107	134,976	204,087	263,259	216,815	158,105	124,528	124,904	146,491
10,080	7,674	8,186	7,808	7,911	5,456	4,471	4,577	5,813
62,750	50,272	50,749	51,067	47,547	33,703	27,226	26,774	38,411
27,361	25,543	25,011	27,445	23,926	23,200	24,913	27,470	25,545
661,567	705,779	675,829	717,820	565,453	548,335	530,726	577,810	556,120
542,806	568,062	600,236	504,378	580,962	542,242	504,518	598,963	709,993
76,700	78,128	80,238	81,854	50,579	71,344	66,981	59,922	83,071
1,673,067	1,702,292	1,777,617	1,521,389	1,043,442	1,356,595	1,389,461	1,149,057	1,392,534
19,347	14,264	11,236	11,373	11,477	6,891	7,006	6,054	6,054
24,177	18,997	17,184	15,545	15,853	10,237	11,039	12,563	8,110
..	..	..	51,137	51,167	645,667	449,842	921,786	617,800
..	..	..	209,548	248,814	290,076	179,097	305,278	199,889
710	1,628	190	325	78	139	32	401	4
3,122	6,283	830	1,182	365	345	149	1,742	12
13,038	12,659	12,514	11,432	11,618	12,286	11,515	12,616	15,618
156,720	135,410	119,517	126,074	133,814	133,736	127,863	135,705	157,221
29,678	31,871	31,376	25,272	17,202	33,173	34,815	24,508	35,605
424,574	455,044	454,639	501,669	334,268	459,429	449,196	511,119	395,943
737,791	799,822	805,179	751,200	738,796	707,086	642,477	619,456	671,917
48,720	62,806	73,772	63,519	54,913	61,589	52,390	68,457	58,964
265,243	366,131	443,656	407,162	335,846	333,538	363,083	486,368	406,734
24,807	17,232	18,207	24,321	15,881	11,093	21,057	12,844	26,254
149,772	90,630	96,004	138,309	86,069	68,410	124,498	68,372	120,347
26,164	36,944	32,065	39,605	38,517	36,121	31,249	24,761	26,248
72,212	105,188	83,734	104,202	80,995	78,066	91,197	53,978	39,814
55,144	66,000	59,882	55,076	72,686	61,569	77,290	74,130	60,912
170,062	177,822	149,396	141,008	185,365	182,225	257,989	208,954	208,955
116,778	108,183	78,581	91,834	109,354	111,833	109,163	116,370	114,122
287,618	271,496	276,296	389,534	426,519	445,584	516,016	610,870	629,459
101,835	110,594	123,610	106,332	108,596	118,378	128,722	126,095	136,011
374,447	380,293	405,513	303,271	209,100	203,674	344,844	332,472	335,842
24,133	22,483	47,832	70,176	60,911	45,497	40,005	36,740	48,077
156,500	181,560	575,929	708,296	734,879	519,511	394,786	446,279	384,285
169,511	230,319	250,567	215,935	212,327	226,087	194,608	161,650	191,024
2,501,198	4,075,790	4,234,619	3,910,668	4,064,415	3,877,479	3,381,902	2,261,580	2,807,363
31,013	47,688	41,342	62,028	46,483	36,834	13,945	60,296	45,761
1,325,559	3,610,870	2,120,564	2,857,842	2,446,249	1,714,098	1,975,865	2,465,000	1,917,697
51,874	71,627	58,073	90,612	62,483	45,325	72,719	79,181	182,100
3,765,788	3,562,071	4,051,265	4,471,790	3,180,543	3,780,593	3,065,864	4,413,652	4,450,311
2,547,950	2,469,889	3,024,605	3,596,056	2,458,407	2,716,829	2,792,028	2,978,597	2,977,952
112,065	113,175	111,779	92,899	77,127	75,015	65,829	63,247	67,748
989,858	1,025,568	1,033,974	925,315	751,587	602,250	593,633	556,568	549,534
14,727	12,076	10,868	8,144	8,436	6,483	8,934	8,587	10,802
124,647	111,843	96,720	85,442	87,568	62,486	90,506	76,810	95,005
2,791,662	3,156,348	2,973,210	3,018,894	3,100,882	2,755,567	3,097,567	3,068,741	3,303,399
2,023,143	2,312,592	2,490,449	2,681,597	2,764,721	2,532,118	2,545,059	2,632,044	2,561,971
1,378,156	1,405,972	2,228,791	2,637,332	3,766,339	3,632,180	2,069,911	2,439,955	1,764,444
57,058	60,678	56,420	56,295	58,513	52,793	56,926	52,897	63,525
859,639	1,047,174	1,074,943	1,288,358	1,329,565	1,102,791	1,007,397	819,841	1,033,894
395,279	364,485	384,070	350,852	403,163	379,161	368,843	370,923	387,212
355,288	369,138	416,735	440,167	514,396	463,980	398,353	375,015	375,192
17,088	16,871	20,956	20,307	21,969	21,428	19,939	24,213	24,597
373,275	338,690	440,360	419,401	454,704	415,181	589,864	413,974	406,448
140,167	120,283	118,415	98,753	82,506	65,057	493,633	54,608	48,778
2,462,600	225,835	235,354	183,690	158,180	119,140	92,904	90,905	78,904
180,792	194,025	134,090	184,469	186,469	164,569	155,347	209,131	285,016
248,218	245,867	277,602	261,683	264,228	191,380	202,855	369,737	321,558
20,749	18,535	22,882	20,187	18,108	20,476	17,200	26,711	14,884
788,348	672,614	817,495	785,779	739,135	762,516	652,041	894,151	1,132,681
968,227	958,799	1,031,449	873,923	1,018,429	1,058,589	1,169,443	1,187,767	1,232,232
943,126	945,896	1,091,922	1,000,535	1,184,705	1,169,440	1,458,462	1,237,072	1,320,090
15,508	16,257	17,039	22,988	25,011	22,063	30,161	29,057	39,067
374,120	412,438	461,021	618,490	699,599	555,882	718,837	654,065	721,867
359,202	379,670	398,974	424,453	422,560	516,597	533,235	488,877	593,083
472,016	517,901	602,681	644,886	576,207	500,933	492,230	491,382	520,065
973,557	996,946	1,078,277	1,438,364	1,078,152	1,127,574	1,592,080	1,456,180	1,688,221
215,882	194,700	192,340	234,997	229,817	244,572	274,378	286,234	276,678
327,110	348,019	315,606	490,489	529,352	552,572	768,095	648,951	720,796
451,728	448,284	374,887	636,690	805,034	749,704	813,937	933,209	755,794
77,890,435	91,401,285	102,881,256	105,080,863	130,415,360	130,180,085	155,125,097	163,002,262	177,146,028
2,103,599	2,565,598	2,588,947	2,397,187	2,683,398	2,446,806	2,546,760	2,484,476	3,368,904
596,774	618,943	644,343	656,891	604,227	604,411	612,818	616,050	582,463
1,065,468	1,179,255	1,211,791	1,219,488	1,126,247	1,093,506	1,095,407	1,049,311	987,165
4,590,997	5,533,110	4,958,563	4,455,733	4,707,894	4,274,374	3,659,338	3,843,791	3,724,054
439,209	616,499	547,752	588,761	597,593	595,184	341,186	363,562	361,558
46,405	77,728	65,243	52,810	42,352	68,602	65,745	53,124	68,351
213,477	312,493	243,913	159,704	162,232	194,617	169,502	135,119	160,282
518,360	560,990	601,849	540,769	564,144	589,365	674,162	782,951	832,028
2,868,261	3,520,342	2,797,274	2,547,416	2,565,074	2,743,814	2,892,107	2,718,469	2,631,038

TABLE III.

GERMAN TRADE. (German figures.)

German Exports (1881-1894), to all Countries, of Dyes, Aniline and Similar; and Spirits of all Kinds.

Year.	Dyes, Aniline and Similar.		Spirits of all Kinds.	
	Kilos.	Marks.	Kilos.	Marks.
1884	1,822,300	34,167,000	75,133,600	32,567,000
1885	1,646,100	31,816,000	89,727,500	28,481,000
1886	5,702,400	38,776,000	76,589,500	23,449,000
1887	6,514,400	42,553,000	58,237,500	18,975,000
1888	6,906,000	49,055,000	35,956,000	12,493,000
1889	6,974,800	38,361,000	32,459,000	13,751,000
1890	7,279,700	37,854,000	37,865,500	14,796,000
1891	8,679,900	44,267,000	21,003,900	10,470,000
1892	10,725,100	52,553,000	16,865,400	4,659,000
1893	11,559,900	53,176,000	16,057,700	4,682,000
1894	12,368,100	53,183,000	16,955,500	4,820,000

German Exports (1885 to 1894) to the United Kingdom.

	Marks.
1885	452,797,000
1886	442,741,000
1887	490,764,000
1888	479,875,000
1889	646,737,000
1890	689,526,000
1891	679,307,000
1892	628,980,000
1893	669,967,000
1894	631,812,000

Note.—Tables I., II., and III. abstracted by T. Burton, of the staff of the London Chamber of Commerce.

PRICE OF PLATE GLASS PER SQUARE FOOT.

Area of Plate in Square Feet.	1802.	1835.	1856.	1862.	1884.	1889.	1895.
10	s. d. 15 3	s. d. 9 5	s. d. 4 6	s. d. 3 7	s. d. 2 8	s. d. 2 3	s. d. 1 8
20	32 0	14 0	5 4	4 0	2 9	2 4	1 9
30	40 11	18 9	6 2	4 7	2 11	2 5	1 10
40	67 10	23 2	6 6	4 10	3 0	2 5	1 10
100	..	..	..	..	..	2 8	2 0

Thus, in 10 years our exports have decreased 73 per cent., whilst our imports have increased nearly 100 per cent.

PRODUCTION OF PLATE GLASS, IN SQUARE METRES, PER ANNUM.

—	1850.	1860.	1868.	1875.	1880.	1890.	1893.	1895.
England.....	200,000	350,000	350,000	800,000	805,000	1,015,000	590,000	450,000
France.....	90,000	305,000	380,000	..	..	..	810,000	..
Belgium.....	60,000	110,000	110,000	325,000	425,000	800,000	1,080,000	1,300,000
Germany.....	..	70,000	120,000	..	..	..	587,000	..
America (U.S.).....	..	..	..	..	..	..	1,732,000	..
	350,000	835,000	960,000	..	..	..	4,799,000	..

SALT DECOMPOSED IN THE LEBLANC AND AMMONIA-SODA PROCESSES (INCLUDING SCOTLAND).

—	1895.	1894.	1893.	1892.	1891.	1890.	1889.	1888.	1887.	1886.	1885.
Leblanc process.....	Tons. 48,173	Tons. 434,298	Tons. 467,562	Tons. 519,593	Tons. 567,863	Tons. 602,769	Tons. 584,203	Tons. 590,312	Tons. 577,381	Tons. 584,323	Tons. 598,096
Ammonia-soda.....	428,614	361,609	349,609	304,897	278,528	252,260	219,279	212,181	158,636	137,220	115,032
Total.....	896,787	795,907	817,171	824,490	846,391	855,029	803,482	802,493	736,017	721,543	713,128
Leblanc.....	PerCent. 48.6	PerCent. 51.6	PerCent. 57.2	PerCent. 63.0	PerCent. 67.09	PerCent. 70.4	PerCent. 72.8	PerCent. 73.5	PerCent. 78.4	PerCent. 80.9	PerCent. 83.8
Ammonia-soda.....	51.4	48.4	42.8	37.0	32.91	29.6	27.2	26.5	21.6	19.1	16.2

IMPORTS OF RAW AND REFINED SUGAR INTO THE UNITED KINGDOM.

Year.	Raw Sugar.		Refined Sugar.	
	Tons.	Tons.	Tons.	Tons.
1882.....	990,279	138,951	104,272	104,272
1883.....	1,017,854	163,272	213,335	213,335
1884.....	982,619	213,335	256,003	256,003
1885.....	969,187	318,351	344,492	344,492
1886.....	807,050	350,538	451,197	451,197
1887.....	897,761	498,878	536,106	536,106
1888.....	892,518	531,209	578,487	578,487
1889.....	877,189	715,536	720,368	720,368
1890.....	785,870	536,106	578,487	578,487
1891.....	810,866	531,209	578,487	578,487
1892.....	814,732	578,487	715,536	715,536
1893.....	811,847	715,536	720,368	720,368
1894.....	806,832	720,368	..	..
1895.....	845,034	..	..	..

—Board of Trade Returns.

Government bounties annually granted by Europe, exclusive of Russia, Sweden, and some minor countries:—

	£
Germany.....	1,150,000
France.....	2,000,000
Austria.....	400,000
Belgium.....	1,000,000
	4,500,000

In round figures the total bounties probably come to 5,000,000*l.* a year.—*Prod. Market Review.*

The bounties in France and Germany, calculated at per ton of sugar, are as follows:—

	£ s. d.
France, raw sugar.....	2 7 6
Germany, raw sugar.....	1 5 0

AUSTRIAN BOUNTY.

	£ s. d.
Raw.....	1 4
Refined.....	1 11

ABSTRACT OF REPORT of the COMMITTEE of COUNCIL on
EDUCATION (ENGLAND and WALES), 1893-94.

ELEMENTARY SCHOOLS.

Page IX.

Year.	On Register.	Increase.	Average Attendance.	Increase.
1892	5,006,979	Per Cent. 3.78	..	Per Cent. ..
1893	5,126,373	(Report 1894). 2.38	4,100,030	..
1894	5,198,741	1.41	4,225,834	3.07

Page IX.—Percentage of Children in Average Attendance.

1892.	1893.	1894.
77.31	79.98	81.29 (Infants 72.14, others 86.26)

Annual Grants.

	1892.	1893.	1894.
Day schools.....	£ 3,326,641	£ 4,133,404	£ 4,587,731
Evening continuation schools	91,510	45,873	48,880
Fee grant.....	2,069,020		

Cost per Child.

Schools.	1892.	1893.	1894.
Voluntary	£ s. d. 1 17 9½	£ s. d. 1 17 6½	£ s. d. 1 18 1½
Board	2 8 4½	2 8 1½	2 8 9½

Page XX.—Government Grant per Child.

	1892.	1893.	1894.
Voluntary schools	s. d. 18 2½	s. d. 0 0½	s. d. 0 0½
Board schools.....	19 1½	0 2½	0 2½
Combined schools.....	18 7	0 1½	0 1½

* Voluntary Schools. Contributions per Child.

1892.	1893.	1894.
s. d. 6 10½	s. d. 6 8½	s. d. 6 6½

* Board Schools. Rate per Child.

1892.	1893.	1894.
£ s. d. 1 1 3½	s. d. 19 9½	s. d. 18 4½

Page XI.—* Voluntary Schools. Total of Contributions.

1892.	1893.	1894.
£ 798,777	£ 808,949	£ 808,553

* These figures include only the amounts shown in the school accounts as applied to the maintenance of the schools; not on provision of new schools, or structural alterations or extraordinary repairs.

* Board Schools. Rates, Total.

1892.	1893.	1894.
£ 1,704,371	£ 1,705,621	£ 1,724,238

* These figures include only the amounts shown in the school accounts as applied to the maintenance of the schools; not on provision of new schools, or structural alterations or extraordinary repairs.

Free Schools and Scholars.

Year.	Schools.	Scholars.	Not Free.
1893	15,914	4,236,867	889,506
1894	16,289 out of 19,709* inspected	4,377,711	821,000

* This number includes the schools to which the grant was paid without actual inspection.

Refused fee grant: 1893 = 132; 1894 = 117.

Page XII.—Evening Continuation Schools.

Year.	Departments inspected.	Scholars on Register.	No. of Teachers.	Grant.
Before new evening code.	1,977	115,582	3,037 men	£ 45,667
1894.....	3,742 (3,318 schools)	206,683	701 women	(1893) 91,540

The bulk of the students take reading, writing, and arithmetic. Next most popular are geography, needlework, and shorthand; then vocal music, life and duties of the citizen, book-keeping, mensuration, history, and domestic economy; drawing is taught in 1,213 schools, science in 803, and manual or technical instruction in 281. Of subjects for women only, cookery was taught in 468 schools (in 1893 in 243 schools), laundry work in 26, dairy work in 2, and housewifery in 23. *The opening of the classes to persons over 21 years of age has added 37,043 to the registers.* Much assistance, pecuniary and otherwise, has been obtained from county councils and co-operation of universities, &c.

Page XIII.—Schools for Blind and Deaf.

Schools.	Scholars.	Schools inspected.	Grant on inspected Schools.
78 (increase of 26)	{ 1,341 blind } { 2,755 deaf }	33	£ s. d. 1,931 0 9

Page XVIII.—Grants to University Colleges.

Total, 15,000*l.* They must send an annual statement of accounts and report to the Department, and until it is received the Treasury will not pay the grant. All (except Bedford College) in England have day training colleges attached, and the three Welsh University Colleges (which also receive 12,000*l.*) have also such day training colleges attached.

Page XIX.—Elementary Schools. 31st August 1894.

19,756 day schools for inspection and claiming grants, having 30,169 departments, under separate head-teachers—

Accommodation	5,873,098
No. on register	5,235,887
Average attendance	4,254,314

Some of the above schools may have been examined twice, others not at all, during the year, owing to change of date of examination.

	No. of Children.		Per Cent.
Under 7 years of age.....	1,635,794	Increase of population during year.....	1.109
Between 7 and 13 years.....	3,334,182	" accommodation, 70,327 places..	= 1.22
Between 13 and 14 years.....	181,136	" scholars on register, 72,368....	= 1.41
Over 14 years.....	47,329	" average attendance, 125,894....	= 3.07
Present at inspection.....	1,802,269		

Page XX.—Evening Continuation Schools, 1894.

Schools.	Departments.	Principal Teachers.		Scholars.					
		Total.	Certified by Department.	Total.	Pay no Fees.	Under 14 years.	14—18.	18—21.	Over 21 years.
3,318	3,742	3,067 men 791 women	2,822 men 623 women	266,683	103,233	32,342 or 12.13%	155,459 or 58.29%	41,839 or 15.69%	37,043 or 13.89%
		3,738	3,445						

Grants are paid upon the amount of instruction given to each scholar; not, as formerly, upon the average attendance.

Page XX.—2,822 masters and 623 mistresses were certified by Department.

Page XXIV.—Elementary School Accommodation.

Year.	For Scholars.	Per Cent. of Population.	= Increase of.
1870	1,875,584	8.75	In board schools..... 2,199,111
1894	5,832,944	19.44	" voluntary 1,755,249

but, compared with 1893, the number of places in voluntary schools had diminished by 20,465, while places were increased by 90,792 in board schools.

Cost of Schools and Teachers' Residences.

(1.) 1870—1882 (Dec. 31st).—New or improved accommodation for 280,146 scholars (1,572 schools and 933 residences):—

	£
Building grants from Department.....	312,290
Local contributions (voluntary and rates), exclusive of sites given gratuitously.....	1,348,169
Total.....	1,660,369

Page XXV.—(2.) The great majority of the remaining 4,775 voluntary schools (1,475,000) which have come under inspection since 1870, have been erected, enlarged, or improved without Government aid at a cost estimated at least at 7,000,000*l.* up to 1891. Large sums have been spent since, but there are no reliable returns.

(3.) On security of rates, 2,024 school boards have provided 2,211,299 school places, the estimated cost per child being 13*l.* 6*s.* 6*d.* This includes the sites (the cost of which is often very considerable), laboratories, workshops, landdries, cooking kitchens, school board offices, &c.

The amounts of loans for building have increased rapidly:—

	£	s.	d.
1888—1889.....	779,558	13	5
1889—1890.....	818,394	15	8
1890—1891.....	1,033,395	4	8
1891—1892.....	1,343,391	13	2
1892—1893.....	1,315,265	9	1
1893—1894.....	1,939,318	19	10
1894—1895.....	2,590,797	14	8*

Page XXVI.—(Total advances of Public Works Loan Board to March 31st, 1894 = 16,522,393*l.*, of which 1,622,189*l.* have been repaid.)

(4.) 1,297 voluntary schools have transferred to school boards, and a number of schools under private management also, but on this point there is no definite information.

* Nearly double 1891—1892; thrice 1888—1889.

Children of School Age (3—13). Estimated by Registrar-General.

In 1881 = 23.9 per cent. of population. In 1891 = 23.2 per cent.

It is estimated $\frac{1}{4}$ ths might be expected to attend elementary schools.

Making due allowance for sickness, weather, &c., it is estimated that school seats should be provided for $\frac{1}{4}$ th of population = 5,010,127 places. The provision (5,832,944) is in excess, but is not evenly distributed. Generally, however, the seats are in excess of $\frac{1}{4}$ th of the present population.

Of children of class usually found in elementary schools, there were in 1894:—

Page XXVII.

Age.	Estimated Number at Middle of Year.	Number on Registers.	Percentage of Children on Registers.
5—7	1,213,838	1,109,722	91.42
5—11	2,379,293	2,343,370	98.49
11—13	1,151,410	991,112	86.08
	4,744,541	4,444,204	93.67

RETURN showing the NUMBER of SCHOLARS for whom ACCOMMODATION was provided, AVERAGE NUMBER in ATTENDANCE, ANNUAL GRANT PAID, and PARTICULARS of INCOME and EXPENDITURE, 1894. ENGLAND.

	Voluntary.		Board.	
Number of schools.....	14,668		4,903	
Departments.....	20,802		8,985	
Accommodation.....	3,646,830		2,113,932	
Average attendance.....	2,410,450		1,089,214	
Annual grant 1892-93.....	£ 2,181,653	s. 16	£ 1,003,349	s. 15
Income 1891-92:—				
From annual grant.....	2,076,104	2 10	1,494,603	3 0
" for grant.....	1,028,989	7 2	726,854	18 8
Endowment.....	158,059	11 7	2,744	2 1
Endowment per head.....	0 1 3 $\frac{1}{2}$		0 0 0 $\frac{1}{2}$	
From voluntary contributions (including collections in church) or rates.....	804,523	18 11	1,670,968	10 3
From voluntary contributions (including collections in church) or rates, per head.....	0 6 8		0 19 9 $\frac{1}{2}$	
From school pence.....	245,947	19 6	45,526	15 8
" books (in addition to school pence).....	0 2 0 $\frac{1}{2}$		0 0 6 $\frac{1}{2}$	
From Science and Art Department.....	62,937	8 8	66,211	5 0
From other sources.....	44,567	18 11	26,311	4 5
Total income.....	£ 4,456,418	s. 5	£ 4,048,741	s. 10

	Voluntary.	Board.
Expenditure:—	£ s. d.	£ s. d.
Salaries of teachers.....	3,447,005 16 10	3,100,575 13 8
Books and apparatus.....	283,519 14 0	239,983 4 7
Miscellaneous (repairs, furniture, cleaning, rates and taxes, &c.).	780,233 4 4	705,119 1 1
Total.....	4,510,758 15 2	4,045,707 19 4

RETURN made to the DEPARTMENT OF SCIENCE AND ART relating to TECHNICAL EDUCATION IN GREAT BRITAIN AND IRELAND, 1895.

THE following refers to the returns actually made by the different local authorities and only to sums expended specifically on technical education and obtained by special rates raised under the Technical Instruction Acts.

The *actual* expenditure in England, Wales, Scotland, and Ireland for the year 1893-94 was 647,631*l.* 18*s.* 7*d.*, and the estimate for the year 1894-95, 737,420*l.* 15*s.* 1*d.*

41 out of the 19 county councils in England (excepting the county of Monmouth) are applying the whole of the residue received under the Local Taxation (Customs and Excise) Act, 1890, to technical education, and the remaining 8 are devoting part to that purpose. Of the councils of the 61 county boroughs, 55 are devoting the whole of this residue and 5 a part of it to the purpose. In Wales and Monmouth practically the whole is dedicated to technical education.

In Scotland, 21 out of the 33 county councils are using all this residue and 9 part of it for technical education. Only 3 are using none of it for that purpose.

In Ireland, 9 local authorities are making grants for technical education. In the year 1893-94, 4,339*l.* 9*s.* 11*d.* was thus expended. For the year 1894-95, the estimate was 4,748*l.* 16*s.* 6*d.*

(a.) The rough notes attached, where chapter and verse are given for each statement, together with the impressions I have gained from their Reports, show that the impressions of the Royal Commissioners are that the German and other Continental teachers in technical institutions are—(1) more practical than in England; (2) travelled men; (3) linguists; (4) acquainted, by practically working in them, with procedure in foreign manufactories.

(b.) That the training in Continental technical institutions is far more practical than in England, and that the heads of manufactories as a rule insist on or encourage the working of their young workers in evening continuation classes.

(c.) That theoretical teaching, although carried on so far as necessary, is regarded as of less importance than applied science.

(d.) That languages are more largely learned by technical students than in England.

(e.) That drawing, and anything training the use together of the hand and eye, are of great importance. This (in my opinion, G. T. H.) is now pretty thoroughly done in England.

(f.) That modern technical training is not so good as apprenticeship, but as the latter is going out of fashion, the training institutions are now essential.

First Royal Commission on Technical Instruction, 1882.

This is a preliminary report on technical education in France and Italy, by Bernhard Samuelson, Henry E. Roscoe, Philip Magnus, John Slagg, Swire Smith, and William Woodall.

Page 5.—Elementary education much neglected in France until within 15 or 20 years before 1882.

Page 6.—Conscripts who could not read or write equalled 47·8 per cent. in 1833; 23 per cent. in 1866-67; 15 per cent. in 1880.

In the principal industrial centres this was not so bad—6·7 per cent. in 1866 and 5·2 per cent. in 1882.

Pages 7 and 25.—As early as June 1881 primary education was free in Paris and many large provincial towns of France, and in many of the rural communes.

They speak highly of lectures delivered on science, &c. in Paris gratuitously by men of "world-wide reputation"; such were those of the Collège de France and the Conservatoire des Arts et Métiers.

There were in 1882 over 100 art classes for adults in Paris.

There were superior elementary schools (Écoles primaires complémentaires) for literary and technical instruction, either free or very cheap. Here instruction in weaving, dyeing, &c. was given among other subjects.

Page 23.—After passing through elementary schools the children (12 years of age) are examined, and, if they fail to show sufficient knowledge, are not allowed to work full time (12 hours) in workshops and factories until they reach the age of 15.

Second Report of the Royal Commissioners on Technical Instruction, Vol. I., 1884.

Page 148.—Some idea of the thoroughness of the technical instruction on the Continent may be gained from the fact that in the classes in weaving at the weaving school in Vienna, the students, all of whom are said to be practically familiar with the loom, are given pieces of cloth sometimes composed of such mixtures as silk, mohair, wool, and cotton, and are expected to dissect them thread by thread, to determine the "counts" of warp and weft, and to count the length of each required for weaving a yard of the cloth and the cost of the individual constituents and of the finished cloth. All this work is done under the supervision of practical men acquainted with the usage in the foremost manufactories of the principal weaving districts. At this school all the students study theoretical chemistry, but only those going in for dyeing study practical chemistry, and they take a course of one or two years at it, and many students pass out into employment as "qualified dyers" without any apprenticeship.

Page 281.—The Commissioners state that the managers and foremen of Continental dyeing establishments had "high scientific knowledge combined with practical training," and that in France, Italy, Switzerland, Germany, Austria, Belgium, and Holland, "in nearly every factory or industrial establishment of importance, the directing skill was supplied by men who had supplemented a scientific education by foreign travel." They add: "In chemical knowledge, the heads of departments in colour-making and dyeing establishments are almost invariably superior to those of England, where Englishmen educated only in England are employed."

Page 297.—They add on page 297, as regards calico-printing, &c. in Alsace: "It is a noteworthy fact that in nearly every instance the employers and foremen of the establishments we visited were men of high attainments. A great proportion of them speak English, and, from frequent intercourse with English machine makers and printers, they are able to obtain accurate information on all matters relating to the development of their industry."

Page 343 to 346.—In referring to the ironworks of Westphalia, the Commissioners describe their visit to the Union Works, of Dortmund, as typical of the iron and steel industry of Westphalia.

All boys under 18 are *compelled* to attend the Fort-building schools of the town on two or three evenings weekly. An overseer at the works examines the register showing the attendances of the boys.

They state that "the managers have received the usual German technical training, are thoroughly familiar with English works and proficient in the English language."

Page 346.—*Re* the military system on the Continent, one of the managers at the Union Works at Dortmund (Westphalia) considered that it improved the men in most ways, the three years' military service making him superior in many respects. He would personally prefer a man as a workman after he had passed through his military term.

Page 383 to the end (page 540).—The Commissioners describe the various training institutions in the United Kingdom, including King's College, Royal School of Mines, and Royal College of Science, South Kensington, City Guilds Institutions, &c.

Extracts from Return made to the Department of Science and Art, showing the extent, &c. to which Funds are applied to Technical Education (including Science, Art, Technical and Manual Instruction). *Byre and Spottiswoode, 1895.*

RETURN showing the EXTENT to which, and the MANNER in which, LOCAL AUTHORITIES in ENGLAND, WALES, SCOTLAND, and IRELAND are applying Funds to the purposes of TECHNICAL EDUCATION (including SCIENCE, ART, TECHNICAL and MANUAL INSTRUCTION).

Manner in which the Funds have been expended during the Year 1895-6.

	Amount appropriated to Technical Education out of the Residue Grant in the Year 1893-4.	Amount granted to Town Councils and Urban Authorities under Section I. (3) of the Local Taxation Act.	Amount expended.										Estimated or Actual Expenditure on Technical Education for the Year 1894-5, out of (a) Residue Grant, (b) Rates raised under the Technical Instruction Acts, and (c) Rates raised under the Public Libraries Acts.		
			In aiding the Supply of Technical Education.								In Scholarships and Exhibitions.	Expenses of Administration.		Other Purposes to which Funds have been applied.	Subjects taught.
			By Grants to Grammar or other Endowed Schools (governed by Schemes established under the Endowed Schools Acts); and under special Conditions.	By Grants to Schools and Classes (other than those included in Column 6) in receipt of Aid from the Department of Science and Art.	By Grants to other Schools, Institutions, &c.	Total (Columns 6 to 8.)	In	Expenses of Administration.	Other Purposes to which Funds have been applied.	Subjects taught.					
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.		
Grand Totals for England, excepting Monmouth, to which the Welsh Intermediate Education Act, 1889, applies.	£ s. d. 508,910 12 0	£ s. d. (a) 552,292 9 2 (b) 25,400 13 3 (c) 2,255 7 9	£ s. d. 42,536 12 1	£ s. d. 279,342 1 0	£ s. d. 15,323 11 2	£ s. d. 5,760 0 9	£ s. d. 44,262 11 6	£ s. d. 156,616 6 5	£ s. d. 18,916 8 7	£ s. d. 43,025 18 10	£ s. d. 12,521 0 3	..	£ s. d. (a) 418,538 12 3 (b) 35,250 2 6 (c) 1,524 14 10		
Grand Totals for Wales, including Monmouth, to which the Welsh Intermediate Education Act, 1889, applies.	£ s. d. 14,333 14 7	£ s. d. (a) 12,212 5 9 (b) 14,778 19 6 (c) 150 0 0	£ s. d. 230 0 0	£ s. d. 19,538 13 10	£ s. d. 150 0 0	£ s. d. 41,583 14 1	£ s. d. 1,277 10 0	£ s. d. 3,611 4 1	£ s. d. 2,887 7 7	£ s. d. 1,416 0 9	£ s. d. 47 19 0	..	£ s. d. (a) 22,295 16 1 (b) 17,599 14 2 (c) 150 0 0		
Grand Totals for Scotland (exclusive of expenditure by School Boards—see below)	£ s. d. 35,111 10 1	£ s. d. (a) 32,181 14 5 (b) 8,281 1 3 (c) 1,658 5 8	£ s. d. ..	£ s. d. 10,260 7 5	£ s. d. 969 11 7	£ s. d. 8,518 10 5	£ s. d. 8,579 16 3	£ s. d. 18,067 18 3	£ s. d. 544 18 4	£ s. d. 997 14 5	£ s. d. 2,373 16 0	..	£ s. d. (a) 35,059 12 6 (b) 3,290 16 6 (c) 1,658 0 0		
Totals for Ireland	£ s. d. ..	£ s. d. (a) 3,281 1 3 (b) 1,658 5 8	£ s. d. ..	£ s. d. 2,815 0 2	£ s. d. ..	£ s. d. 571 0 0	£ s. d. 457 0 0	£ s. d. 1,016 0 0	£ s. d. ..	£ s. d. 318 15 1	£ s. d. 129 14 8	..	£ s. d. (a) 3,290 16 6 (b) 1,658 0 0		
		£ s. d. 4,339 9 11											£ s. d. 4,748 16 6		

* A considerable proportion of the amounts included under cols. 4, 5, and 6, was applied to schools also in receipt of aid from the Department of Science and Art.

† In some of the Boards and Urban Districts the expenses of administration have been paid out of the grants received from the County Councils (col. 1), and not out of the sums raised by rate.

‡ Part of the amounts included under cols. 4 and 5 was applied to schools also in receipt of aid from the Department of Science and Art.

SCHOOL BOARDS.—			Subjects taught.	Remarks.
SCOTLAND.				
	Amount expended during the Year 1893-94.	Amount expended during the Year 1894-95.		
1.	2.	3.	4.	5.
	£ s. d.	£ s. d.		
Arbroath (Burgh)	12 2 10 (Also see col. 5)	27 18 10 (Also see col. 5)	Science and Art subjects of the Directory.	A new Higher Class School (including accommodation for Science and Art instruction) has been erected mainly by means of a loan of 11,500 <i>l.</i> from the Public Works Loan Commissioners. The loan is repayable from the School Fund.
Dalziel (Lanark)	117 8 2	187 9 8	Science and Art subjects of the Directory.	—
Elgin (Burgh)	74 7 5	56 19 8	Science and Art subjects of the Directory.	—
Glasghiel (Burgh) ...	14 9 5	50 9 0	Chemistry (Theoretical and Practical). Wool Dyeing. Cloth Weaving.	—
Old Monkland	769 11 0	578 9 1	Science and Art subjects of the Directory. Iron and Steel Manufacture. Mechanical Engineering. Brickwork and Masonry. Carpentry and Joinery. Mine Surveying. Manual Training. Shorthand.	—
Totals	987 18 10	901 6 3		

They refer on page 402 to the 34 subjects in which the City Guilds Authorities examine students in technical subjects.

From page 505 to 540 they give their conclusions on their researches. They consider that we still retain the lead in most technical work, but that Continental nations are advancing more rapidly than we are.

They introduce our machinery and methods, and improve upon them in many cases.

Page 508.—The Commissioners point out that the Continental technical schools are almost entirely supported by the State. They say: "Your Commissioners cannot repeat too often that they have been impressed with the general intelligence and technical knowledge of the masters and managers of industrial establishments on the Continent. They have found that these persons as a rule possess a sound knowledge of the sciences upon which their industry depends. They are familiar with every new scientific discovery of importance, and appreciate its applicability to their special industry. They adopt not only the inventions and improvements made in their own country, but also those of the world at large, thanks to their knowledge of foreign languages and of the conditions of manufacture prevalent elsewhere."

Page 507.—The Commissioners point out that the early supremacy of the English was in part due to loss of energy and capital on the Continent during the great wars of the early part of the century, and mention that various Acts of

the last century rendered it penal to enlist English artisans for employment abroad (these Acts were repealed in 1825), and that the exportation of spinning machinery to foreign countries was prohibited until the early years of the present reign. They add that when Continental countries began to construct railways and to erect modern mills, &c., "they found themselves face to face with a full grown industrial organisation in this country, which was almost a sealed book to those who could not obtain access to our factories."

They add that the English are fully alive to the necessity of technical education, and are doing much to forward the object. Their expressions of opinion as to the future of the movement are on pages 514 *et seq.* They are not suitable for abstracting, and are not of much importance, but the conviction is stated that the "workshop is really the best technical school in the world."

Vol. III., pages 643 to 690, contain letters showing the opinions of employers of labour, officers of trade societies, &c. in the United Kingdom. Generally speaking, they refer to the great value of museums, &c., and to the teaching of drawing, but there is a good deal of divergence of opinion on other questions.

Vol. IV. contains evidence given before the Commissioners by various persons, teachers, employers of labour, &c. There is little of interest as regards science, the bulk referring to drawing and ordinary workman's employments.

Vol. V. contains accounts of various colleges, &c., with plans, &c. of their workshops, laboratories, &c.

The PRESIDENT then read the report of the scrutators, from which it appeared that all the members and officers nominated had been duly elected. That gave him the honour of announcing officially that Dr. Schunck would be his successor, and he congratulated the Society on having for its President one who had contributed more to the chemistry of natural colouring matters than perhaps any living chemist, as was shown by researches such as those to be found in the Journal of the Chemical Society (see annexed list). Dr. Schunck's scientific industry was now released from the hindrances of business, and he trusted that

health would be given to him to crown a high scientific career by some further discovery, which perchance he might divulge at our next Annual General Meeting.

J. Chem. Soc.

24, 380	Anthraflavic acid.
1, 401	The products of decomposition of chrysammic acid.
12, 198	Colouring matters of madder.
19, 462	Products derived from indigo-blue.
5, 56	Rubian and its products of decomposition.
M. 1, 71	The substances contained in the lichens employed for the preparation of archil and cudbear.
M. 3, 144	Substances contained in <i>Rocella tinctoria</i> .
1873, 900	Methylalizarin and ethylalizarin

J. Chem. Soc.	
1874. 720	Colour of Nankin cotton.
1878. A. 885	Indigo-blue from <i>Polygonum tinctorium</i> and other plants.
1879. A. 532	On indigo-purpurin and indirubin.
1879. T. 528	Notes on the purple of the ancients.
1879. T. 589	Chlorophyll from <i>Eucalyptus globulus</i> .
1880. T. 613	
1880. A. 894	
1881. A. 606	
1887. A. 972	Constitution of chlorophyll.
1885. A. 1241	
1889. A. 297	
1888. T. 292	Supposed identity of rutin and quercitrin.
1888. P. 12	
1876. I. 591	A new acid isomeric with anthrallic acid.
1876. II. 88	Anthrallic and iso-anthrallic acids.
1876. II. 299	Anthrapurpurin and flavopurpurin.
1877. I. 645	Notes on madder colouring matters.
1878. T. 442	
1877. II. 624	Purpurin.
1877. II. 788	Mangistiu, ϵ -purpurin, and purpuroxanthine-carbonic acid.
1878. A. 77	Anthrallic acid and a new dioxanthraquinone.
1878. A. 322	Derivatives of flavopurpurin.
1878. A. 984	Anthranilin, a new dioxanthraquinone from m -oxybenzoic acid.
1878. A. 510	Comparison of ϵ -purpurin with purpuroxanthine-carbonic acid, and on anthrallic acid.
1879. A. 68	m -benzodioxanthraquinone.
1879. A. 654	α - and β -nitro-alizarin and β -amido-alizarin.
1879. A. 725	Nitro-alizarin.
1880. A. 424	Detection of alizarin, iso- and flavopurpurins, and the estimation of alizarin.

A. Abstracts.

M. Memoirs.

T. Transactions.

Dr. E. SCHÜCKER proposed that a cordial vote of thanks be accorded the President for his able and thoughtful address. He did not propose to discuss that address, but he might be allowed to refer to one part of it that greatly interested him, namely, the supposed pre-eminence in technical matters of foreign nations as compared with the English. He could say of his own knowledge, however, that Englishmen had greater natural ability than perhaps any other nation, and therefore any technical shortcomings that might exist could not be attributed to that cause, but must be due to lack of scientific training. In that respect Germany was first in the race. He was not sure that in discussing this question sufficient weight had been given to one point. Much had been said about the work of the great corporations in assisting technical science. But was it not possible that there might exist a great difference of sentiment and opinion on this matter? The greatest importance attached to early education; and when they found parents quite indifferent to their boys acquiring a profound knowledge of science, languages, and everything that constituted modern culture, and attaching far more importance to cricket and other athletic sports, no amount of financial help would have any lasting effect. This could be altered only by influencing public opinion, and could best be done through the instrumentality of societies such as this.

Sir HENRY ROSCOE seconded the motion, and in doing so said he was glad to learn from the address to which he had just listened that Mr. Tyrer did not take a pessimistic view of the industry in which they were concerned. Neither did he. He believed that their Society was doing a great work in bringing scientific and practical men together. He was astonished at the progress which chemistry had made in England during the last 30 years, both scientifically and practically. They must not, however, lose sight of the important fact referred to by the President, namely, the progress of their Continental competitors. He was quite in accord with Mr. Tyrer's views as to the desirability of establishing a teaching university in London, and trusted that before many years had passed it would be an accomplished fact. That the nation was making satisfactory progress in recognising the necessity and importance of scientific research was proved by a fact to which the President had not referred. The Royal Commission for the Exhibition of 1881 was now devoting 5,000*l.* a year to the maintenance of scientific scholarships in various departments of industry. This was only one instance of the general interest now awakened in the subject of scientific education—a subject which their Society had done much and would do still more to encourage. The resolution was then put by the President-Elect, and was carried by acclamation.

The President then briefly thanked the meeting.

The Council for 1896–97 is composed as follows:—

President:

Dr. Edward Schüneck, F.R.S.

Vice-Presidents:

Chas. Dreyfus.	A. Gordon Salomon.
Dr. A. Dupre, F.R.S.	E. C. C. Stanford.
Prof. A. K. Huntington.	G. N. Stoker.
A. H. Mason.	Dr. T. E. Thorpe, F.R.S.
Bovort on Redwood.	Prof. W. A. Tilden, F.R.S.
Sir H. E. Roscoe, F.R.S.	Thomas Tyrer.

Ordinary Members of Council:

George Beilby.	C. C. Hutchinson.
R. Forbes Carpenter.	Ivan Levinstein.
R. Le Neve Foster.	J. S. McArthur.
Oscar Guttman.	B. E. R. Newlands.
Douglas Herman.	Sir Robt. Pullar.
David Howard.	Wm. Thorp, B.Sc.

With the Chairmen and Secretaries of Sections.

Honorary Treasurer:

E. Rider Cook.

Hon. Foreign Secretary:

Ludwig Mond, F.R.S.

Mr. C. C. HUTCHINSON proposed that Messrs. Miall, Wilkins, Randall, and Co., be elected auditors for the ensuing year at a remuneration of 10 guineas. This was seconded by Mr. Thos. Fairley, and carried.

Sir R. PULLAR proposed that Mr. E. Rider Cook be re-elected the representative of the Society on the Council of the Imperial Institute. The proposal was adopted.

Mr. THOS. MACFARLANE, in seconding the motion, said that as a member residing in the Dominion of Canada he would express the hope that Mr. Cook's activity in the position he was to occupy would contribute towards bringing into existence closer trade relations between Great Britain and her colonies and dependencies than existed at present. The motion was carried unanimously.

Mr. GEORGE E. DAVIS said that he was deputed by the Manchester Section to convey a most cordial invitation to the Society to hold its next Annual Meeting in Manchester. It would be, he said, 10 years since the Society visited that town, and though they could not hope to provide a programme equal to that of the present meeting, they would do their best to make the members heartily welcome.

Dr. C. DRYVER, in seconding the motion, hoped Manchester would be able to show their visitors such evidence of progress during the last 10 years as would surprise them. It was unanimously resolved that the invitation of the Manchester Section be accepted.

Mr. DAVID HOWARD moved that the best thanks of the Society be given to the Master and Wardens of the Carpenters' Company for their hospitality that day. They had heard something of what the Company had done for technical education. But their work was not to be measured merely by the amount of the cheques drawn; what was far more important was the wisdom which had guided them in applying their gifts, and the constant thought and care which they had devoted to the cause they wished to help.

Mr. E. K. MESSYATT had much pleasure in seconding the motion. The recital of the long list of City Companies that had aided technical education made him regret that there existed as yet no Worshipful Company of Industrial Chemists, in whose hall they would naturally hold their London meetings. Reference had been made to the greater encouragement given to scientific education and research by foreign Governments as compared with our own, and Dr. Schüneck had remarked on the necessity for educating public opinion. He would suggest that they should commence by educating the opinion of the Chancellor of the Exchequer, who seemed far more alive to the needs of the army and navy than to the importance of national educa-

tion. That was a wrong state of things, and he thought it should be remedied by the foundation of a much larger number of scientific scholarships throughout the country. The vote was then put by the President and carried by acclamation.

Mr. A. PRESTON acknowledged the vote on behalf of the Master and Wardens, who were unavoidably absent at that moment, and in doing so endorsed the remarks that had been made as to the importance of better technical education—which he thought applied to masters as well as to subordinates. He assured the Society that the Carpenters' Company thoroughly sympathised with their views, and were very happy in being of service to them that day.

VISITS TO WORKS AND PLACES OF LOCAL INTEREST.

After the conclusion of the morning's business, luncheon was partaken of at the Cannon Street Hotel by invitation of the London Section. The company numbered about 300. After lunch the following works were visited:—

THE WORKS OF THE COLONIAL CONSIGNMENT AND DISTRIBUTING COMPANY, LTD.

[Small installation of cold storage and refrigerating machinery under Cannon Street Station, and large installation, Nelson's Wharf, Lambeth, S.E.]

Both these installations were visited by parties of members. The following is a description of machinery and process of meat refrigeration and storage at Nelson's Wharf:—

During the year 1895 no fewer than 3,423,347 carcasses of frozen sheep and lambs, and 323,698 quarters and pieces of beef, arrived in England from New Zealand and Australia alone (without counting 1,652,625 sheep and 12,418 quarters of beef from the River Plate, and 19,432 sheep from the Falkland Islands), a total of 5,095,404 frozen sheep and lambs, and 336,116 quarters of beef in the year; and for the first six months of this year a total of 3,214,660 frozen sheep and lambs, and 155,195 quarters of beef, have been received from the same sources of supply.

The extensive buildings at Nelson's Wharf, devoted to cold storage, &c., were erected by Nelson Brothers, Ltd. Instead of entering them from the ground floor they are entered from the sixth storey, to which one is carried by a lift. Of side doors there are none, and the only entrances are just under the roof. The reason for this arrangement is that, as cold air sinks, whilst warm air rises, it is found best to have the freezing chambers as low down as possible, and to enter them from a "shaft" by means of a lift passing through the various "levels" or floors. This arrangement minimises the chance of the cold air escaping into the atmosphere outside. Arriving at the top floor, a series of rooms is found where the work of receiving, weighing, and consigning is carried on. Here there are elevators, or endless chains, with, at fixed distances, projecting irons forming "cradles" where the carcasses of sheep can be placed direct from the barges into which they have been loaded from the ocean-going steamers in the docks. Placed in one of these cradles, the sheep is carried by the elevator to the centre of the room on the sixth storey, and there it falls on to a table where men are at work sorting the carcasses according to the different brands, afterwards pushing them on trucks to the "shafts," down which they are taken to the series of freezing chambers in which they will be stored as long as may be necessary. It is possible to raise as many as 1,500 carcasses per hour in this manner from the river barges; in fact, the elevators will work much faster than the men above can dispose of the carcasses falling on the tables before them. It is no unusual thing for 12,000 sheep to be received here in the course of a day from the eight barges which are kept constantly working, though 10,000 is regarded as an average day's work.

Descending some steps into the cold storage chamber beneath, like the 'tween decks of some gigantic ship, with "bays" about 23 ft. deep on each side, most of the sheep, laid in bags, are seen piled one on top of another. The temperature is 20° F., and the elaborate series of pipes

running the whole length of the chamber and into each bay, are covered with hoar frost, which is, in places, at least an inch thick. It is necessary to have two men constantly employed in keeping the pipes clear, so that the *maximum* of cold which the pipes are capable of conveying may be secured. In the lowest of the cold chambers, however, the pipes give very little trouble, as by the time the air reaches them from the top storey it has so far lost its humidity that the deposit of rime is very slight indeed.

This floor is so extensive that it is divided into three sections, with fire-proof doors between each. There are four other floors beneath, of exactly the same size and description, and, altogether, it is possible to store no fewer than 250,000 sheep in this one building, with an absolute guarantee that they will be as fresh when they are brought out as when they were put in. The average stock in hand is about 150,000.

At the other end of the series of rooms forming the top floor one looks down upon a large covered-in yard, where, by means of lifts and elevators, a number of railway vans are being loaded with sheep, which, sent down from the sixth storey, are going to all parts of the country. This one establishment is now dealing with frozen colonial sheep and lambs at the rate of about 1,500,000 a year, to say nothing of miscellaneous thousands of single joints, and 90,000 or 100,000 quarters of beef from Queensland.

The whole place is illuminated by 1,600 electric lights, gas being only used in the offices.

The cold of the freezing chambers is produced by means of ammonia, which is first compressed, condensed, and liquefied under pressure, and then driven through the pipes until it reaches a point where, passing through an aperture about the size of the point of a needle, it suddenly expands, assumes its natural volume, and, at the same time, produces intense cold.

Defrosting Process.—The Chairman of the Company, Mr. E. Montague Nelson, has devised a process by which the frost is removed from frozen meat, the meat returning to its original state and recovering its pristine flavour and juiciness. Hurried thawing makes the meat flabby and unsightly. Mr. Nelson's system is carried out in chambers in which steam pipes are carried along an open battened floor, the warm air rising from these passes over the meat hanging in the chamber, and, by natural circulation, is attracted to a number of pipes of expanded ammonia attached to the walls, and all moisture is deposited on these pipes as snow. Four days are required to thoroughly remove the frost, which means excess of moisture, from quarters of beef and two days from carcasses of mutton; beginning at 35° F. there is a gradual rise of temperature till 55° is reached, and the meat is restored to its original state, dry and bright looking, without any of the dripping and moisture usually observed on thawed meat. Eighteen chambers are devoted to this work, capable of "defrosting" 2,000 quarters of beef and 5,000 sheep weekly.

Among the machinery, &c. at Nelson's Wharf are:—

Two De la Vergne Sterne ammonia compression machines, used alternately. Vertical compressing cylinders 12 ins. × 24 ins. Horizontal steam cylinders, compound and condensing. Capacity of each machine expressed in terms of ice manufactured per 24 hours = 10 tons.

One small machine on the above system, but with single acting compressor. Ice, tons capacity, 2. Used experimentally, but now disconnected.

One Haslam's cold air machine, compound, duplex, and condensing. Cubic feet of air, at about 80° F. below zero, delivered per hour = 170,000. Two air compressors 2½ ins. diameter, 36-in. stroke, at 80 revolutions = 350 h.p. Ice equivalent, 34 tons.

One (Smith and Vale) hydraulic pump, compound duplex condensing, and accumulator, loaded to 28 tons; pressure water = 750 lb. per square inch. Service constant. (The London Hydraulic Power Company's water is available at need.)

19 hydraulic apparatus for lifting.

One mechanical stoker engine.

Three steam boilers, two usually under steam at 140 lb. per square inch working pressure at one time. Vicar's mechanical stokers.

One general surface condenser and air pump.

THE TOWER BRIDGE.

This beautiful structure was a work undertaken by the Corporation of London for connecting the Middlesex with the Surrey side of the Thames, the original proposal for a bascule opening bridge having been made by the City architect, the late Sir Horace Jones, with whom was associated Mr. J. Wolfe Barry, engineer to the undertaking. The Bridge House Estates Committee directed the undertaking and Mr. G. E. W. Crutwell was resident engineer. The contractors for the steelwork were Messrs. Sir Wm. Arrol and Co., the contract for the work being let in July 1889, for the construction and erection of between 13,000 and 14,000 tons of iron and steel work; Mr. J. E. Tait was engineer in charge. Messrs. Perry and Co. were contractors for the masonry, and Messrs. Sir Wm. Armstrong, Mitchell, and Co. supplied the hydraulic machinery.

The bridge consists of three spans, *viz.*, two approaches on the suspension principle and a central lifting bridge. Subsidiary to the latter there are two foot-bridges at a sufficient height to allow for the masts of vessels requiring to proceed to the wharves higher up the river, to pass underneath. The middle span is 200 ft. in the clear, whilst those on either side are 270 ft. each. The opening bridge is on the bascule system, each leaf extending 100 ft. These leaves are actuated by hydraulic machinery, placed in suitable chambers in the piers. The centre of the pivot is 13 ft. 3 in. inside the face of the pier, so that the total length of each movable part from the centre of the pivot to the end is 113 ft. 3 in. The short end of the lifting part is 49 ft. 3 in. This is loaded at the end with kentledge to balance the longer arm, which projects over the waterway when the bridge is closed. Although the towers forming the principal features in the bridge appear to be of masonry, the main structure is steel; that is to say, there is a steel skeleton clothed with stonework. This method of construction adds not only to the expense, but to the weight to be borne by the foundations; it has, however, been adopted in order that the bridge may harmonise with the Tower of London.

The main piers contain hydraulic machinery for operating the bascule, and the footways above are approached by means of hydraulic lifts in the towers themselves. The length of each of the fixed spans forming the footways is 237 ft., and each consists of two cantilevers and a centre girder. The height of the columns of the towers is 119 ft. 3 in. There are three landings to each tower, the floors being of steel. The approaches to the piers are on the suspension principle, but the chains are of novel design, being formed of two segments of unequal lengths. The central bridge consists, as already stated, of two fixed and one opening span, the two fixed spans forming the high-level footway. The distance between the two piers is a little over 230 ft., and the height in the clear, above Trinity high water, is 140 ft. The waterway between the piers is 200 ft. wide.

Returning to the towers, there are four lifts to the high-level roadways, two in each tower, the cages being each 14 ft. by 6 ft. For those preferring the exercise of walking, staircases are provided.

Permission to inspect the bridge and its machinery was kindly accorded by the Corporation of the City of London (W. H. Liversidge, Esq., Chairman of the Bridge Committee), and the members, by the courtesy of the bridge-master, were conducted in parties of 25 at one time. A full and illustrated description of the Tower bridge, its history, machinery, and construction, will be found in *Engineering*, 1893, Vol. 56, Nos. 1447, 1448, 1449, 1450, and 1451; also illustrations in Vol. 57, No. 1487.

MESSRS. COMBE, DELAFIELD, AND CO.'S BREWERY.

The visitors were met at the entrance to the brewery by Mr. John Combe and Mr. Frank Wilson (President of the

Institute of Brewers), and conducted in parties of about twenty.

This brewery, situated in Castle Street, Long Acre, was started more than 100 years ago by Thomas Shackle, but the present business was virtually founded by Mr. Harvey Christian Combe at the beginning of the century, and was the scene in 1807 of the famous brew-house dinner of rump steaks and porter, given by him to the Royal Family in one of the mash tuns.

Since this time the brewery has been considerably enlarged.

The brewing plant consists of five mash tuns, of a total capacity of about 600 qrs.; from these the wort runs into the underbacks, to be pumped to the coppers, of which there are six, all boiled by Jucke's revolving furnaces; the capacity of the coppers varies from 200—500 barrels. The seven coolers are supplied with seven refrigerators for cooling the wort; from these it runs to the fermenting tuns, which vary from 100—600 barrels capacity. During the summer months the air over these is cooled by a series of brine pipes, worked by a Reece's ammonia absorption machine, capable of absorbing 600,000 thermal units per hour.

The water for refrigerating purposes is cooled by three of Hall's carbonic acid machines, each of 400,000 to 500,000 thermal units per hour capacity.

All the yeast used in this brewery since 1893 has been a single-cell yeast grown according to Prof. Hansen's system of pure yeast culture.

The pure culture is grown in Hansen's pure yeast cultivating apparatus, from which the yeast in the brewery is renewed at frequent intervals. The following is a short description of the preparation of a pure yeast culture:—

Some of the yeast, from which it is desired to prepare the pure culture, is largely diluted with water, well shaken, and a drop of it added to some liquefied wort gelatin; this is again shaken, and a drop of the mixture is withdrawn by a glass rod and spread on the under surface of a thin cover-glass which is cemented on to the ring of a Böttcher moist chamber, the other edge of the ring being made fast to a glass slide by smearing it with vaselin.

When the gelatin has solidified, the position of the cells embedded in it, is marked; it is then left for two or three days at about 50° F.; at the end of this time the specks of yeast may be taken off by a short piece of platinum wire and the wire dropped into wort contained in a Pasteur flask. From this we get a growth of yeast known to proceed from a single cell, which is used to infect other flasks, which in their turn are used to infect the Hansen apparatus. Throughout the whole process all apparatus and nutritive material must be carefully sterilised.

The pure culture once made may be preserved for years in a 10 per cent. solution of cane sugar, from which the fermentations in the Hansen apparatus may be restarted when it has been necessary, for repairs, &c., to clean out the machine.

From the large fermenting vessels, which are mostly wood—and some, wood lined with copper,—the beer is cleanned into the pontos—small wooden vessels of 5- to 10-barrel capacity; here the yeast works off, and is run into shallow iron backs cooled by water from the ice machine.

The cooperage is situated about three minutes' walk from the brewery; as the casks return from customers they are examined as to their soundness and sweetness; after having been cleaned on the rummaging machines, washed with boiling water, and steamed, they are returned clean to the brewery.

MESSRS. REID AND CO.'S BREWERY, CLERKENWELL ROAD.

About 30 members availed themselves of the invitation to visit the brewery of Messrs. Reid and Co., Clerkenwell Road, accompanied by Mr. John Heron. They were received by Mr. Tanqueray and the brewing staff, and were conducted over the brewery in parties, the machinery and various processes being fully explained. After visiting the brewing department and the ice machinery, they were conducted to the stores, where they were invited to test the merit of the "Imperial Stout" for which this brewery is noted.

RECEPTION AND CONVERSAZIONE AT THE MANSION HOUSE.

The Lord Mayor of London, Sir Walter Wilkin, and the Lady Mayoress, had on this occasion a double function to perform, two sets of invitations having been issued—one to meet the President of the Royal Society (Sir Joseph Lister) and the members of the International Conference on the Classification of Scientific Literature; the other to meet members of the Society of Chemical Industry, with their President, Mr. Thomas Tyrer, and the President-Elect, Dr. Ed. Schunck.

Over 800 guests crowded the Saloon, Egyptian Hall, and the adjacent apartments, conversing, admiring the display of civic plate, listening to the music of the band of the Royal Artillery, Woolwich, and the students of the Guildhall School of Music. The Lord Mayor and the Lady Mayoress received their guests with the state usual on such occasions.

SECOND DAY.—THURSDAY, JULY 16.

RIVER THAMES EXCURSION.—CAVERSHAM TO WINDSOR.

About 400 members and friends with their ladies started from Paddington Station for Reading at 9.10 a.m. Embarking in launches at Caversham Lock they proceeded down-stream past Shiplake, Wargrave, and Henley, to Medmenham Abbey, where luncheon was served. Unfortunately the weather was cold and damp, with a lowering sky and north-east wind. There were, however, spacious saloons in the launches, where those more thinly clad could assemble. After luncheon the launches proceeded past Great Marlow, Cliveden, Boulter's Lock, and Bray to Surley Hall, where tea was served in a large tent. After tea, the gentlemen of the Eton College Choir sang a selection of glees which were greatly appreciated. The launches then proceeded to Windsor, and the party returned by special train to Paddington at about 9.29 p.m.

THIRD DAY.—FRIDAY, JULY 17.

THE ROYAL ARSENAL, WOOLWICH, ORDNANCE FACTORIES.

On arrival at the Royal Arsenal, the party was divided into sections, each containing about 30 members. Each section was preceded by a man with a staff, bearing a number, and was accompanied by a guide in uniform to furnish explanations and to give descriptions of all that was to be seen. The whole arrangements were carried out under the supervision of the Director-General of Ordnance Factories. The following operations were seen by the members:—

1. *Royal Laboratory*.—Bullet making. Lead squirting. Manufacture of rifle bullets. Manufacture of lead cores and cupro-nickel envelopes for magazine rifle bullets; assembling and finishing the same.

2. Manufacture of solid drawn brass cartridge cases for quick-firing guns. Drawing. Indenting. Heading and finishing operations.

3. Manufacture of zinc and brass cartridge cylinders and cases.

4. Manufacture of metal time fuzes. Exhibition of specimens showing various operations.

5. Shell forging. Manufacture of quick-firing shell bodies.

6. Cast steel shell making. Sand mixing. Core making. Moulding. Casting. Annealing. Grinding, &c.

7. *Royal Carriage Department*.—Manufacture of siege, field, quick-firing, and machine gun carriages. Various operations. Exhibition and explanation of finished carriages.

8. General machine operations and work on mountings for heavy ordnance.

9. Band saw for metal work.

10. Steam saw mills.

11. Tiring gun-carriage wheels.

12. General woodwork in connection with carriages.

13. Small-arm and quick-firing ammunition box making. Machine planing, dovetailing, nailing, &c.

14. Large band saw for timber.

15. Wheel making. Turning spokes and other copying-lathe work. Making felloes. Pressing wheel together. Saddle-tree making.

16. *Royal Gun Factories*.—Oil-hardening hoop for heavy breech-loading gun.

17. General operations in connection with heavy breech-loading guns. Boring hoops and tubes, rifling, &c.

18. Breech mechanisms. Working models of breech mechanisms of heavy B.L. guns. Examination and explanation of 12-pr. field guns, and of 6-pr. and 4.7" quick-firing guns.

19. Wire winding.

20. Manufacture of field and quick-firing guns.

21. Sighting and completion of B.L. guns.

22. Shrinking hoop on to B.L. gun.

23. *Harness Stores*.—Inspection of.

LUNCHEON.

A Luncheon was provided in the Masonic Temple, Mount Pleasant, the Upper and Lower Halls of which were filled with members. The President took the chair in the Upper Hall, and Mr. B. E. R. Newlands, Chairman of the London Section, presided in the Lower one. Speeches were made by the President and Chairmen of the London and New York Sections.

Professor CHANDLER, Chairman of the New York Section, said that, with regard to the unpleasant feelings sometimes said to exist in America against Great Britain, he could assure them that if ever such feelings did exist they only lasted for a moment, and even then were entertained only by a very limited portion of the population. The majority of Americans regarded themselves almost as Britishers, and in many instances did their best to imitate the British, as was proved by the fact that in establishing the American branch of the Society of Chemical Industry they had taken the English Society as their model. Personally he could assure them that there was not a drop of blood in his veins that was not English, for his ancestors went to Boston in 1664.

After lunch, the members proceeded by tramcars from the Arsenal Gates to Charlton, near to the

WORKS OF MESSRS. SIEMENS BROS. AND CO.

Here again the members were divided into parties, each led by a guide, who described the various operations carried out in the workshops. The arrangements were under the direction of Mr. G. Palgrave Simpson. The following departments and shops were thus visited:—

Milling Shop.—Special cutters for milling small metal pieces. Capstan lathes for screws, nuts, &c. Putting together commutators for dynamos.

Winding Shop.—Winding cotton-covered copper wire on electro-magnet bobbins. Building up dynamo armatures. Winding transformers.

Dynamo Shop 1.—Lathes, drills, and boring machines. Punching machines for iron core discs, and copper end connections.

Dynamo Shop 11.—Large lathes and boring machines for heavy work, such as magnets of dynamos, bed-plates, &c. Longitudinal and circular planing machines. Electrically driven travellers.

Testing Shop for Machines.—All machines are thoroughly tested under conditions similar to those under which they will have to work. Fusing length of iron wire by passage of a powerful current of electricity.

Testing Shop for Lamps and Instruments.—Arc lamps adjusted and regulated. Ammeters and voltmeters tested and calibrated.

Electrical Fire Engine.—Can be got to work at once by attaching its electric motor driving a rotary pump to the electric distributing mains by means of a concentric cable.

Pressure Tank.—All core for deep-sea cable is submitted to hydraulic pressure, so as to search out any little defect.

India-Rubber Shops.—The raw rubber is cut up and washed under rollers, which also tear it up. It is then dried and passed through the mixing rollers, where it may have sulphur incorporated with it if it is to be vulcanised. This is done in large steam-heated vessels.

Covering Shops.—Tinned copper wires, either single or stranded together, are covered with the prepared rubber cut into strips, and with tape or braiding.

Show Room.—A museum of historical and modern apparatus and instruments.

Core Tanks.—The gutta-percha covered core for submarine cables, as well as all india-rubber core, is here tested under water at two different temperatures.

Instrument Shop and Adjusting Room.—Making delicate instruments by skilled mechanics. After being made in the shop, all electrical and telegraph instruments are overhauled and adjusted.

Carpenters' Shop.—For pattern making, and making of cases and stands for instruments.

Switchboard Shop.—Mounting instruments and controlling gear on slate or marble frames for electric light stations.

Insulator and Battery Shop.—Porcelain insulators of all shapes and kinds. Galvanising stalks, brackets, &c. Galvanic batteries, wet and dry.

Cable Shop.—Making submarine cables. The core served with a covering of jute yarn passes from the small tanks into the rear of the sheathing machine, through the hollow axle of a circular frame carrying bobbins filled with steel wire; this frame revolves and lays the wires round the core without any twist; these are covered with alternate layers of compound and jute yarn, and pass finally to the tanks.

Cable Testing Room.—During the whole time of manufacture the cable is kept under electrical test to make sure that all is going right.

Cable Tanks.—In these the completed cable is stored under water until such time as it is delivered on board ship.

Lead Cable Shop.—Stranded copper conductors are covered with yarn, which is then thoroughly dried and soaked in a bituminous insulating compound. The covered wire is then passed up through a hydraulic press, which squeezes out a continuous lead pipe round it. The lead-cased cable is then further protected by iron armouring.

Wire Testing Room.—All wire delivered to the works is tested for strength and homogeneity.

Power Station.—The whole of the machinery throughout the works is driven by electric motors situated in the several shops. Here are collected the engines and dynamos for supplying the electric current, which is used also for lighting the shops and offices, being distributed to all parts by underground cables.

The total force represented in the electric department is estimated as about 1,200 horse-power.

PRESIDENT'S RECEPTION AND ANNUAL DINNER AT THE HOTEL CECIL.

At 7 p.m. the President held a Reception in the Drawing Room, after which, at 7.30 p.m., the members and guests dined in two large rooms, in one of which the chair was occupied by the President, in the other by Mr. B. E. R. Newlands (Chairman of the London Section).

After the usual loyal toasts, the healths of Prof. C. F. Chandler, Chairman-Elect of the New York Section, and Mr. B. E. R. Newlands, Chairman of the London Section, were proposed and drunk.

SMOKING CONCERT.

After dinner, the company adjourned to the Prince's Hall of the Hotel Cecil, where a Smoking Concert was held. An attractive programme of glees, songs, and recitations was provided, the artists being Mr. Edward Walford and the Guildhall Glee Singers (Messrs. Burford, Simmons, Williams, and Hinchliff); accompanist, Mr. R. W. Browne. Recitations were given by Messrs. Chas. Collette and E. J. O'Lea, and humorous speeches by Dr. J. Lewkowitsch and Mr. B. E. R. Newlands.

The toast, "Success to the Society of Chemical Industry," was proposed by the President during an interval, and was received with enthusiasm.

Mr. B. E. R. NEWLANDS proposed the "Health of the President," who, in briefly responding, desired the members, as the best thanks they could render him, to ponder well the grave issues he feared he had put before them in his address only too feebly; and next, to increase the value of the Society's Journal as a medium of technical information and the membership, so that the influence of the Society as a "power in the land" might become a great reality.

London Section.

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Hon. Local Secretary: John Heron,
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Hugo Schweitzer, 153, Front Street, New York, U.S.A.

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I.—PLANT, APPARATUS, AND MACHINERY.**PATENTS.***Evaporating, Condensing, and Cooling Fluids, Improved Method of and Apparatus for.* E. Theisen, Baden-Baden, Germany. Eng. Pat. 10,571, May 28, 1895.

INSTEAD of using a fan or similar device to secure the passage of air currents over the wet surfaces to be heated or cooled, the patentee forces the liquid through jets or nozzles placed centrally in tubes, whereby he claims that a rapid current of air is induced in the tube, "the frictional contact of which with the layer of liquid will produce an intense evaporative and cooling action."—O. H.

Evaporating, Condensing, and Cooling Fluids, Improvements in Apparatus for. E. Theisen, Baden-Baden, Germany. Eng. Pat. 4604, Feb. 29, 1896.

THE patentee describes several arrangements for the purposes set forth, the essential features of which consist in the delivery of the liquor under pressure, through reaction-nozzles on to the surface of a condenser; fan or propeller blades are attached to the nozzle pieces. The reaction causes the revolution of the fan blades with the nozzles, producing at the same time a current of air over the surface of the condenser, as well as spray of the liquid. See preceding patent.—O. H.

Cooling Apparatus for Liquids, Improvements in. H. Krack, Teplitz, Austria. Eng. Pat. 6749, March 27, 1896.

THE principle of the apparatus consists in the use of a series of flat tubes arranged in steps or terraces, and fixed on an adjustable inclined tray or support, at such an angle that the liquid to be cooled flows slowly over the cooling pipes: the upper and under surfaces of the pipes are always surrounded by liquid.—O. H.

Heating, Cooling, or Attenuating Water or Liquids, Improvements in Apparatus for. H. Prince, London. Eng. Pat. 8444, April 29, 1895.

THE apparatus described is practically an injector, fitted to steam and water supplies, so that by manipulating the steam or cold-water valves, steam alone, or water of any desired temperature, may be obtained.—O. H.

* Any of these specifications may be obtained by post by remitting 5s.—the price now fixed for all specifications, postage included—to Sir Henry Reader Lack, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Filtering Material, Construction and Manufacture of; Improvements in. A. Smith, London. Eng. Pat. 11,973, June 5, 1895.

THE improvements consist in making filtering blocks or plates of coarse material and covering them with a thin coating of charcoal or other suitable material sufficiently fine to arrest any pathogenic or other germs that may be in the water filtered, thereby rendering such water sterile.

—O. H.

Basket or Packing Case, Improved, for Carboys of Acid and other Goods. C. Pottier, Paris. Eng. Pat. 11,405, June 11, 1895.

THE patentee claims "an improved basket or packing case for carboys of acid and other goods, consisting of the combination of an upper and lower ring of bent wood, uprights of flat iron or steel, intermediate rings of flat iron or steel, or of wood- or wicker-work, and a bottom of flat metal strips crossing each other, and having a central elastic guard."

—A. S.

Cooling Liquids, Improvements in Means for. H. Bamford, sen., S. B. Bamford, H. Bamford, jun., J. Bamford, Uttoxeter. Eng. Pat. 12,350, June 26, 1895.

THE object of this invention is to prevent the bulging which frequently takes place in the ordinary corrugated-plate refrigerator when any slight choking occurs.

To secure this end, suitable internal stiffening stays or strips of \sim -shape are fixed or soldered to the inside surfaces of the corrugated plates, so that when the plates are brought together and slid into position, the respective edges of the stays become locked together, thus holding the plates firmly.—O. H.

Sugar and like Substances, Melting of; Improvements in and relating to Machinery for. M. Blake, Greenock. Eng. Pat. 12,362, June 26, 1895.

THE apparatus essentially consists of a long cylindrical vessel running on rollers, and which may be either slightly inclined or horizontal. The rollers are connected to suitable gearing, and a slow rotatory motion is imparted to the cylinder. The inside of the vessel is fitted with blades, which may vary in size and disposition. The charging end is fitted with a stuffing box and gland which rotates with the machine, and works into a trunnion piece, bolted on to the bend and bracket forming part of the hopper. At the discharging end, a similar stuffing box and gland with a fixed trunnion siphon pipe is provided, so that in continuous working there is no obstruction to the charging or discharging of the apparatus. The claim is for "rotary acting machines for melting sugar and the like."—J. L. B.

Liquefying Gases or Gaseous Mixtures, and for Producing Cold, more particularly applicable for separating Oxygen from Atmospheric Air; Process and Apparatus for. C. Lände, Munich, Bavaria. Eng. Pat. 12,528, June 28, 1895.

THIS process consists essentially in allowing the gas or gaseous mixture to expand so as to produce a lower temperature, the amount of cooling being in accordance (Centigrade degrees) with the following equation:—

$$\delta = 0.276 (p^2 - p^1) \left(\frac{273}{T} \right)^2,$$

where $p^2 - p^1$ indicates the difference of pressure, and T the absolute temperature of the outflow. The invention is particularly described in connection with separating oxygen from atmospheric air, in which case the air, say at pressure (p^2) and temperature (T^2), is compressed by a pump to $p^1 T^1$, and thence passes to the main compressor, where it is raised to $p^2 T^2$. From here it passes to a cooling apparatus, which it leaves at $p^2 T^3$, and passes to a junction, from which the main current passes to a heat exchanger. This consists of a helical tube arranged within a larger helical tube through which cooled gas passes in the reverse direction. Leaving this at $p^2 T^4$, the air passes through a constricted orifice into a chamber, where it expands to p^1 , and is proportionately reduced in temperature to T^5 . The cooled expanded air passes out to the outer coil of the heat

exchanger above, thus further reducing the temperature of the incoming air, and is led back to the main compressor. After a time, some of the air in the expansion chamber liquefies and collects at the bottom thereof, the uncondensed portion passing back as before. This liquid air is drawn off through a tube having a regulating valve, into a vessel having a lower pressure p^3 , whereby a portion of the liquid, namely, the nitrogen or a part thereof, evaporates. In this vessel is arranged a coiled pipe through which some of the air at $p^2 T^5$ is led from the before-mentioned junction, whereby further nitrogen is evaporated, and practically pure liquid oxygen remains, which may be withdrawn for any desired use. The evaporated nitrogen gas passes through the outer coil of a reversed-flow heat exchanger similar to the one above mentioned, through which the air used in the last vessel passes on its way from the junction. The nitrogen then escapes. If the oxygen be required in the gaseous form, it is allowed to overflow from the vessel wherein it is collected in the pure state to a third heat exchanger, through which a portion of the air at $p^2 T^5$ from the junction may be led, whereby the latter is cooled to T^6 and is then led to the inlet of the expansion vessel, while the oxygen evaporates. Drawings are given of two modified forms of the actual apparatus employed. The whole apparatus must be perfectly enclosed in a good isolating medium, without any parts of it, either fixed or moving, being exposed to atmospheric temperature; while the internal parts which move by friction must not be subject to the low temperatures required for liquefying the air. The heat exchangers may be formed of long metal channels instead of tubes.—R. S.

Filtering Apparatus, Improvements in and relating to. H. J. E. Jensen, Hamburg, Germany. Eng. Pat. 12,597, June 29, 1895.

THIS filtering apparatus, intended for filtering wine, beer, and the like, is constructed with an upper distributing chamber contracted somewhat at its lower part, and carrying therefrom a perforated surface or wire-gauze sieve lined internally with asbestos or similar filtering fibres, and having a solid bottom. The filtered liquid passes into an outer cylindrical receiver provided with a draw-off cock. The upper distributing chamber has a central supply funnel, the tubular lower portion of which is either perforated, whilst its bottom is covered with a metal plate, or the tube is unperforated and the metal plate arranged so as to leave a space all around, between it and the lower end of the tube. The supply of liquid to the funnel is regulated by a ball valve, having a stationary slotted plug and a movable casing, to which is attached the pipe carrying the ball. The pipe is extended downwards by two arms or branches which dip into the liquid in the funnel.—R. S.

Superheated Steam, Improvements in the Method of and Apparatus for the Production of. F. Bornmann-Zix, Zürich, Switzerland. Eng. Pat. 13,896, July 20, 1895.

THIS apparatus consists of a vertical cylindrical casing, in the bottom of which is a reservoir, above that a furnace, and above the latter a central steam producer surrounded by a superheating coil. The reservoir has two charging pipes, for air and water respectively, leading from suitable forcing apparatus, and two discharge tubes, one at the bottom for water and the other at the top for air. These tubes pass, one each side of the apparatus, up to a disperser or spray producer arranged immediately above the top of the apparatus, whereby a fine spray is introduced into the steam producer. By means of the furnace below, steam is produced, and led by a tube from the centre of the bottom of the producer on one side and into the top of the superheating coil outside. From the latter the superheated steam passes up a vertical pipe to the outlet.—R. S.

Soap and other like Plastic Substances, Improvements in the Kneading and Moulding of, and in Apparatus therefor. W. P. Thompson, Liverpool. From A. and E. des Cressonnières, Brussels. Eng. Pat. 19,960, Oct. 23, 1895.

TO obviate irregularity of working and lack of uniformity of composition of the material kneaded or moulded, an ordinary kneading apparatus is connected with one in

which combined feeding and squeezing are effected. The cylinders of the former are arranged in a lateral opening of the drum, parallel to the axis of the screw conveyor, whilst the knives or scrapers are fixed in such a way that the scrapings fall between the blades of the screw conveyor, and are immediately carried forward to the mould. It is claimed that by this process no irregularity in kneading can occur, and that the quantity of material introduced can be exactly regulated.—C. A. M.

Heating or Cooling Agent [Glycerin], New or Improved. A. J. Boulton, London. From M. W. Judell, Petersburg, South Australia. Eng. Pat. 3575, Feb. 17, 1896.

GLYCERIN or its allied products, either alone or mixed with water, is used as a heating or cooling agent in jackets, chambers, pipes, and the like. A number of applications are mentioned, but the invention is generally applicable.—R. S.

Furnaces, Improvements in. W. R. Jones, Rome, Italy. Eng. Pat. 7878, April 14, 1896.

THE invention primarily relates to furnaces for heating gas retorts. The sides and back of the furnace are built with a smooth surface and inclined towards the centre in order that the clinker may slide down easily. Along the centre of the bottom of the furnace the bricks do not meet, leaving a slit. The primary air is drawn through flues situated on either side of this slit, and the secondary air through movable fire-clay or iron tubes, which may be situated in the retort flues or below them, and communicate with flues in the setting, through which the air is delivered into the retort flues. Cold air may be substituted for the heated air supply, in which case it is admitted below the slit, a screen or wind-guard being provided to prevent a too sudden in-rush of air.—A. G. R.

Superheating Steam, Improved Apparatus for. B. Jaßé, Charlottenburg, Germany. Eng. Pat. 8112, April 17, 1896.

THE apparatus consists of one or more tubes, preferably vertical, containing within each of them a helical blade, which forms, together with the inner surface of the tube, a helical passage. Where more than one tube is employed, they are connected together by external bends. The tubes are exposed outside to the action of the flames and combustion gases, whilst the steam passes through them. In consequence of the helical blades, the steam is retained for a very considerable time, in comparison with the length of the tubes, in contact therewith.—R. S.

II.—FUEL, GAS, AND LIGHT.

Mond Producer-Gas applied to the Manufacture of Steel. J. H. Darby, Iron and Steel Inst., Spring Meeting, 1896. The Ironmonger, 282—286.

IN his presidential address to the Society of Chemical Industry in 1889, Ludwig Mond made public his process for the manufacture of producer-gas with the recovery of sulphate of ammonia (this Journal, 1894, 938—939). The present author deals with this process and its improvements, and then gives details and results of the practical application of this gas to the manufacture of steel.

When fuel is gasified in the ordinary producer, the products of distillation, including tar, first leave the fuel, and the fixed carbon is ultimately converted into carbon monoxide. This raises the temperature of the contents of the producer and of the resulting gas to a high degree, and is sufficient to decompose most of the ammonia which was originally present in the fuel as nitrogen, as well as to effect a distillation of the volatile products. The objects which Mond wished to attain in his producer plant, were to utilise the heat developed by the combustion of carbon monoxide, by transferring the sensible heat in the steam and gas leaving the producer, to the air and steam entering the producer. In this way he was enabled to use far more steam than is generally employed, and to work with a low temperature in the producer, thus preventing the decom-

position of the ammonia. This enabled him to obtain the enormous yield of nearly 100 lb. of sulphate per ton of fuel, at the same time producing a much larger volume of gas of about the same calorific value, volume for volume, compared with ordinary producer-gas. When he introduced, together with superheated air required to burn the fuel in the producer, $2\frac{1}{2}$ tons of steam for every ton of fuel consumed, he found that over 70 per cent. of the total nitrogen in the coal could be recovered in the form of sulphate of ammonia from the producer-gases. Only about one-third of the steam introduced into the producer is decomposed in its passage through the fuel, so that two thirds remain in the gases, leaving the producer at a temperature of 450 to 500 °C. The problem was to return this steam, or its equivalent, to the producer, and to transfer the initial heat in the gas and steam leaving, to the air and steam entering the producer for the combustion of the fuel.

The gas leaving the producer from one ton of coal is about 160,000 cu. ft., and mixed with this gas is steam to the amount of 100,000 cu. ft. The difficulty of providing suitable cooling arrangements for this heavy ratio of steam is solved by Mond as follows:—The hot producer-gas is passed through a series of pipes surrounded by an annular space, through which the mixture of air and steam to be introduced into the producer is led in an opposite direction, thus taking up the heat from the hot gas and becoming superheated. Thence the producer-gas is led through a rectangular chamber partly filled with water, which is thrown up in a fine spray by revolving beaters, so as to fill the whole area of the chamber. This water becomes hot, a certain quantity of it evaporates, and the spray produced washes all the dust and soot out of the gases. From this chamber the gas, which is now cooled down to about 100 °C., and is charged with a large amount of water vapour, is passed through a leaden scrubber filled with perforated bricks in which the ammonia contained in the gas is absorbed by dilute sulphuric acid. In this scrubber a fairly concentrated solution of sulphate of ammonia, containing 36 to 38 per cent., is used, to which a small quantity of sulphuric acid is added, so that the liquid leaving the scrubber contains only 2.5 per cent. of free acid. This liquid passes through a separator, in which it is clarified. The greater portion of the clear liquid is, after the addition of a fresh quantity of acid, pumped back to the scrubber. The remaining portion of the liquid is withdrawn and evaporated by steam coils in lead-lined pans, which are kept constantly filled by the addition of fresh liquor until the whole mass is thick. This is run out on a strainer, and yields, after draining, a sulphate of ammonia of very fair quality and up to the market strength of 24 per cent. of ammonia. The mother-liquor is pumped back to the scrubber. The gas, on entering the scrubber, contains only 0.13 volume per cent. of ammonia, and, on leaving, less than one-tenth of this quantity.

The gas next passes through a second scrubber, where it meets with a current of cold water passing over perforated wood blocks, which condenses the water vapour, the water itself being thereby heated. The gas is cooled down from 80 to about 50 °C. in this scrubber, whence it passes to the gas main for consumption. The hot water is pumped through a third scrubber, through which, in an opposite direction, cold air is forced previous to entering the producer. The air thus gets heated to about 74° C. and becomes saturated with moisture at that temperature, whilst the water is rendered cold enough to be pumped back through the second scrubber. The same water is thus constantly used for condensing the water vapour in one scrubber and giving it up to the air in the other. In this way about one-half of the steam required for the producer is recovered, and returned to the producer. The rest of the steam required is in part obtained as exhaust steam from the engines driving the blowers and pumps, and the remainder, wherever possible, from any other available exhaust.

On removing the plugs at the bottom of the tubes leading the gas from the producer to the mechanical washer, nothing but dust issues with the gases, showing that in

this process the gas, although washed, does not lose its tarry products, but retains them as permanent gas. The labour item in connection with this producer is very small. Repairs, owing to the low temperature at which it works, are nominal. The quantity of fuel gasified per producer for 24 hours is 20 to 22 tons. The gas contains on an average by volume, carbon dioxide, 17.1; carbon monoxide, 11.0; olefines, 0.4; methane, 1.8; hydrogen, 27.2; and nitrogen, 42.5 per cent. The total combustible gas equals 49.4 per cent, giving about 1,350 K.C. cals.

The calorific value of this gas per unit of weight of fuel gasified, is higher than that of ordinary producer-gas, and is equal to 80 per cent. of the calorific value of the fuel used, instead of about 60 to 65, as in the ordinary producer. The plant may be worked in two ways—either with recovery of sulphate of ammonia or without.

Owing to the general belief that washed gas was not satisfactory in the manufacture of steel, Mond erected a three-ton furnace to ascertain whether he could obtain the high temperatures required, quickly and efficiently. No trouble whatever was found with using the washed gas, the furnace working three charges in less than 24 hours. The average analysis of nine casts gave the following results:—Carbon, 0.240; silicon, 0.038; sulphur, 0.039; phosphorus, 0.037; and manganese, 0.457 per cent. The mechanical tests of 12 samples containing 0.16 to 0.22 per cent. of carbon showed a tensile strength of from 25.2 to 27.6 tons per square inch, with from 32 to 36 per cent. elongation.

One of the points of difference observed by the author between the Mond gas in the steel furnace and the ordinary producer-gas, was the considerable length of the flame. With a fair-sized furnace the gas was able to thoroughly expend itself and to keep the steel at a satisfactory temperature during the whole operation with apparently a very small consumption of gas.—A. W.

Nitrogen and Nitrogen Compounds from the Distillation of Coal. J. Lundin. Teknisk Forenings Tidskrift, 1892, 22, 21–25.

The author describes experiments made by Knublauch, and others by himself, chiefly on Westphalian coals; other coals show a different behaviour. The following are the conclusions arrived at:—(1.) About 50 per cent. of the nitrogen remains in the coke. (2.) About 30 per cent. of the nitrogen appears in the gas; it is objectionable on account of its deteriorating influence on the light given thereby. (3.) 12–14 per cent. of the nitrogen is converted into ammonia, this quantity corresponding with 10.4 kilos. of ammonia per ton of coal. (4.) Barely 2 per cent. of the nitrogen, *i.e.*, 0.02 per cent. of the weight of the coal, appears as cyanide, corresponding to 1.4 kilo. of potassium ferrocyanide per ton of coal; two-thirds of this quantity is retained by the purifying material. (5.) $\frac{1}{2}$ per cent. of the nitrogen is found as bases in the tar. At the most 0.2–0.25 per cent. of nitrogen in the coal is recovered in a marketable form, the quantity lost representing (at present prices) a loss of 10,000 marks per million cubic metres of gas.—B. B.

Acetylene, Products of Combustion of. N. Gréchant. Comptes rend. 1896, 122, 832.

A "MANCHESTER" burner, with which acetylene was burnt, was placed under a metal cylinder so that the products of combustion could be drawn over into a gas-holder and examined. The ratio between the volume of carbon dioxide formed and of oxygen used was 0.82, that calculated on the supposition that the acetylene underwent complete combustion being 0.8. Further tests, both chemical and physiological, failed to reveal the presence in the products of combustion of the smallest trace of any combustible gases containing carbon.

The author finds that among the various explosive mixtures of air and acetylene, that containing 1 volume of acetylene to 9 of air explodes with the greatest violence.

—T. E.

Acetylene, Action of, upon Iron, Nickel, and Cobalt reduced by Hydrogen. H. Moissan and Ch. Moreau. Comptes rend. 122, 1240–1243.

Iron, nickel, and cobalt which have been reduced by hydrogen at the lowest possible temperatures, reduce acetylene in the cold with incandescence, forming hydrogen and metallic carbides. The decomposition is due to the porosity of the metals, and takes place also with platinum black.—V. C.

Incandescent Alcohol Lamps for Street Lighting. Zeits. f. Spiritusind. 1896, 19, 143.

The question of the employment of alcohol for illuminating purposes is being investigated in Germany, and the owners of a number of distilleries are undertaking the lighting of small towns in their neighbourhood by means of incandescent spirit lamps. In a town in Saxony, a trial is said to have already been made in the market place, whilst a distiller in East Prussia states that he has undertaken to light the neighbouring town at the same cost as the petroleum lighting hitherto in use.—A. K. M.

Cyanogen from Ammonia. Eng. and Mining J. 1896, 61, 449.

See under VII., page 543.

Sulphur in Illuminating Gas and Coal, Determination of. C. F. Mabery. Amer. Chem. J. 18, 207.

See under XXIII., page 562.

Acoustic Analysis of a Mixture of Air and Another Gas (or of Two Gases of Different Densities). E. Hardy. Bull. de la Soc. d'Encouragement. May 1896, [5], 653.

See under XXIII., page 558.

Photometry, A Suggested Remedy for a Source of Error in Official. L. T. Wright. J. Gas Lighting, 67, 1896, 1213–1214.

See under XXIII., page 558.

PATENTS.

Coke Manufacture, Construction of Coke Ovens, and Recovery of By-Products from same; An Improved System for. J. T. Key, Royston, Yorkshire, and W. S. Key, Winthrop, Mass., U.S.A. Eng. Pat. 10,356, May 27, 1895.

BEEHIVE coke ovens with false bottoms, and with channels down which the by-products can flow into the main. This main opens under the centre of the false bottom, and is furnished with a number of subsidiary mains, radiating from it, so that the products may be drawn off by an exhauster uniformly. Air enters through an annular flue surrounding the top of the oven. Thus, the air drawn in is evenly distributed over the coke, so that it is claimed, a more consolidated product and a higher yield than that got by other systems is obtained. The coke is quenched *in situ* by the admission of steam through pipes opening under the false bottom; this is said to effect desulphurisation.—A. G. B.

Incandescent Gas Burners, Improvements in. J. H. W. Stringfellow, Hackney. Eng. Pat. 16,743, May 30, 1895.

The inventor proposes to utilise a foundation of natural or artificial meerschaum or other similar bodies having the requisite lightness, coherence, and slow conduction, coating this with a material or materials capable of becoming incandescent, such as certain metallic oxides, asbestos, &c., either by cementing or otherwise, the body thus prepared being suspended in a non-luminous flame or in the non-luminous face of an illuminating flame.—C. S.

Gaslight, Improvements in Glowing Nets [Mantles] for. H. Burkert and R. Seemann, Berlin. Eng. Pat. 3262, Feb. 13, 1896.

The improvement claimed is the employment of a mixture of thorium (in the form of nitrate) with an element of the chrome group, preferably uranium—1 per cent. of the oxide

of uranium developing the incandescent power of the thorium—without using magnesia, zirconium, or the cerium group.—C. S.

Incandescent Gas and Oil Lamps, Improvements in Mantles for. J. P. de Liéry, New York, U.S.A. Eng. Pat. 7429, April 8, 1896.

NITROCELLULOSE is dissolved, preferably by glacial acetic acid or other solvent capable of dissolving the salts or oxides suitable for producing incandescence (such as are derived from monazite sands), to a thick paste or jelly, along with the said oxides, &c., and formed into threads, which are washed and de-nitrified in the usual manner, operating preferably by alkalis in a neutral solution. The material is finally manufactured into mantles in the ordinary way. Increased durability and greater capacity to withstand wear and tear is claimed for mantles thus prepared.—C. S.

Acetylene Gas, Improvements in Apparatus for Generating. J. H. Exley, Huddersfield. Eng. Pat. 12,344, June 26, 1895.

THIS consists of a vertical receiver with a cistern on the top, which latter delivers water by a pipe opening near the bottom of the receiver. One or two external cylindrical generators are placed outside and close to the receiver, and are connected with the same by two pipes, one near the top of the generator and receiver, to admit the acetylene gas; the other near the bottom of the receiver and generator, for the passage of the water. The apparatus is intended to work automatically on the principle of the well-known Kipp's generator.—L. T. T.

Acetylene Gas Lamps, An Improved Generator for. R. Campe, Berlin. Eng. Pat. 16,691, Sept. 6, 1895.

THE calcium carbide (in a finely powdered condition) is contained in a funnel-shaped vessel, the small opening at the bottom of which is closed by a milled or grooved cylinder rotated by clockwork. In rotating, this cylinder carries down a little of the carbide into a small chamber below. This second chamber is closed by a slide-valve, actuated by a rod having a handle outside the generator. When this valve is opened, the clockwork is released and the carbide is slowly dropped into water in a vessel situated below the valve. If the carbide be released too rapidly by the grooved cylinder, the small chamber below becomes filled, and so retards the action of the cylinder. In closing the valve, this stops the clockwork by coming against a stop-pin in the cylinder shaft. The speed of generation can be regulated by the degree to which the slide-valve is opened.—L. T. T.

Acetylene Gas, An Improved Apparatus for Generating, Storing, and Purifying. J. C. Bayley, Bournemouth. Eng. Pat. 322, Jan. 6, 1896.

A VESSEL containing water is provided, inside which a float is inserted through an opening in the top, which can be closed so as to be air-tight. This float has its sides perforated, and serves as a receptacle for the carbide. The float is free to rise and fall in the water between vertical guides. Water rises in an annular space in this float, which is packed with porous material, percolates the material, and then comes in contact with the carbide. If the generation of gas be more rapid than its consumption, the pressure of the gas presses down the water in the annular space, and so removes it from contact with the carbide. An automatically regulated supply of gas is thus obtained.—L. T. T.

Acetylene Gas, Improvements in the Production and Utilisation for Lighting. G. Ragot, Forest-lez-Bruxelles, Belgium. Eng. Pat. 5279, March 9, 1896.

THIS is an automatic apparatus, the admission of water from a reservoir to the generator filled with calcium carbide—or, conversely, of carbide to the generator filled with water—being regulated by the descent of the gasometer, which causes the flexible outflow pipe to deflect and deliver into

the supply pipe leading to the generator. A mercury seal in this supply pipe prevents the access of moisture to the carbide except when the water is turned on. The generator consists of two cylinders, and, when the carbide in one is exhausted, the descent of the gasometer causes an affixed tappet to engage with a pawl attached to a tap on the supply pipe, thereby opening a branch pipe and delivering water to the second cylinder. A reducer, similar to that employed for utilising rich gases in railway carriages, is attached, for regulating the pressure to the burners. These latter consist of a couple of converging jets about an inch apart, thus allowing a suitable commingling of air with the two jets of gas on the way to the (vertical) flame, and utilising the illuminating power of the gas to its fullest extent.—C. S.

Acetylene, Method of and Apparatus for Generating. W. C. Clarke, New York, U.S.A. Eng. Pat. 7242, April 2, 1896.

THIS apparatus consists of a holder connected with two or more generators of such a size as each to contain a charge of calcium carbide less than sufficient to fill the holder. Each generator has a tank of a size to hold the requisite quantity of water for a charge, and the pipe leading from the tank to the generator is controlled by a valve, the arm of which is so weighted and arranged that on being slightly depressed by a projecting arm on the descending holder, it is at once fully opened, and discharges the full quantity of water requisite for the charge. By multiplying the number of generators and arranging the actuating arms at slightly different heights on the holder, the different generators can be successively brought into operation and a continuous supply of gas automatically maintained for any desired time.—L. T. T.

Illuminating Gas [Acetylene], Method of Generating. W. C. Clarke, New York, U.S.A. Eng. Pat. 7243, April 2, 1896.

THIS apparatus is similar in construction to that of the preceding patent, except that in this case larger generators are used, and the water-supply valve on each is so weighted that when depressed by one of the arms projecting from the holder, a little water only is admitted to the generator. On the pressure being removed by the rise of the holder, the weighted valve shuts off the water supply, only to be opened again on the next fall of the holder. In this way an intermittent supply of water is fed into the generator till all the carbide is used up, when the next generator is brought into action.—L. T. T.

[Acetylene] Gas, Improvements relating to the Generation of, and to Apparatus therefor. E. T. Turney, Chicago, U.S. Eng. Pat. 5375 (under Internat. Convention), March 10, 1896.

THE essential part of this generator consists of a small cylinder containing a rod of solid or compressed calcium carbide (or other similar material), moving easily therein. One end of the cylinder is closed by a screw cap (for introducing the rod of carbide), and to this is attached a coiled spring to push forward the carbide rod. Surrounding the other end of the tube is an elastic ring or collar, the diameter of which, when not stretched, is less than that of the tube, so that when arranged thereon with a portion projecting beyond the end of the tube, this projecting portion will form an elastic lip which has a constant tendency to contract. When the carbide rod (which must be of greater diameter than the elastic lip) is pushed through the elastic ring, the latter forms a liquid-tight joint around the rod. The cylinder projects into a closed generating vessel containing, preferably, very dilute methyl alcohol to moderate the violence of the action. In this vessel a stop is arranged to prevent the carbide rod being pushed through the elastic ring beyond a suitable and very short distance. In this way a constant and definite surface of carbide is exposed to the active liquid, and thus a constant and regular generation of gas is maintained.—L. T. T.

[Acetylene] Gas, Improvements in Apparatus for the Manufacture of. E. Farnsworth, Minneapolis, U.S. Eng. Pat. 5624 (under Internat. Convention). March 12, 1896.

In this apparatus the essential novelty consists in attaching the calcium carbide receptacle to the top of the movable or telescoping gas-holder, so that the filling of the holder, automatically and bodily lifts the carbide receptacle out of the water. Through the centre of the top of the holder passes a tube (fitted with an air-tight screw cover) projecting about half the depth of the well. Inside this is a closely fitting hollow piston, fitted with an air-tight screwed cover, and packed so as to make an air tight but movable joint. From the bottom of this piston hangs the perforated receptacle filled with carbide. Generation of gas immediately commences when the holder is low in the water, and consequently little gas is present, and continues till, on rising, it lifts the carbide receptacle out of the water.

—L. T. T.

Gas, Freezing of, in Gas Mains, Improvements in Preventing the, and Apparatus therefor and for Carburetted Gas The Whessoe Foundry Company, Limited, Darlington, Durham. From The Berlin Anhaltische Maschinenbau-Aktiengesellschaft, Martinikendorf, Berlin, Germany. Eng. Pat. 882, Jan. 13, 1896.

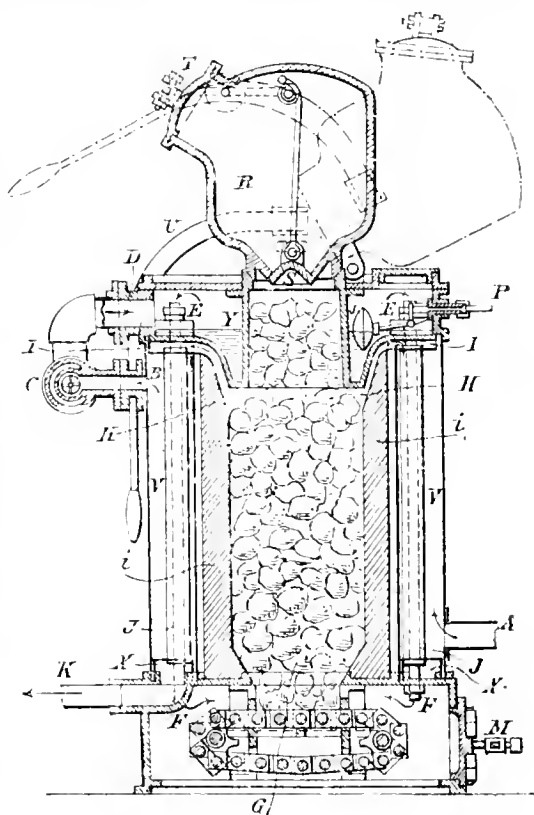
By mixing vapour of alcohol with gas, the "freezing point" of the gas (temperature at which it deposits naphthalene) is so lowered that even in the coldest weather stoppage of the pipes will be prevented. The apparatus designed for the application of this discovery consists of a receiver for holding the spirit, into which the latter is advantageously introduced by hydraulic pressure; by dividing this receiver into an upper and a lower chamber connected by a suitable arrangement of pipes, regularity of flow of the spirit from the receiver to the vaporiser, described hereinafter, is secured; and by admitting gas instead of air to take the place of the spirit withdrawn, loss by evaporation is avoided. The receiver is connected, by means of a regulating valve, with a vaporiser, in which the spirit flows down inclined floors provided with corrugations to increase the surface; steam or hot water is admitted beneath these floors and is caused to travel in the same direction as that of the spirit. When it is merely desired to prevent the "freezing" of gas, the spirit may be allowed to flow directly into the main, when it will mix with the gas by its own tension. The whole apparatus, however, is also designed for carburetting gas with benzene, petroleum spirit, or other light hydrocarbon, in which case the vaporiser is brought into play in the manner described.—A. G. B.

Gas Generator, A Self-regulating. S. S. Bromhead, London. From A. Niel, Evreux, France. Eng. Pat. 4574, March 2, 1896.

THE claim is for a generator for the manufacture of water-gas. It consists of a double cylindrical casing V, of which the interior cylindrical space is the furnace of the gas generator for containing the burning coal. In passing through this, the mixture of steam and air is decomposed, thereby forming the combustible gas. The furnace is lined with fire bricks *i*, and at its upper end is placed the vaporising chamber Y, arranged so that its lower side is heated by the gases leaving the furnace through the pipes H. A feed-tunnel R, furnished with a cover T, is arranged above the central part of the boiler, which forms the upper part of the furnace, and communication is effected between the two by means of the cone S, which is operated from the outside by means of a lever. The feed-funnel may be moved as indicated by the dotted lines, by means of the lever U.

The water enters the boiler through the pipe P, and its height is kept constant, automatically, by means of the float *j*, acting in conjunction with a cock in the pipe P. The flow of water is regulated so as to obtain only a thin layer upon the highest part of the lower side of the boiler. Air is supplied by a pump, and is conducted through the pipe A into the space formed by the double casing of the furnace, where it is heated by contact with the sides of the furnace and the pipes I J. It then passes through the pipe B,

through the self-regulating valve C, and through the pipe D, into the boiler Y, where it passes over the surface of the hot water and helps to vaporise it. The air thus saturated, with steam descends through the pipes E F into the closed



furnace, and is converted into the water-gas by passing through the mass of burning fuel G. The gas leaves the furnace through the pipes H, and, descending through the pipes I J into the space X, passes through the pipe K on to the washer.

The washer, wherein the gases are washed by means of a column of coke kept moist by water, and also, if necessary, by a stratum of sawdust, the self-regulating valve, and the feed pump which supplies the air, are described and illustrated.—A. S.

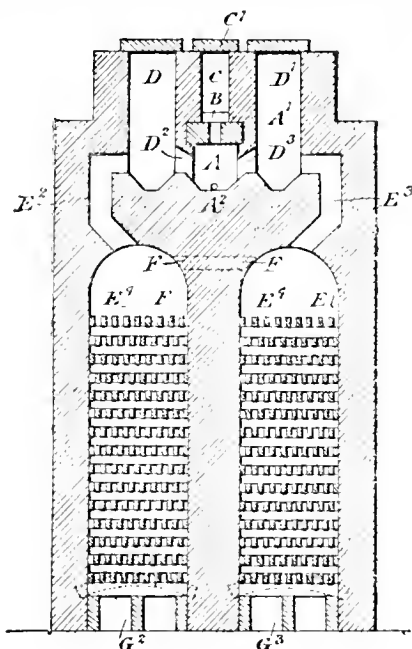
Regenerative Furnaces, Improvements in, and in the Method of Operating the same. S. Pitt, Sutton, Surrey. From H. L. Gantt, Norristown, Montgomery, Pennsylvania, U.S.A. Eng. Pat. 8065, April 16, 1896.

THE figure represents a vertical section of the furnace.

A is the hearth, access to which is obtained through the opening A¹ when the slide B is withdrawn. The material to be heated is charged through the chamber C, covered by the cap C¹, and is removed through an opening situated at A². D and D¹ are fuel chambers communicating with the hearth by the flues D², D³, and with the regenerators E and E¹, by the flues E² and E³. The chequer-work E⁴ is of the usual material.

Behind the regenerators E and E¹ are two other chequer chambers, communicating with E and E¹ by the flues G² and G³. At the upper ends of these rear chambers are flues communicating with the outer air and furnished with fans for causing a draught. In working the furnace, chamber D¹ is filled with incandescent fuel, and air is forced by the fan down the chamber in the rear of regenerator E¹, up this regenerator, and through the fuel in D¹, which burns to carbon monoxide. The products of combustion pass through the fuel in D, which is thus heated up, and down regenerator E; here

the carbon monoxide burns in that portion of the air which finds its way through the flue F from E' to E. This combustion heats the regenerator as well as the rear chamber



up which the products of combustion must pass, by way of G², into the outer air. A reversal of the fan will obviously reverse the course of the air and products of combustion. Since hot carbon monoxide and nitrogen alone pass into the hearth, the action on the material to be heated, is a highly reducing one.—A. G. B.

Burners and Vaporisers for Liquid Combustibles, Improvements in. L. Runge, Berlin. Eng. Pat. 8151, April 17, 1896.

In this burner the liquid is introduced into a vaporising cylinder, the vapour being conveyed down to the burner-foot, where it issues from a central jet and re-ascends within a cylindrical mixing chamber to the incandescent body. The latter is held in position by uprights attached to a ring encircling the vaporising cylinder and forming part of a cap which surrounds the upper extremity of the mixing cylinder and carries the burner gallery, the head of the cap being perforated to allow the mixed vapour to rise to the flame.—C. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum Industry of the District of Ter. K. J. Tumsky. Trudy bak. otd. imp. russk. tehn. obschtsch. 1896, 11, 80.

This district was the first to be worked for petroleum in Russia, refineries being erected at Mosdok. Oil was discovered in the Grosney field in 1833, but was only obtained in small quantities and from a few shallow wells. On boring deeper the yield was, however, increased, the most productive well being that bored by the Stuart Company in 1895, which spouted to a height of 100 metres, and yielded during the first few days about 800,000 poods per diem.

The Grosney oil contains about 15 per cent. of petroleum spirit, but comparatively little burning oil. The residue, amounting to about 55 per cent., has a specific gravity of about 0.960 and flashes at 120 to 130° C. As a lubricating oil it was preferred to Baku residuum, but is too thick to spray for fuel, and the crude oil is too inflammable,

so that the refiners simply distil off the spirit and sell the remainder for heating purposes, now that petroleum is cheap and the demand for lubricating oils insufficient.—C. S.

Petroleum Naphtha, The Production of Bitumen and Tar from. Kouindjy. Bull. de la Soc. d'encouragement pour l'industrie nationale, 94, 1116—1119.

With the object of producing from the petroleum residues certain substances hitherto largely obtained from coal—*viz.*, bitumen, tar, and hydrocarbons of the aromatic series without the production of coke—M. Adiassewitch has devised a process in which the residues are distilled at a temperature of 150°—200° C. Meanwhile hot air is blown into the heated mass, and an electric current caused to pass through it. After four hours' heating, the residue consists of a bitumen of density 1, the yield being 95 per cent. of the original weight, and after eight hours a solid bitumen is obtained of density 1.04, with a yield of 85 per cent. This product contains no coke, and is perfectly soluble in petroleum spirit.

A similar bitumen results from suitable treatment of the "mineral naphtha" found as a deposit in the district of Harie, in the Caucasus. This mineral contains 5 to 35 per cent. of bitumen, soluble in CS₂, which Adiassewitch separates from the mineral by disintegrating the latter in a vessel of special construction, furnished with revolving knives and screws, and filled with boiling water. The bitumen floats on the surface, whence it is drawn off into settling tanks to free it from sand and water, and is subsequently concentrated to a density slightly above 1.

This bitumen may be fractionated by distillation by means of superheated steam, or may be subjected to the treatment already described for acid residues. By the former process 50 per cent. of oils of sp. gr. 0.926—0.972 are obtained, and a tarry residue remains, containing 10 per cent. of coke. If, however, the method of Adiassewitch be employed, a series of tars, it is said, from the condition of liquid to that of solid, result (sp. gr. 1.005—1.06). All these products are soluble in petroleum spirit, CS₂, &c. Their chief uses are in the manufacture of asphalt, for railway sleepers, &c.—R. B. B.

American Petroleum, Investigations on. Chemistry of the Berea Grit Petroleum. C. F. Mabery and O. C. Dunn. Amer. Chem. J. 18, 215—236.

THE composition of the oil from the Berea grit of Ohio and the adjoining States has not hitherto been investigated. As a result of their examination of a number of oils from various depths of strata, the authors find that Engler's conclusion that the specific gravity of petroleum varies inversely with the depth of the well, is not supported in the case of the sand-stone oils of Southern Ohio, the oil from the 500-ft. sand being nearly as light (sp. gr. 0.7971) as that from the 1,500-ft. sand of the Berea grit (0.7939). The latter sand also contains the heaviest oil of all (0.8274). The proportion of nitrogen appears in most instances to increase with the depth of the well.

In consequence of the difficulty in the way of procuring a sufficient quantity of the lighter fractions of distillate, attention was concentrated on the less volatile portions. The lowest fraction examined was that boiling at 159°—160° C., and this yielded, after repeated re-distillations, a hydrocarbon of sp. gr. 0.7629, boiling constantly at 162°—163°, and containing 85.25 per cent. of carbon and 14.53 of hydrogen (the "decane" of Pelouze and Cahours boiled at 161°—162°). After purification, the distillate had a sp. gr. of 0.7475.

The next distillate of importance came over between 168° and 173°, the boiling point on re-distillation being finally 174°—175°.—C. S.

PATENT.

Oils [Petroleum], Improvement in Refining. J. Y. Johnson, London. From The Ohio Oil Improvement Company, Cleveland, Ohio, U.S.A. Eng. Pat. 8348, April 21, 1896.

THE process is designed principally for removing the sulphur from "sulphur petroleum," and consists in

allowing the crude petroleum distillate to flow slowly between, or remain in contact with, plates or sheets of lead and carbon, placed in close proximity to one another, but not touching. The nature of the reaction that occurs is not yet definitely ascertained, but the result produced is that the clear oil turns dark red, becoming nearly opaque, and when subsequently refined by the ordinary acid treatment, deposits a whitish powder, difficult to analyse, but apparently containing the sulphur impurities. The lead appears to be the active agent, although it is not corroded, but the carbon seems to be essential to the completeness of the reaction. The carbon plates must be clean. At the outset, longer contact is necessary to effect the reaction than is subsequently required. The time of exposure varies with the oil, half an hour being usually sufficient for Lima oil. By discharging the oil into a vessel containing water, some of the impurities may be removed before applying the "acid treatment."—C. S.

IV.—COLOURING MATTERS AND DYES.

Dinitronaphthalene-1:8. C. Gassmann. *Comptes rend.* 1896, **122**, 937—939.

The author finds that the proportion of the 1:8 product is increased by using strong acids in nitrating, and by not cooling. The best results were obtained as follows:—A mixture was made of 260 grms. of 61·7 per cent. nitric acid, 200 grms. of 92 per cent. sulphuric acid, and 200 grms. of 60 per cent. sulphuric anhydride. 128 grms. of naphthalene were then gradually added without cooling, and when all the naphthalene had been added, the whole was heated for 10 hours on the water-bath, allowed to cool, and poured into 5 litres of cold water. 215 grms. of crude product (98·6 per cent. of theory) were obtained, which yielded 148 grms. of 1:8-dinitronaphthalene and 52 grms. of the 1:5 isomeride.—L. T. T.

Anisol, Iodo Derivatives of. F. Reverdin. *Ber.* 1896, **29**, 997—1005.

o-Iodo-anisol, $C_6H_4(OCH_3)I$, prepared by the action of potassium iodide on diazotised *o*-anisidine. Best isolated by steam distillation in presence of SO_2 . *o*-Iodo-anisol is a heavy oil, sp. gr. 1·8, boiling at 239° — $240^{\circ}C$, under 730 mm. pressure.

o-Iodo-p-nitro-anisol, $C_6H_3(OCH_3)I.NO_2$ [1:2:4], obtained by nitration, at a low temperature, of the preceding compound.

o-Iodo-p-anisidine, $C_6H_3(OCH_3)I.NH_2$ [1:2:4], obtained by reducing the above nitro body with stannous chloride and hydrochloric acid, is soluble in much boiling water, from which it separates, on cooling, in fine, white needles, melting at 74° — $75^{\circ}C$. It is volatile with steam. Its diazo derivative yields with naphthol sulphonic acid ($OH:HSO_3 = 1:1$), a red dye resembling that obtained similarly from *p*-anisidine.

Di-iodo-anisol, $C_6H_3(OCH_3)I_2$ [1:2:4].—The above iodo-anisidine is diazotised in presence of potassium iodide. The new compound separates in the shape of a brown oil, which solidifies on cooling, and is best purified by steam distillation in presence of SO_2 .

p-Iodo-anisol, $C_6H_4(OCH_3)I$ [1:4], is prepared in the same way as the ortho compound. It is a solid body, and crystallises in white leaflets. It melts at 51 — $52^{\circ}C$, and boils at $237^{\circ}C$. (725 mm.).—H. T. P.

Dimethylaniline, Derivatives of. [Direct Cotton Dye.] A. Schuster and J. Pinnow. *Ber.* 1896, 1053.

DIMETHYLANILINE dissolved in dilute sulphuric acid and treated with dilute nitric acid, forms α -dinitrodimethylaniline. By reduction, this forms α -diamidodimethylaniline, which is partially decomposed by distilling at the ordinary pressure, but distils at $178^{\circ}C$. under 22 mm. pressure.

Methylethylacetamidophenylene-amidine.—The diamido compound is added to 4—5 times its weight of boiling acetic anhydride, well shaken, and kept boiling for four hours. Then half is distilled off. The remainder is treated with water, boiled down, and then precipitated with

soda. The precipitate, after being washed and dried, is dissolved in luke-warm methyl alcohol (2 c.c. for 1 gm. of substance), reprecipitated with five or six times its volume of ether, and lastly crystallised from water. The substance which separates out from the methyl alcohol and ether solution after standing a few days, is, according to Warster and Seldtner (*Ber.* 12, 1806), the *mono*-acetyl derivative, and should therefore contain a free amido group capable of being diazotised.

No diazo compound could be formed, and the substance was shown to be diacetyldiamidodimethylaniline.

By boiling with hydrochloric acid, methylethylacetamidophenylene-amidine loses its acetyl group; the base separates out with potash, is extracted with chloroform, and, after evaporation of the latter, is re-crystallised from water. The diazo compound of this base is very stable; the *azo*-colour made from methylethylacetamidodiphenylene-amidine and β -naphthylamine, viz.:—



dyes unmordanted cotton direct, like the *azo* colours prepared by Lellmann and Heiler (*Ber.* 26, 2759) from amido-benzylphenylenediamine. These authors showed that the imido group may be substituted for sulphur in the group—



characteristic for primuline *azo* colours. The methylethylacetamidophenylene-amidine contains a group which is not exactly like, but to some extent resembles, the group in Lellmann and Heiler's compound.

Methylethylacetamidophenylene-amidine hydrochloride, $C_{11}H_{11}N_3.2HCl$, crystallises from methyl alcohol in needles melting at 260° .—H. M.

Naphthalene Derivatives, Isomeric. III. P. Friedländer and H. Rüdrt. *Ber.* 29, 1609—1613.

THE authors describe the preparation of naphthoresorcinol according to the method already described (this Journal, 1896, 110), and they have also obtained naphthofluorescein. They describe some further reactions of 1,3-dihydroxynaphthalene, which melts at $124^{\circ}C$, and gives an acetyl derivative melting at $56^{\circ}C$. Nitrosodimethylaniline acts on the compound in acetic acid solution, forming a reddish-violet colouring matter which turns green with hydrochloric acid, thus differing from the 2,3-derivative, which forms an iodo-blue oxazine, which is unaltered by hydrochloric acid. The *azo* compounds of 1,3-dihydroxynaphthalene differ from their isomerides both as regards shade and behaviour on reduction. They are all coloured yellow, and on reduction yield presumably 2,1,3-amidodihydroxynaphthalene, which in presence of alkali oxidises very rapidly in the air, turning dark green and then dirty brown when spotted on filter paper. The sulphonic acids of the naphthoresorcinol show a similar reaction. When 1,3-dihydroxynaphthalene is heated for several hours to about $190^{\circ}C$. with 60 per cent. caustic soda, it takes up water, yielding acetic acid and *o*-toluic acid melting at $105^{\circ}C$. On heating with ammonia to $140^{\circ}C$, the β -hydroxyl is first substituted, 3,1-amidonaphthol being obtained together with some 1,3-naphthylendiamine. The former gives a sparingly soluble hydrochloride, and oxidises very easily in presence of alkalis. When 1,3-dihydroxynaphthalene is boiled with an excess of aniline, there remains, after distilling off the excess, a white precipitate of phenylamidonaphthol, which behaves in an alkaline solution in a characteristic manner on exposure to air. The solution, which rapidly turns brownish, deposits small violet-red crystals consisting of naphthoquinone-anil. The paper concludes with a description of two naphthoresorcinol sulphonic acids.

—T. A. L.

Thiodiphenylamine [Chloro Derivatives]. O. Unger and K. A. Hofmann. *Ber.* 29, 1362—1368.

When thiodiphenylamine is heated with aniline and aniline hydrochloride, it yields a blue colouring matter (*Ber.* 27,

3324). The yield can be improved by shortening the duration of the melt and adding certain oxidising agents, or else by using instead of thioldiphenylamine the violet-black product obtained by the action of nitrous acid gas on the ethereal solution of thioldiphenylamine. In the present communication the authors describe the action of hydrochloric acid on this substance, forming mono-, di-, and tetrachlorothioldiphenylamine. The last-named product is best obtained by passing nitrous acid gas (from nitric acid sp. gr. 1.3 and arsenious acid) through a solution of thioldiphenylamine in ether, warming the precipitate with alcoholic hydrochloric acid, and extracting with alcohol, when the tetrachloro derivative remains undissolved. The direct action of nitric acid on warming gives rise to the formation of a nitro compound with elimination of chlorine, but nitration in acetic acid does not take place, for a sulfoxide is formed. Hence the chlorine atoms appear to occupy both the *o*- and *p*-positions. Dichlorothioldiphenylamine is contained in the alcoholic extract mentioned above, and can be purified by repeated crystallisation from benzene and alcohol. It crystallises from alcohol in small shining plates, which gradually turn green on exposure to air. On nitration, it forms dinitrodichlorodiphenylamine sulfoxide, which crystallises from nitric acid in yellow needles. This product, on reduction, forms leuco-isothionine. An isomeric dichloro derivative which appears to have both chlorines in the *p*-position, since on nitration and reduction it does not give any colouring matter, is obtained together with tetrachlorothioldiphenylamine, by the direct chlorination of thioldiphenylamine. The product of the action of nitrous acid gas on thioldiphenylamine has a quinonoid structure, and this is borne out by the fact that on heating with aniline and aniline hydrochloride, blue colouring matters are obtained which have been identified as phenylated and anilido-phenylated thionines.—T. A. L.

Products obtained in the Chlorination of Benzaldehyde and their Derivatives. R. Gnehm and E. Bänziger. Ber. 29, 875—878.

By the action of iodine and antimony pentachloride on benzaldehyde, a number of compounds are produced, the principal product, however, being 2,5-dichlorobenzaldehyde. The authors have separated the various products, and identified them, and have investigated the colouring matters derived from 2,5-dichlorobenzaldehyde, or from the above mixture. For instance: *New Solid Green 3B* is a mixture of the nitric and hydrochloric acid salts of tetramethyldiamidodichlorotriphenylcarbinol. *New Solid Green 2B* consists of the hydrochlorides of the same carbinol, together with tetramethyldiamidochlorotriphenyl carbinol, and also contains sodium and zinc sulphate. *Glacier Blue*, obtained by condensing methyl-*o*-toluidine with 2,5-dichlorobenzaldehyde, is the hydrochloride of dimethyldiamido-di-*o*-tolyl-dichlorophenyl carbinol.—T. A. L.

Triphenylmethane Colouring Matters. Constitution of. Hugo Weil. Ber. 29, [10], 1541—1542.

G. VON GEORGEVICH has stated (this Journal, 1895, 150) that when a cold dilute solution of pure rosaniline hydrochloride is treated with a very slight excess of cold dilute caustic soda, a precipitate of a coloured base is obtained. This was considered by him to be the true base of the rosaniline colouring matters.

The author has been unable to confirm these results, and finds that under the above conditions no precipitate is formed until the solution is "salted out," when the unchanged hydrochloride is recovered. More concentrated solutions yield, it is true, a coloured precipitate, but that always contains chlorine.

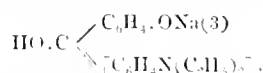
On treating a rosaniline hydrochloride solution with moist silver oxide, gradual precipitation of the ordinary colourless base takes place, the solution retaining its colour as long as any chlorine is present.

The colouring matters of the rosaniline series behave as true quaternary ammonium salts.—H. I.

Fuchsines, Properties of and Oxidation by Lead Peroxide. M. Prud'homme. Bull. Soc. Chim. 1896, 780—783.

In pointing out that Patent blue is not an ether (Bull. Soc. Chim. 1895, 907), the author is at variance with Rosenstiehl,

who considers that this constitution explains its behaviour with caustic alkalis. The former states, moreover, that in the reaction he has described, more particularly the transformation of blue decolorised by soda into tetra-ethylbenzidine, he never stated that this was characteristic of fuchsine colouring matters fast to alkalis. In fact, blue decolorised by soda is easily transformed into tetra-ethylbenzidine on oxidation with lead peroxide and acetic acid, whilst Patent blue under the same conditions does not give an alkylated benzidine. According to Rosenstiehl, the precipitate obtained by the action of ammonia on alkylated fuchsine contains a mixture of the carbinol with the fuchsine, and is coloured. As a matter of fact, the addition of ammonia to solutions of Fuchsine, Hexamethyl violet, and Malachite green, gives colourless solutions after a short time, and the bases also are colourless. On the other hand, *m*-hydroxylated Malachite green gives a dark green base with ammonia, and the author is of opinion that this colour is a property of the base—



In oxidising dimethylaniline or tetramethyldiamidodiphenyl carbinol, dissolved in the theoretical amount of hydrochloric acid, with lead peroxide and acetic acid, the liquid turns yellowish-orange and then green on adding sodium acetate, and dyes silk a fugitive grass-green. On heating the liquor, it becomes decolorised and alkylated benzidine is precipitated. The oxidation of the fuchsines proceeds in an analogous manner, except that of course a much larger quantity of lead peroxide must be employed. The following colouring matters have been investigated:—

Malachite green.—This is converted into bluish-green colouring matters dyeing silk blue, maximum blueness being obtained with four molecules of lead peroxide. With eight molecules, the green entirely disappears and the filtered liquid is yellowish-orange, which becomes green on adding sodium acetate, and dyes silk grass-green. The ultimate product is alkylated benzidine. *Helectia green*, which is Malachite green sulphonated in the para-position, behaves in an exactly similar manner. *m-Hydroxylated Malachite green* dyes silk a very yellowish-green, the shade becoming darker after oxidation with 4 molecules of lead peroxide, and the transformation into alkylated benzidine being complete with eight molecules. *Patent blue* is the disulphonic acid of the foregoing, and gives a dark blue with 4 molecules of lead peroxide, whilst with 6 the transformation is complete. The resultant compound is not a blue colouring matter, nor is it an alkylated benzidine. In the case of Patent blue decolorised with soda, the addition of an equimolecular proportion of lead peroxide gives directly alkylated benzidine. *Hexamethyl-p-fuchsine* gives a violet with 4 molecules of lead peroxide, the complete transformation requiring eight. *Fuchsine* gives with 3 molecules of the oxidiser a colouring matter dyeing silk garnet, whilst with 6 molecules benzidine is formed. Hence, of the substances studied, only Patent blue and its derivative decolorised by soda behave in a special manner. Under no circumstances does the former yield an alkylated benzidine, whilst the latter gives it with a single molecule of the oxidiser directly, without the formation of an intermediate compound. The fuchsines are transformed into new colouring matters on oxidation by the removal of hydrogen from the benzene nucleus adjacent to the methane carbon. This requires generally about 4 molecules of lead peroxide, and the further oxidation, which usually requires about twice this amount, probably acts in splitting up that benzene nucleus which took part in the first phase of the reaction.—T. A. L.

Fuchsines and Amido-carbinols, Certain Reactions of. A. Rosenstiehl. Bull. Soc. Chim. 1896, 15, 327—330.

AN extended criticism of Prud'homme's views as to the constitution of Patent blue (this Journal, 1895, 27; 1896, 267, 268).

The author, in collaboration with Smis, has discovered that alkyl-benzidines are amongst the products of oxidation of the leuco bases of various colouring matters which contain

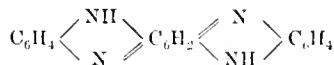
the group $C_6H_4NR_2$ (R being an alkyl group), such as Malachite green and the Acid greens, the latter of which are sensitive to alkalis. They are contained in the deposits of (lead sulphate or chloride, formed from the lead dioxide employed for oxidising, and their formation partially accounts for the loss of colouring matter which is experienced in the manufacture of the colouring matters in question.

With respect to the green precipitate (this Journal, 1896, 268) obtained by the action of ammonia on the unsulphonated Patent blue, the author remarks that (1) ammonia is incapable of completely saponifying the alkyl-rosaniline compounds which exhibit even a feeble resistance to alkalis, the carbinols of such compounds being able to decompose ammoniacal salts, even in the presence of ammonia, so that the precipitates, formed by means of ammonia, contain the undecomposed colouring matters along with the colour-bases; (2) the carbinols, even when pure (*i.e.*, colourless), give with pure alcohol coloured solutions, at all events in the absence of an excess of alkali; (3) the amido-carbinols known (*e.g.*, the colour-bases of Malachite green, Crystal violet, &c.), derived from rosanilines, whether fast to alkalis or not, dye wool and silk, and cotton mordanted with tannic acid; the only logical conclusion, however, which can be drawn from this is that wool and silk, like tannic acid, furnish the acid requisite for the formation of coloured salts.

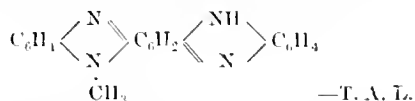
The author does not maintain that coloured amido-carbinols cannot exist. His position is that no such compounds have yet been discovered.—E. B.

Fluorindines, Constitution of the. III. F. Kehrman and H. Bürgin. Ber. 29, 1246—1254.

THE authors have further investigated Fischer and Hepp's phenylfluorindine formula—



according to which mono- and dialkylated or acetyl derivatives should be obtainable, the substitution taking place at the nitrogens. Employing the method already given (Ger. Pat. 78,601; Ber. 28, 1543; this Journal, 1895, 859), several substituted fluorindines have been obtained. It appears to be a general characteristic of the mono-alkylated fluorindines, owing to their tolerably strong basic nature, that on boiling with benzoic ethyl ether they are more or less rapidly converted into benzoyl derivatives, whilst the diphenyl fluorindines can be crystallised unchanged from the same medium. *Phenylphenylfluorindine* has been obtained either by condensing 2-hydroxyphenylphenazone (Annalen, 290, 301) and *o*-phenylenediamine hydrochloride, or else by condensing the latter product with the hydrochloride of the oxidation product of *o*-amidodiphenylamine; and Fischer and Hepp's statement (Ber. 28, 295; this Journal, 1895, 565) that the latter process gives diphenylfluorindine, is incorrect. The product is identical with that obtained by Fischer and Hepp from aposafranine and *o*-phenylenediamine (Ber. 29, 367; See next abstract but one), and gives a benzoyl derivative when boiled with benzoic ether. Its hydrochloride is sparingly soluble in alcohol. *Diphenylfluorindine* is obtained by condensing *o*-amidodiphenylamine with the hydrochloride of its oxidation product by means of benzoic acid. The same substance is produced by oxidising azophenine with yellow mercuric oxide. It has the formula given at the commencement of the paper, the two imide hydrogens being replaced by phenyl groups. *Methylphenylfluorindine* is formed by condensing the hydrochloride of the oxidation product of methyl-*o*-phenylenediamine with *o*-phenylenediamine hydrochloride in presence of benzoic acid. The base has the formula—



Ortho-amidodiphenylamine, Oxidation Products of.
O. Fischer and A. Dischinger. Ber. 29, 1602—1608.

In criticising Kehrman's proof (Ber. 29, 1249; see Kehrman and Bürgin, previous abstract) of the constitution of

the oxidation product of *o*-amidodiphenylamine, the authors point out that three years ago Heiler and Fischer (Ber. 26, 378; this Journal, 1893, 751) had already recognised the product as anilido-aposafranine. The reason for the higher melting point found, was the presence of another substance very similar to anilido-aposafranine, which Kehrman and Messinger had also overlooked. It has not been possible to obtain an oxidation product in which a free amido group could be detected, which should be the case if Kehrman's formula were correct. Fischer and Heiler's results as regards the decomposition of the oxidation product are confirmed, 11-anilidobenzene indone and 11-*o*-oxybenzene indone being obtained, the former being insoluble and the latter soluble in dilute caustic soda. Hence the chief oxidation product of *o*-amidodiphenylamine by means of ferric chloride is identical with anilido-aposafranine. As regards the second substance formed, it melts at 259° C., and is characterised by the bronzy-yellow colour of its hydrochloride. The base has the formula $C_{26}H_{22}N_2$, and on decomposition with dilute sulphuric acid at 170° C. gives two products, one insoluble and the other soluble in alkalis, and identical with oxyaposafranone. Furthermore, on heating with *o*-phenylenediamine and its hydrochloride to 210° C., a fluorindine is obtained. At the conclusion of the paper, Fischer and Hepp, replying to Kehrman's last paper, point out that the conclusion of the latter that the formation of phenylfluorindine from *o*-phenylenediamine and the oxidation product of *o*-amidodiphenylamine, is a proof that the latter has the constitution given, must be incorrect.

Finally, the authors do not confirm Kehrman and Bürgin's statement that phenylfluorindine cannot be recrystallised unchanged from benzoic ether.—T. A. L.

Relation of the Indulines to the Safranines. F. Kehrman, Annalen, 290, 247—306.

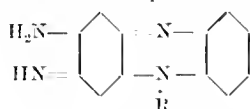
THE author concludes from the experimental evidence brought forward in the paper that the question as to the difference between the indulines and safranines reduces itself to the position and nature of the substituting amido groups. Both series of compounds belong to one large class—the azonium bases and their amido or hydroxy substitution products. The non-substituted azonium bases only exist in the hydrate form, and this also is the case with those substituted azonium bases, which, owing to the position of the substituting groups, are incapable of undergoing the *p*-quinoid anhydride formation (induline or indone formation), whereas those substituted azonium bases which contain amido or hydroxy groups in a suitable position can sometimes exist as hydrates, but lose water very easily. This is the case with rosinduline, aposafranine, and phenosafranine. The indulines and indones thus formed do not give different salts from the corresponding azonium hydrates. The salts of both forms of the bases are identical, since simultaneously with the formation of the salt, molecular transformation into the *o*-quinonoid azonium form takes place. In a preliminary notice (Ber. 27, 3349), the formation of rosinduline chloride by means of the azonium reaction and the behaviour of acetyl rosinduline chloride showed definitely the relationship between the safranines and indulines, and further experimental evidence is brought forward in the present paper in support of this view.

In conclusion, a number of new condensation products are described, obtained by the action of benzyl-*o*-phenylenediamine on 4.1.2-acetamidonaphthoquinone and on 2.1.4-hydroxynaphthoquinone. The former compound, when condensed, gives benzyl chloride, acetamidonaphthophenazine and acetylbenzyl rosinduline chloride. From 2.1.4-hydroxynaphthoquinone, benzylrosindone, hydroxynaphthophenazine, and benzyl chloride or benzyl alcohol are obtained. Similar condensation products resulting in the formation of phenazone derivatives are obtained from alkylated or phenylated *o*-phenylenediamines and dihydroxyquinone, dihydroxytolquinone, and chlorodihydroxyquinone.—T. A. L.

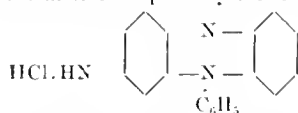
Indulines and Safranines. O. Fischer and E. Hepp. Ber. 29, 361—371.

THE mauves, indazines, rosindulines, Naphthyl red and blue, and Magdala red all belong to the class of the

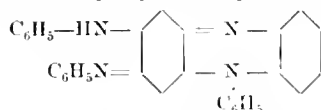
p-quinones, and this is also true of the safranines—a fact which has been recently demonstrated (this Journal, 1896, 192). All these compounds react with bases to form indulines, the formula of the simplest induline being—



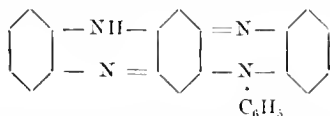
in which R can be either methyl, ethyl, or phenyl, &c. The safranines are distinguished from the indulines by their characteristic behaviour in sulphuric acid. The simple safranines, aposafranine, phenosafranine, mauveine, indazine, and rosinduline dissolve in concentrated sulphuric acid with a green colour, whilst the anilides dissolve to violet or blue solutions. Recognising the relationship between the safranines and indulines, it is no longer necessary to insist on the old ammonium formula for the safranine salts, and Kehlmann's view (Ber. 28, 1710; this Journal, 1895, 858) that the salts of the induline bases and indones (rosinduline, &c.) are derived from an *o*-quinonoid azonium formula whilst the oxygen free induline bases and the indones are only *p*-quinonoid anhydrides of amido or of hydroxy-azonium bases, is untenable. It is more probable that the strong basicity of many of these colour bases is due to the imido group, and not to the azine nitrogen. Hence aposafranine hydrochloride has probably the formula—



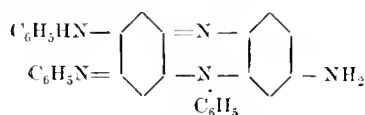
By the action of aniline on aposafranine salts, two compounds are obtained, the one being anilido-aposafranine, $\text{C}_{22}\text{H}_{18}\text{N}_4$, the other phenylanilido aposafranine, $\text{C}_{30}\text{H}_{24}\text{N}_4$ —



This constitution is proved by splitting off successively the two phenyl groups, leaving finally hydroxyaposafuranone, which was characterised by conversion into its methyl ether (red needles or prisms melting at 248°C). In a similar manner two products are obtained by the action of *p*-toluidine on aposafranine. With *p*-phenylenediamine, *p*-amido-anilido-aposafuranine is obtained, which crystallises from benzene in bluish-green prisms, melting at 227°C . On heating with dilute sulphuric acid to 170°C , *p*-phenylenediamine and hydroxyaposafuranone are produced. By reacting with *o*-phenylene diamine on aposafranine chloride, phenylfluorindine—



is produced, which bears out the authors' formula for the fluorindines. As already observed, anilidophenylaposafuranine (formerly known as phenylinduline) is obtained from aposafranine or from anilido-aposafuranine by the action of aniline. It can further be obtained by removing the amido group from amidophenyl induline, which is an important induline of the amido-azobenzene melt. This compound has the constitution—

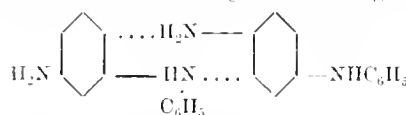


and it can be converted by heating with dilute sulphuric acid first into amidohydroxyaposafuranone, and subsequently into dihydroxyaposafuranone. Decomposition with an alkali yields safranin and anilidosafuranol. Its relationship to phenosafranine, mauveine, and phenylmauveine is shown by the fact that the same induline is obtained from it as

from these compounds, when heated with aniline. This product is formed in the induline melt, and is the greenish-blue induline remaining behind when the induline melt is extracted with alcohol. It forms a characteristic acetate, which crystallises from acetic acid in flat bronzy prisms. It has most probably the formula $\text{C}_{20}\text{H}_{16}\text{N}_6$, since in its production from phenylmauveine an intermediate product can be isolated, which melts at 215°C , and has the formula $\text{C}_{20}\text{H}_{16}\text{N}_6$.—T. A. L.

Safranines, Constitution of. R. Nietzki. Ber. 29, 1442—1446.

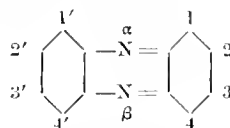
The author points out that in almost all the previous work (see preceding abstract) on the safranines the symmetrical formula has been adopted, although their constitution, according to the methods of preparation, could be equally well expressed by the unsymmetrical formula. Hitherto the isomerism of aposafranine and the simplest induline has been taken as evidence of the correctness of the latter formula, but since Kehlmann has shown that the simplest induline does not exist, there is no longer a necessity for expressing a distinction. Experimental evidence is now brought forward, at any rate for mauveine, in support of the symmetrical formula, and the author adopts it also for all the safranine colouring matters. The joint oxidation of *m*-amidodiphenylamine and *p*-amido-diphenylamine, or of diphenyl-*m*-phenylenediamine and *p*-phenylenediamine, could take place in either case in two ways. Since, however, the same colouring matter is obtained by either method, the product must be formed according to the following scheme—



and hence mauveine is expressed by a symmetrical formula. This, then, follows for all the allied colouring matters. The substance, in view of its strongly basic character, has an azonium rather than a quinone-imide formula, and this view obtains especial support in the strong basicity of diacetyl-safranine. In a similar manner the reddish-violet base acetylposafuranine, gives yellow salts which are not decomposed by dilute alkaline carbonates. Fischer and Hepp's statement that aposafranine cannot be diazotised is not confirmed by the author. At any rate, if just sufficient acid be added to an aqueous aposafranine solution until it just begins to turn green, on adding sodium nitrite it turns yellow. No colouring matter is formed with alkaline β -naphthol solution, but the addition of cuprous chloride causes a violent evolution of nitrogen, and the colour of the solution changes. With respect to Kehlmann's view that the anhydrous bases are expressed by quinone-imide formulae, it would appear more probable (since such a transformation would certainly be evidenced by a change of colour, and the safranines are distinguished from the eorhodines and true indulines by their stability to alkalis) that an inner anhydride formation takes place between the ammonium hydroxide and the amido or hydroxyl group. That the rosindulines and rosindones have an analogous constitution is sufficiently evident from their properties.—T. A. L.

Phenazine Colouring Matters, Nomenclature of. IV. G. P. Jaubert. Ber. 29, 414—418.

The author suggests a scheme for the nomenclature of the various phenazine derivatives (this Journal, 1895, 858), to which belong the eorhodines, safranines, indulines, and mauveines, &c. It is proposed to number the parent substance, phenazine, as follows:—

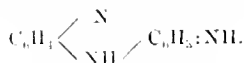


It will be seen subsequently that in the induline colouring matters the α -nitrogen plays the same part as the methane carbon in triphenylmethane derivatives. The

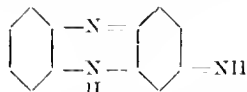
phenazine derivatives can be divided into two classes—the eorhodines and the indulines. The former have an o-quinonoid structure—



whilst the indulines are *p*-quinonoid derivatives—



As already mentioned (Ber. 28, 1585; this Journal, 1895, 858), the simplest representatives of the eorhodines and indulines are isomeric. The above formulae will explain the stronger basicity of the eorhodines and their diazotizability in contrast to the indulines, which are weaker bases and non-diazotizable. The simplest eorhodine is 3-amidophenazine, which yields 3-hydroxyphenazine or eorhodol, when the amido group is replaced by hydroxyl. The introduction of an amido group para to the α -nitrogen yields amido-eorhodine or Phenylene red (3,3'-diamidophenazine). The dimethyl derivative of this substance is Neutral violet. If one amido group be replaced by hydroxyl, amido-eorhodol is obtained, whilst the replacement of both amido groups yields hydroxyeorhodol. With regard to the *p*-quinonoid derivatives, the simplest induline—



has not yet been prepared. Replacement of the amido group by oxygen yields indulone (Fischer and Hepp, indone). In order to designate substitution in the azine ring, the author adopts Witt's suggestion, making use of the prefixes, metho-, etho-, pheno-, α - and β -naphtho-, &c., whilst the usual prefixes methyl, ethyl, phenyl, &c., are employed to denote substitution in the amido or imido groups. Hence aposafranine is pheno-induline and safranine is pheno-indulone. The introduction of an amido group into the simplest induline para to the α -nitrogen gives the simplest safranine, whilst if the imido group be replaced by oxygen there results amido-indulone, from which hydroxyindulone or safranil can be obtained by substituting the hydroxyl for the amido group. Several compounds belonging to this class have already been described (Comptes rend. 121, 947; this Journal, 1896, 108). In conclusion, the author points out some analogies between Malachite green and *p*-rosaniline, induline, and safranine. The introduction of an amido group into the benzene ring of diamidotriphenylmethane (unmethylated Malachite green) para to the methane carbon, yields *p*-rosaniline. Substitution in any other position ortho or meta gives colouring matters which have little in common with *p*-rosaniline. This is also true as regards the formation of safranine from induline. A safranine is only formed when the amido group enters the molecule para to the α -nitrogen. The function of the β -nitrogen appears to be that of strengthening the molecule, like the sulphur in Methylene blue or the oxygen in Nile blue, preventing its decomposition by acids like the indamines.—T. A. L.

Dibromo-Gallic Acid and its Derivatives, Action of Nitrosodimethylaniline on. [Gallocyanine.] A. Biétrex. Bull. Soc. Chim. 1896, 15, 104—408.

A monobromo-derivative of Gallo-cyanine is obtained by heating dibromo-gallic acid (1 mol.) with nitrosodimethylaniline hydrochloride (1 mol.) in methyl alcoholic solution.

It differs from Gallocyanine in its reactions mainly in not being affected by the addition of acid to its aqueous solution, Gallocyanine changing in colour from blue to violet-red when its aqueous solution is so treated.

The monobromo-derivatives of Prune and Gallanilic violet are similarly obtained from nitrosodimethylaniline and the methyl ether of dibromo-gallic acid and dibromogallanilide, respectively.—E. B.

Casein, Colour-Lakes prepared from. C. Dreher. Färb. Zeit. 1896, 7, 164—165.

COLOUR-lakes, which possess the advantages of being very pure in shade, fast to water, relatively inexpensive, and innocuous, are produced by precipitating casein, from an ammoniacal solution, in the presence of the (basic or acidic) colouring matter of the shade desired, by means of stannic chloride, basic stannic acetate, aluminium acetate, or aluminium chloride.

An Auramine (yellow) lake is, for instance, prepared from the following solutions:—

Casein Solution.—10 parts of powdered casein are made into a paste with 20 parts of water, and then 80 parts of water and 1—2 parts of ammonia solution are added. The whole is heated at about 40° for two hours. The liquid is then strained through fine cloth to remove undissolved matters.

Dyestuff Solution.—5 parts of Auramine are dissolved in 1,000 of water at 60°.

Stannic Chloride Solution.—10 parts of the crystallised salt in 1,000 of water.

The lake is obtained by mixing 30 parts of kaolin with 20 of warm water and 80 of casein solution, adding 100 of the dyestuff solution and, lastly, while stirring, the stannic chloride solution (about 2 parts are required) until the colouring matter is completely precipitated. The precipitate is collected, pressed, and dried at 60°.—E. B.

Magenta and Acid Magenta, Distinction between; Schiff's Reaction. P. Cazeneuve. J. Pharm. Chim. 1896, 3, [11], 595.

See under XXIII., page 560.

PATENTS.

Colouring Matters [Cotton Bluish-Blacks], The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 13,626, July 16, 1895.

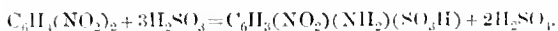
ACCORDING to Eng. Pat. 7337 of 1892 (this Journal, 1893, 350), of which this is an extension, colouring matters are obtained by combining diazotised amido-azo compounds with phenyl- or tolylnaphthylamine sulphonic acids. In the present specification these latter compounds are replaced by alkylated naphthylamine sulphonic acids, such as methyl-, ethyl-, or benzyl- α - or β naphthylamine sulphonic acids, or by alkylated naphthylamine disulphonic acids. The alkylated naphthylamine sulphonic acids are produced in the usual manner by the action of an alkyl haloid on the particular naphthylamine sulphonic acid in the form of its sodium salt, under pressure, and with or without the presence of an alkali. Thus an aqueous solution of one molecular proportion of 1.1'-naphthylamine sodium sulphate is heated with one molecular proportion of ethyl bromide in an autoclave to 90°—100° C. with constant agitation until the pressure disappears. The melt is then allowed to cool, and the ethylated naphthylamine sulphonic acid is separated in the usual manner. The following example illustrates the formation of a colouring matter:—The diazo solution from 17.3 kilos. of *m*-sulphanilic acid, 7 kilos. of sodium nitrite, and sufficient hydrochloric acid, is run into 800 litres of water containing 18 kilos. of α -naphthylamine hydrochloride. The formation of the amido-azo compound is assisted by the addition of sodium acetate and by slightly warming the liquid. When cold, 30 kilos. of hydrochloric acid (30° B.) and 7 kilos. of sodium nitrite are added. The formation of the diazo-azo compound is complete in about 12 hours, when it is filtered off and stirred into a solution of 25 kilos. of 1.1'-ethylnaphthylamine sulphonic acid, together with 5.3 kilos. of sodium carbonate. The formation of the dyestuff is completed by adding 7 kilos. of sodium acetate, and by gently warming the mixture. The colouring matter is separated in the usual manner, and the acid has the following formula:—



It dyes unmordanted cotton fast bluish-black shades. Other variations are described.—T. A. L.

Meta-nitraniline-sulpho Acid and its Analogues. Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst a. M., Germany. Eng. Pat. 14,382, July 29, 1895.

By the action of neutral sulphites on *m*-dinitro compounds of the benzene series, a reaction takes place according to the following equation:—



A solution of 5 kilos. of neutral sodium sulphite in 20–25 litres of water is heated to boiling, and 1.68 kilos. of *m*-dinitro benzene are added in small quantities with constant agitation. When the dinitrobenzol melts, a vigorous reaction ensues, and the mixture forms a clear yellowish-brown solution, from which small brownish-black needles of the new nitro-amido sulphonic acid may be separated by the addition of 2.5–3 kilos. of crude hydrochloric acid. The new acid, when pure, forms almost colourless needles, very sparingly soluble in cold water and fusible without decomposition. It dissolves easily in alkaline carbonates and in sodium acetate, and gives with nitrous acid a sparingly soluble diazo compound. The acid, from the above properties, appears to be different from the *m*-nitraniline sulphonic acid of Post and Hartung (Annalen, 205, 102). In a similar manner to the above, a corresponding acid may be obtained from dinitrotoluene [$CH_3 : (NO_2)_2 = 1 : 2 : 1$], although the reaction does not take place so smoothly. The resulting nitrotoluidine sulphonic acid is somewhat more readily soluble in water than the corresponding *m*-nitraniline derivative.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Sansevieria Zeylanica Fibre. Report on. Imp. Instit. Journal, Scient. Investig. Dept., July 1896, 264.

The fibre of this plant, which belongs to the natural order Liliaceæ, is of a beautiful light colour and fine gloss. The staple is about 4 ft. in length, of smooth well-formed threads.

The sample was obtained from Angoorie, in Assam, where Dr. Watt observed that it was being grown upon waste land by a tea-planter. Dr. Watt states that the plant can be grown without cultivation; if fragments of the leaves are scattered over the soil, each fragment takes root rapidly, and a good crop is yielded in a very short time.

Chemical examination shows this fibre to be of high quality. C. F. Cross examined a sample of "Sansevieria," which was included in the collection at the Indian and Colonial Exhibition, and also tested its paper-making qualities; the chemical results obtained by him showed that the specimen he examined was inferior in quality to the present sample. (Report on Indian Fibres, 1886.)

The following are the results furnished by the two samples:—

Sansevieria Zeylanica,	Assam.	From Colonial* and Indian Exhibition.
	Per Cent.	Per Cent.
Moisture	3.4	2.7
Ash	0.7	..
Loss by A. hydrolysis	11.8	12.0
" B.	14.9	16.5
" mercerising	11.6	..
" acid purification	1.4	2.5
Gain by nitration	33.5	6.0
Cellulose	75.6	64.6
Length of ultimate fibre in mm. ...	1.5–3.5	1.5–2.5

* Report on Indian Fibres.

With the exception of the results of chemical examination obtained in the Scientific Department of the Imperial Institute, there are very few available for purposes of general comparison of monocotyledonous fibres. Many of the fibres dealt with in these reports were obtained, it is true, from plants which were not indigenous to the locality

they were grown in. Special care, however, had been taken in the cultivation and treatment, so that the fibre which they furnished was probably little inferior to the same kind of fibre derived from the wild plants grown in their natural habitat. Accepting the results which they furnished as suitable for purposes of general comparison, it appears that the "cellulose" numbers furnished by fibres of monocotyledonous origin range from about 61 to 77, the average number being about 70. The "nitration" numbers range from 9 to 34, with an average of about 20.

Sansevieria, which furnishes the numbers 75 and 33 respectively, therefore ranks high among these fibres. Again, the A. and B. "hydrolysis" numbers, and especially the difference between them, are of special significance. The Victorian monocotyledonous fibres may, indeed, be classified from this point of view. Thus, the approximate hydrolysis numbers and the differences are, respectively, for the Cordylines, 15, 19, and 4; for the Agaves, 16, 21, and 5; for the Kniphopas, 17½, 23, and 6.

Sansevieria gives the numbers 12, 15, and 3. These would indicate that it should possess special powers of resistance to weathering and the accompanying hydrolytic effects. The general results of chemical examination of this fibre may be considered as very satisfactory. A comparative statement of the results furnished by the monocotyledonous fibres, showing the relation of *Sansevieria* thereto, is appended:—

	A. Hydro-lysis.	B. Hydro-lysis.	Difference.	Cellulose.	Nitration.
	No.	No.		No.	No.
Cordylines	15	19	4	68½	18
Agaves	16	21	5	75½	19
Kniphopas	17½	23	6	71	29
General range	10–18	20–30	10	61–77	9–34
Sansevieria Zeylanica	12	15	3	75½	33

The reports of experts on this sample of *Sansevieria* were favourable, although it exhibited some trifling defects, due, probably, to the degree of maturity of the plant from which it was prepared.

Silk, Weighting Materials in: The Quantitative Estimation of. H. Silbermann. Chem. Zeit. 20, 472.

See under XXIII., page 563.

PATENTS.

Wools, Woollen Rugs, or Tissues [Carbonisation] intended to be Carbonised or Bleached, A Process for the Acidulation of. G. Philips, Stolberg, Germany. Eng. Pat. 12,857, July 3, 1895.

In order to effect a complete and rapid saturation of the matters which are to be destroyed, the woollen materials are treated with a dilute solution of the acid to be applied, in a vessel from which the air is exhausted.—E. B.

Treatment of Vegetable Fibres [Preparing for Spinning]. Improvements in the. C. Etros, New York, U.S.A. Eng. Pat. 7405, April 7, 1896.

VEGETABLE fibres in general, but, more particularly, those which are used in the manufacture of ropes and cordage, as hemp, linen, and jute, are improved in appearance and better adapted for spinning "or otherwise working," by impregnating them with a solution of sodium phosphate, "or of a caustic alkali," or of a mixture of some or all of the following substances:—Magnesium silicate (this may be replaced by kaolin, steatite, potassium or sodium silicate, or other substances), glucose, wheaten flour, paraffin wax (for which may be substituted stearin, bees-wax, mineral wax, or vegetable wax), "alkali soap," neutral soap, creasote, sodium phosphate, paraffin oil, tallow, and water. The solution or mixture may be applied in various ways, one of which is to spray it, heated at about "60° R." upon the fibres previously spread out and heated at about the same temperature.—E. B.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Textile Fibres, Animal, Bleaching of, by Hydrogen Peroxide. G. Dommergue. *Rev. de Chim. Ind.* 1896, 7, 75, 73—74.

THE apparatus employed for bleaching tissues consists of two eubical tanks: one for the treatment with hydrogen dioxide, the other for rinsing. The first of these is provided with a cover, winches, and squeezing rollers. It is filled with hydrogen dioxide solution (12—14 vols.), diluted with 20 times its volume of water, and rendered slightly alkaline with either sodium or potassium hydroxide, or ammonia. The pieces, previously thoroughly scoured, are introduced into the bath, and worked therein for 6 to 10 hours, according to the degree of bleaching to be attained. They are then squeezed and withdrawn, and are afterwards washed, hydro-extracted, and dried.

"Market whites" are produced by faintly tinting the tissues thus bleached, with blue-violet dyestuffs, such as "Methyl violet, 350 N." or "Crystal violet."

Pelgrain's method for applying the hydrogen dioxide is more laborious and costly than the above. It consists in passing the tissues through an alkaline solution of hydrogen dioxide, contained in a mangle or dye-jigger, and receiving them on a wooden roller, leaving them on this for 12 hours, and then unrolling and washing.

Sodium silicate, which has been suggested as a suitable addition to the hydrogen dioxide bath, imparts a harsh feel to the tissues, and is not, therefore, to be recommended.

—E. B.

Lactic Acid as an Assistant in Mordanting Wool. E. Hoffmann. *Färber Zeit.* 7, 217—218. (See also this Journal, 1896, 196.)

FURTHER experiments have convinced the author of the superiority of lactic acid to other assistants when mordanting wool with chromium. The difference is most marked when pieces of wool mordanted respectively with "chrome" and tartar, chrome and oxalic acid, and chrome and lactic acid are all dyed in the same bath. Besides yielding fuller shades, lactic acid is cheaper than tartar. The present price in Germany is 60—65 M. per 100 kilos. The German commercial product contains 50 per cent. of lactic acid, that of American manufacture about 27 per cent. The shades produced are equal in fastness to those obtained with other assistants.—R. B. B.

Indigo Vat, The Stannous Chloride. F. Reisz. *Färber Zeit.* 7, 221—222.

THE author states that this vat, described by Dreher in *Färber Zeit.* 7, 115—117 (this Journal, 1896, 354), was referred to by Bancroft in 1826. Its great defect is that it undergoes rapid changes and can only be used for a short time, in this respect being inferior to the ferrous sulphate and zinc-powder vats. Owing to its strong alkalinity it is not suitable for wool dyeing. The ideal indigo vat is one in which some neutral organic substance yet to be discovered, acts as solvent for the indigo white.

—R. B. B.

Indigo Vat, The Stannous Chloride. A Reply to F. Reisz. (See preceding abstract.) *Färber Zeit.* 7, 222—224.

THE stannous chloride vat was not proposed as a substitute for the ferrous sulphate or zinc-powder vats, but for the hydrosulphite vat, over which it possesses the advantages of greater stability and less cost. It is especially suitable where dyeing is carried on in a closed vessel, e.g., in cop dyeing. The indigo vat of the future will more probably be one in which reduction is brought about by electrolytic action, unless, as is most likely, natural indigo is replaced within a few years by the artificially prepared product.—R. B. B.

Furs, The Use of "Ursol" in the Dyeing of. E. Gruene. *Färber Zeit.* 7, 197—200.

WITH the dyestuffs Ursol D, P, and C [the "Ursols" are para-amidophenol and *p*-phenylenediamine and their

derivatives] of the Berlin Actien Gesellschaft, it is possible to dye skins and furs in all shades, from the lightest brown to black. Two methods of application are recommended: either the wool is first mordanted with chrome and tartar, or it is dyed directly with Ursol. In both cases, towards the end of the dyeing operation an oxidising agent is added to the bath, and for this purpose hydrogen peroxide should be employed. Before dyeing the furs, &c., are cleansed from fatty matters by brushing with a solution containing lime. Dyeing is carried on at a temperature of 15—20° C. As an example, a dark brown may be thus dyed:—Mordant for three hours at 20° C. with 200 grms. of $K_2Cr_2O_7$ and 100 grms. of cream of tartar, dissolved in 100 litres of water. Dye with 200 grms. of Ursol D, dissolved in 100 litres of water. After dyeing at 20° C. for two hours, add 5 litres of H_2O_2 (3 per cent.), and continue steeping for four hours. To soften the leather after dyeing, it is brushed over with a solution of salt, and the fur is then revolved in a drum, in which it is closely packed with sawdust and sand.—R. B. B.

Wool- and Cotton-Dyestuffs, The "Overboiling" of.

M. Kitchelt. *Färber Zeit.* 7, 181—183 and 218—221.

ON long boiling with certain dyestuffs, the colour of the dyed wool is changed or destroyed. Complaints of this nature made with regard to sulphone-cyanine, that instead of blue, black or brown shades were obtained, led to the investigation of the causes of this defect. It was found only to exist in the case of wool containing a little alkali from the scouring process, and must be attributed to the reducing action of sodium sulphide. This is formed by a partial decomposition of the wool substance in alkaline solution, whereby sulphur is set free and enabled to combine with the alkali. This view is borne out by the fact that wool dyed with sulphone-cyanine and "overboiled" has the same colour as if "stoved" after dyeing. The remedy consists in making the bath faintly acid, and in adding a small percentage of $K_2Cr_2O_7$ towards the end of the operation to counteract reducing influences. The same change is noticed in goods which are steamed after printing or dyeing with sulphone-cyanine, and in this case $CuSO_4$ is employed as the oxidising agent.

Similar phenomena have been observed in cotton dyeing, but here the causes are different. Benzo fast grey is a dyestuff readily affected. In one case investigated, the defect was found to be due to the water used for dyeing, which was rich in organic impurities. The reducing action of these impurities can be prevented by boiling the water with $K_2Cr_2O_7 + H_2SO_4$ before dyeing. In other cases the reduction was due to the cotton having become mouldy, and here again preliminary treatment with $K_2Cr_2O_7$ and H_2SO_4 sufficed to prevent decomposition.—R. B. B.

PATENT.

Printing Inlaid Patterns upon Linoleum and like Fabrics, A Process for. J. E. and C. S. Belford, Leeds. Eng. Pat. 11,716, June 17, 1895.

THE object is to produce in an improved manner printed linoleum fabrics, with coloured designs penetrating to a greater or less extent the substance of the fabrics.

This is accomplished by printing (preferably by means of a block-printing machine) the pattern to be produced on the linoleum, upon a sheet of cartridge paper or calico, which has been previously sized to render it non-porous, and transferring by pressure to the porous linoleum, evenly spread upon a cloth backing.

The colours employed, consist either of pigments, ground to a stiff paste with boiled linseed oil, and mixed with a "volatile pigment vehicle" in the following proportions:—for example:—Pigment paste (5 parts), semi-solid, oxidised linseed oil (2), petroleum of sp. gr. 0.812 (3), turpentine (2), benzene (2), and resin ($\frac{1}{2}$), or of solutions of appropriate colouring matters, such as, for instance, rosaniline combined with linoleic acid in an oil-mixture similar to the above.

The object may also be attained by directly printing the colours upon the lightly-pressed surface of the porous linoleum composition.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Thirty-Second Annual Report on Alkali, &c. Works, by the Chief Inspector. May 12, 1896.

Mr. R. FORBES CARPENTER, who succeeded Mr. Fletcher in the office of Chief Inspector under the Alkali Works Act in June 1895, gives this year his first report, following the lines laid down by the first inspector, Dr. R. Angus Smith, and his successor. Of the present report, 97 pages are devoted to England, Ireland, and Wales, treated as seven districts, and the remaining nine pages are given to Scotland in a separate communication.

There has been a steady, though small, diminution in the average amount of acid gases escaping in alkali and in sulphuric acid works for the years 1893-95, the escape for all these years being greatly below the legal limit. The acid gas escaping by chimneys, including that produced from the sulphur contained in the coal used, is higher, but for this no standard is prescribed by the Act, though it is watched by the inspectors, especially in wet copper works and in sulphur recovery works.

The following table is given of the—

SALT DECOMPOSED IN THE LEBLANC AND AMMONIA-SODA PROCESSES (INCLUDING SCOTLAND).

	1895.	1894.	1893.
	Tons.	Tons.	Tons.
Leblanc process.....	408,173	434,298	467,562
Ammonia-soda	428,614	361,603	319,609
Total	836,787	795,901	817,171

Here the steady gain of the new process upon the old is clearly shown, and soon, it would appear, both processes are likely to have a new competitor in the electrical process, preparations for working which are being made by the Electro-Chemical Co., at St. Helens, using Holland and Richardson's process; by the Castner-Kellner Alkali Co.; and by Hargreaves and Bird's process for the production of alkali and chlorine, already worked out on the experimental scale at Farnworth. In obtaining alkali carbonate by this process, the voltage was so low as 3·2 to 3·5; but on working for alkali as caustic, the voltage rises, and Mr. Hargreaves claims "that from a given amount of electrical energy a greater aggregate market value is produced when working for carbonate of soda and injecting carbonic acid into the empty cathode compartments, than when working for caustic." The carbonic acid required, is obtainable from the exhaust of the gas-engine employed to run the dynamo.

The treatment of alkali waste does not appear to have made progress in the year past, and it is stated that "the problem of how to turn to account the 10 to 15 per cent. still lost as sulphur and escaping from the Chance-Claus process in gaseous forms and in the finely divided state of flowers of sulphur, is no step nearer solution," notwithstanding the ingenuity of many practical minds turned to the subject.

At Middlesbrough, a large plant is nearly completed for working Col. Sadler and Mr. Wilson's nitric acid chlorine process. In Scotland, the use of the oxidising action of nitric acid upon hydrochloric acid, has made no practical advance, and is not yet in operation in the manufacture of bleaching powder on a commercial scale.

Mr. Kessler's process for rectifying sulphuric acid at a temperature far below that attained by other apparatus, has been introduced in Scotland, and its illustrated description forms a feature in the report. Attention is directed to Dr. Valentiner's process of distilling weak nitric acid with sulphuric acid of sp. gr. 1·40 in a partial vacuum, at a temperature not above 100° C., monohydrate of 94 to 95 per cent. being obtained; but the process has not been actually introduced. Professor Hart's novel form of combined glass and earthenware condenser (this Journal, 1895, 967) has been introduced here, and should, it is stated, be of service in diminishing local escape from joints, as these are reduced in number, and the condenser is water-cooled instead of air-cooled.

In sulphate of ammonia works, the sulphuretted hydrogen evolved in the distillation of gas liquor is either, in large works having vitriol plant, converted first into sulphurous acid and then into sulphuric acid; or sulphur is obtained in the Claus kiln. In smaller works, the method of absorption in oxide of iron is generally used. The practice sometimes adopted of burning the gas and allowing the products to pollute the atmosphere, is strongly deprecated. The continuous distillation of gas-liquor is found to be not only economical, but to simplify the problem of dealing with the foul gases. It is stated that the use of valves of ordinary construction for shutting off access of foul gas to disused purifiers is attended with great risk, and description and drawings are given of a change water lute that has been advantageously used for many years in several sulphate works. The necessity, in designing sulphate of ammonia plant, to provide for the drawing off of the water condensed from the vapours leaving the saturator at the hottest possible point in this portion of the plant, is insisted on. The amount of sulphate of ammonia produced in the United Kingdom is shown in the following table:—

	1895.	1894.	1893.
	Tons.	Tons.	Tons.
Gasworks	119,645	113,634	112,179
Ironworks	14,588	16,075	8,833
Shale works	38,335	32,891	28,185
Product-gas, coke, and carbonising works.	7,083	3,448	3,265
Total	179,651	166,048	152,762

Considerable progress has been made in the recovery of ammonia from blast furnaces where coal is used, costly and extensive plant being erected for the purpose. It is estimated that the tar, ammonia, and light oils (including benzol) recoverable from the consumption of 14,300,000 tons of coal used in the annual make of pig iron in coke-fired blast furnaces, would be worth three and a half millions sterling. Proposals for the extended use of sulphate of ammonia in agricultural industries are referred to, the introduction of beet-root cultivation in this country being recommended, as well as the home manufacture of glucose from potatoes.

The production of superphosphates in this country is nearly a million tons; the same in the United States; in Germany, 800,000 tons; in France, 750,000; in Belgium, 300,000; in Denmark and Holland, 200,000; and in Italy, 50,000 tons, worth altogether, ten millions sterling, in addition to which nitrates to the value of eight millions, ammonia to the value of two and a half millions, and other fertilisers to the value of two millions; in all, between twenty-two and twenty-three millions are used.

The number of works registered under the Act in England, Ireland, and Wales, is 1,065, besides 126 works registered in Scotland. The number of processes exceeds the number of the works. Many details are given respecting the processes used in minor works for the condensation of acid gases. Such condensation is especially difficult in Venetian-rod works, and experiments have been conducted as to the amount of acidity removed by scrap-iron towers.—E. S.

Sulphuric Acid, Use of Lunge-Rohrman Towers in Manufacture of. H. H. Niefenführ. Chem. Zeit. 20, (1896), 31—33.

The object of the Lunge-Rohrman tower in the sulphuric acid manufacture is, in the first place, to diminish the chamber space necessary for any given output, and, finally, to replace the lead chamber altogether. The author gives his experience with towers built for the first of these purposes.

Sometimes the tower is placed immediately behind the Glover tower, usually between the chambers, and less frequently in the latter half of the plant. It is not advisable to place the Lunge tower in front of the chambers, since, at this point, a small amount of chamber space does relatively a large amount of work; and further, in this position, there is danger of accompanying arsenious and arsenic acids, and even flue dust, blocking the holes in the plates. The

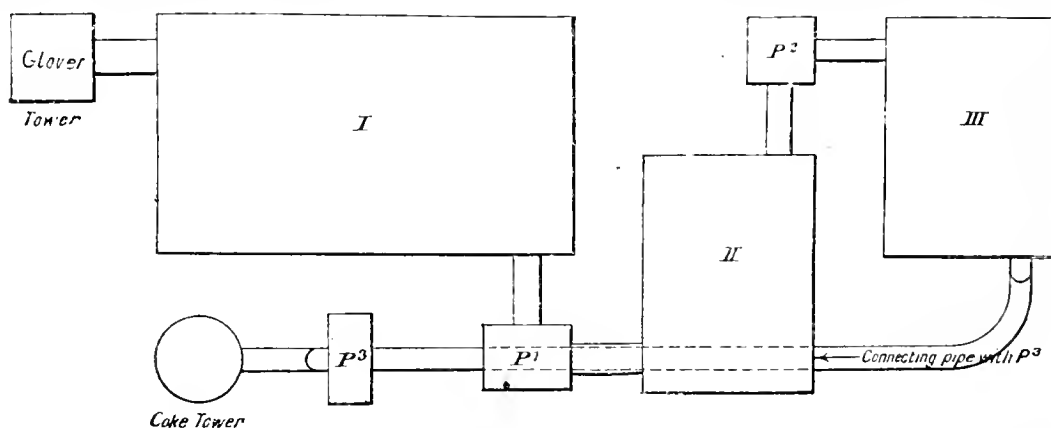
appreciable rise in temperature which must necessarily result, further destroys the lead portions of the apparatus and causes loss of nitre; the author states that a works arranged in this manner has derived no advantage from the tower.

On the other hand, manufacturers who have used a tower in the middle or last portion of the chamber space have obtained increased outputs ranging from 10—45 per cent., the use of nitre remaining as before, or in some cases being greater or less. The author draws attention to the great differences existing in works, in the amount of chamber space per 1 kilo. of sulphur burnt, the size of the chambers and their number, the distance traversed by the gases and the rate at which these are drawn through the apparatus. On account of these differences he finds it impossible to give absolute values for the work of each plate or plate-layer, in a Lunge tower. His experience, however, shows that in badly constructed works the full value of a tower is not obtained, since part of its performance is absorbed in correcting mistakes in the other portions of the plant. He gives the following details obtained from works in which

the towers were placed in the middle of the respective systems:—

(1.) The arrangement consisted of two equal chambers of 2,680 cb. m. total capacity, the ratio between cross-section and length being good (length approx. 59 m.). Under ordinary conditions the daily consumption of Sicilian sulphur was 1,500 kilos., and the kilns burnt this with their normal draught. On placing a Lunge tower between the chambers, the daily conversion rose to 2,300 kilos. of sulphur, i.e., the chamber space per kilo. of sulphur burnt in 24 hours fell from 1.8 to 1.16 cb. m. The increased distance travelled by the gases allowed of increased draught, and this again enabled the kilns to burn the greater quantity of sulphur necessary.

(2.) The capacity here reached 1,080 cb. m., which was divided between four chambers; the total length of these, however, was only 24 m. A daily consumption of 750 kilos. of sulphur was increased to 900 kilos. by the introduction of a tower. The construction of the system rendered normal working difficult; the use of the tower made the working more regular, at the same time increasing the



output; it did not, however, compensate for lack of chamber length.

(3.) Here again the capacity was 1,080 cb. m., but the plant was better constructed, its length being 39 m. As in 2, difficulty arose at the Gay-Lussac tower. 800 kilos. of sulphur, as pyrites, were burnt daily, and this rose, with the use of the tower, to 960 kilos.

The chamber space in this case is therefore 1.12 per kilo. of sulphur. Increase in the number of the pyrites burners would have given a still better result. A diminution in the nitre required, was proved to have occurred in this factory with the introduction of the tower.

These examples give no absolute figures for the value of the towers, but they show that one use of these is to correct errors in the construction of existing plant, and the author has found that any grave mistakes may be rectified when a suitable tower is introduced in the proper position. He also points out that in nearly all cases, the maximum yield is not obtained from the system, the cool chamber space at the back of the tower doing but little work. This might be altered, it is thought, by increasing the pyrites kilns or condut pipes, or by other known means.

An early objection to the use of the towers was that the vitriol obtained from them contained nitric acid. This fault does not occur if the feed acid be of proper strength, 30—42 B $\frac{e}{\circ}$; in this case, the outflowing acid is no richer in nitrogen acids than that obtained from a chamber in a similar position in the ordinary system.

Experience has shown that a plate tower cannot replace the Glover tower; the flue dust from the pyrites kilns blocks the holes in the plates, and the frequent cleansing of these, even if possible without breakage, would interfere too much with the working of the process. One or two layers of plates with larger holes might, however, prove of advantage if fixed on the top of an ordinary tower.

On the other hand, the Lunge-Rohrmann apparatus has given splendid results when used as a Gay-Lussac tower. In two instances the author has replaced the first of a series of two Gay-Lussac towers, in a system of about 2,800 cb. m. capacity, by a plate apparatus 1.6 m. in height, and with this has done exactly the same work as when previously a coke column of 8 m. had been employed; that is, a saving of four-fifths of the absorption height has been effected.

The Lunge towers give a nitrous vitriol of more constant strength, and cause a steadier draught through the whole system. They are specially valuable in districts subject to sudden storms.

The towers have been found useful as denitrating apparatus for the preparation of sulphuric acid free from nitrogen products, such as is used in refining stearin, petroleum, &c. It is here only necessary to conduct a part of the kiln gases through a tower fed with chamber acid of the desired strength.

The author recommends the following combination of the old system with Lunge towers for a new works, from which an output equivalent to a normal chamber system of 3,000 cb. m. is desired:—

The gases proceed from the Glover, through a tube 90 cm. wide, to chamber I, which is 7 m. wide, 6 m. high, and 12 m. long, and allows space for a good initial reaction. Chamber I is connected with the first tower, P 1 , by a 78-cm. pipe. The tower consists of 10—12 plate-layers and each layer contains 12 plates, i.e., here (and in the succeeding towers) the free cross-section is $1\frac{1}{2}$ times that of the entrance tube. From P 1 the gases travel through a 76-cm. tube, to chamber II. (5 m. wide, 6 m. high, and 7 m. long), and from here, by means of a 72-cm. conducting pipe, to the second tower, P 2 . This tower is formed by 16 layers, each of 9—10 plates, and is connected with chamber III, by a 70-cm. pipe, and from chamber III, there runs a 65-cm.

pipe 24 m. in length. This serves to cool the gases before they enter the tower P^6 (18—20 layers of 8—9 plates), which serves as the first Gay-Lussac tower. Behind this is an ordinary Gay-Lussac 8 m. high, filled with coke in the usual manner.

The dimensions have been calculated so as to ensure a uniform flow of gas in the connecting parts whilst diminishing the rate of flow in the towers, thus increasing the duration of reaction here. It is advisable to connect the free end of the Gay-Lussac with a Kötting's hard lead ventilator.

In conclusion the author confirms Lasehe's statement regarding the value of these towers for condensing hydrochloric acid, he himself having obtained good results with hydrochloric acid gas containing admixed sulphurous acid and organic impurities.—J. T. C.

Fatty Acids, Distillation of. E. Sorel. Comptes rend. 1896, 946—948.

FOLLOWING up his work on the distillation of alcohol (this Journal, 1893, 782), the author has examined formic, acetic, propionic, and butyric acids to discover the relationships of distillate to acid distilled, when partial cooling of the vapours before passing out of the retort is prevented. The upper part of the retort was jacketed, so that all the vapour passed over into the neck before condensation, and thus partial condensation (and consequent partial fractionation) on the upper walls of the retort was prevented.

The following abstract table gives the relationship between the distillate and the acid distilled:—

Strength of Original Acid.	Strength of Distillates.			
	Formic Acid.	Acetic Acid.	Propionic Acid.	Butyric Acid.
Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1.0	6.7	0.75	1.3	1.5
2.0	1.4	1.5	2.6	3.0
5.0	3.8	4.8	6.4	8.5
10.0	5.0	7.7	12.0	13.6
15.0	7.5	11.5	16.2	16.5
17.2	..	..	..	17.2
18.4	..	..	18.4	..
20.0	10.5	15.3	19.6	17.9
25.0	14.9	18.7	20.8	18.5
30.0	17.3	22.1	21.0	18.5
40.0	25.0	29.3	..	18.6
50.0	35.1	37.6	..	21.0
60.0	46.7	46.8	..	23.6
70.0	60.4	57.8	..	..

Thus, for acids of low strength, the water in the retort retains a greater proportion of acid the lower the molecular weight of that acid is, but above a certain strength, this state of things is reversed. Propionic and butyric acids of certain strengths (18.4 and 17.2 per cent. respectively) distil over as a whole, without change of strength. Butyric acid between 24 and 34 per cent. strength gives a distillate of constant strength (18.5 per cent.), thus being intermediate between liquids entirely soluble in water and those entirely insoluble therein.—L. T. T.

Cyanogen from Ammonia. Eng. and Mining J. 1896, 61, 449.

EXPERIMENTS have been made by Bergmann on the action of ammonia diluted or not with coal-gas or Dowson gas, on glowing charcoal. At 800° C. only 4 per cent. of the nitrogen supplied as ammonia was converted into cyanogen; at 1,000° C. 24 per cent. was converted. Using a mixture of ammonia and coal-gas, 60 per cent. of the nitrogen of the former appeared as cyanogen at a temperature of 1,180° C. Of the balance (40 per cent.), 29 per cent. was recovered as NH_3 and the remainder was split up into N and H. It is not certain whether the coal-gas acts simply as a diluent or whether its carbon takes part in the reactions. Using Dowson gas rich in CO, to take advantage of the equation $\text{CO} + \text{NH}_3 = \text{CNH} + \text{H}_2\text{O}$ (should it occur), very little cyanide was formed. The results of the experiments are summarised thus:—HCN, and not NH_2CN , is formed when ammonia is passed over red-hot charcoal; the by-products are N and H, and not

CH_4 . The addition of coal-gas increases the yield of cyanogen and decreases the decomposition of the ammonia. "Hydrocarbons of higher molecular weight seem to prevent the decomposition of the ammonia, becoming themselves decomposed, and their admixture is hence not advisable." Carbon monoxide and Dowson gas behave like coal-gas, but favour the decomposition of the ammonia. On the whole, the best yields were obtained with a temperature of about 1,100° C.—B. B.

Mond Producer-Gas Applied to the Manufacture of Steel. J. H. Darby. Iron and Steel Inst., Spring Meeting, 1896. The Ironmonger, 282.

See under 11., page 529.

Chlorides, Hypochlorites, and Chlorates; Volumetric Analysis of Mixtures of. A. Carnot. Bull. Soc. Chim. 1896, 15, 393.

See under XXIII., page 559.

Chlorides, Chlorates, and Perchlorates; Analysis of Mixtures of. A. Carnot. Bull. Soc. Chim. 1896, 15, 397.

See under XXIII., page 559.

Magnesia, A Basic Nitrate of. G. Didier. Comptes rend. 1896, 122, 935.

See under XXIV., page 565.

PATENTS.

Cyanides and Ferrocyanides, Improvements in the Manufacture of, from Sulphocyanides, and the Recovery of By-Products. J. Raschen and J. Brock, Liverpool. Eng. Pat. 10,476, May 27, 1895.

A SULPHOCYANIDE, such as sodium or calcium sulphocyanide, is mixed with or dissolved in four to five parts of water, and the mixture is allowed to flow gradually into a closed vessel containing some water maintained at or near its boiling point. Nitric acid is simultaneously admitted in excess. The vessel is provided with a stirrer and an exit pipe leading the gases evolved to a suitable absorber. The sulphur of the sulphocyanide is oxidised to sulphuric acid, and hydrocyanic acid with nitric oxide and steam pass to the absorber, charged with a solution of a caustic alkali or alkaline earth. A cyanide is thus formed, and air being carefully excluded, the nitric oxide is not absorbed, and is passed on to a suitable apparatus for regeneration as nitric acid, by treatment with air and steam. It is advisable to maintain "a slight vacuum" in the apparatus, to prevent leakage. The solution of the cyanide formed, may be evaporated in a vacuum pan, but, as it is liable to contain a little of the higher nitrogen oxides, it should not be fused, unless such oxides have been removed before the gases reached the absorber. If a ferrocyanide be required, the cyanide solution may be treated with a salt or oxide of iron.—E. S.

Cyanides and Ferrocyanides, Improvements in the Manufacture of, from Sulphocyanides, and the Recovery of By-Products. J. Raschen and J. Brock, Liverpool. Eng. Pat. 10,956, June 1, 1895.

THE process employed differs from that described in the preceding abstract (Eng. Pat. 10,476) in the use of an oxidising agent—such as a nitrate, chromate, lead peroxide, manganese peroxide, or the like, with sulphuric acid—instead of nitric acid, to oxidise the sulphur in the sulphocyanide to be decomposed. As the reaction is rather violent, the oxidising mixture is heated by itself, and the sulphocyanide, in solution or suspension in water, is gradually added. The hydrocyanic acid and other gases and steam evolved, are passed into a solution of an alkali or alkaline earth to form a cyanide, from which, if desired, a ferrocyanide may be obtained. In case a nitrate is used as the oxidiser, nitric oxide will be present in the evolved gases, and the treatment will be the same as that described in the abstract to the previous patent.—E. S.

Concentrating Sulphuric and other Acids, Improvements in Apparatus [Vessels] employed for. R. Wilson, London. Eng. Pat. 14,221, July 26, 1895.

BREAKER-shaped vessels are used, constructed of porcelain, glass, or glazed earthenware, in each of which, behind the lip, a vertical passage or conduit is formed by bending a strip of porcelain or glazed earthenware, while plastic, in the shape of a channel or groove, to the inside, reaching to within about an inch of the bottom. In the system adopted for a plant, the vessels are arranged in steps, so that the acid in each must pass up the channel formed as described, and flow over the depressed lip into the vessel next below, thus ensuring a perfect circulation, the lighter or weaker acid being always at the top.—E. S.

Nitrides and Ammonia, Improved Method for Producing. H. Mehnert, Charlottenburg, Germany. Eng. Pat. 12,471, June 27, 1895.

OXYGEN compounds of such elements as boron, silicon, magnesium, titanium, and vanadium, capable of combining with nitrogen at a high temperature, are exposed to the heat of an electric furnace in the presence of free nitrogen and carbon. A high-tension current must be employed, unless the furnace be fed with coarse pieces of coke and a jet of sand be blown in whilst generator gas is introduced; on entering the hot zone of the electric furnace, "the sand evaporates and then acts as desired." Nitrides thus manufactured may be treated with steam to obtain ammonia, and an oxide from which a nitride may be re-formed as before.—E. S.

Cyanogen Compounds, Improvements relating to the Production of, and to the Preparation of Materials for Use therein. Dr. A. Frank, Charlottenburg, and Dr. N. Caro, Berlin, Germany. Eng. Pat. 15,066, Aug. 10, 1895.

BARIUM carbide, or a mixture of calcium and barium carbide, or of calcium and sodium carbide, is heated to a "dark red" in a retort through which a current of nitrogen saturated with moisture is passed. The resulting mass is lixiviated, any acetylene gas given off is collected, and the cyanide solution obtained may be treated in any well-known manner. Preferably carbonic acid gas is passed into the solution to expel hydrocyanic acid, which is collected and converted into any desired cyanide. If a caustic alkali or alkaline carbonate be added to the carbide treated, nitrogen, free or combined, may be used dry. When it is desired to obtain ferrocyanogen compounds, iron is added to the carbide treated.

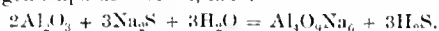
In preparing carbides from free metal and carbon, if a volatile metal, as potassium, sodium, or magnesium, be used, the metal is heated with carbon to the necessary high temperature in closed vessels, so that the vapour of the metal may be converted into carbide.—E. S.

Acid Pumps, Improvements in. E. P. Peyton, Birmingham. Eng. Pat. 15,425, Aug. 16, 1895.

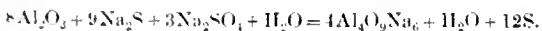
THE pistons of acid pumps, under this invention, are made of glass, china, or other material impervious to acids, instead of earthenware, which latter in time admits passage of the acid, whereby the iron rod cemented in the piston and by which it is worked, becomes corroded. Earthenware pistons may, however, be rendered impervious by means of paraffin, wax or resin, applied either in a melted state, or repeatedly, after successive dryings, in solution in a volatile solvent. Or such pistons may be enamelled.—E. S.

Aluminous Ores and Silicious Matters, A New or Improved Process for the Treatment of. W. T. Whiteman, London. From The Compagnie Générale d'Alumine Exploitation des Brevets F. Raynaud (Société Anonyme), Brussels, Belgium. Eng. Pat. 8072, April 16, 1896.

WHEN a mixture of bauxite and sodium sulphide is heated in the presence of steam, sodium aluminate is formed and hydrogen sulphide evolved, thus:—



If sodium sulphate be added to the mixture, sulphur is set free—



Replacement of the alumina by silica in the mixtures, gives soluble silicates, the other products being the same. It is preferred in the first-described process to form briquettes of a mixture of aluminous ore, carbon, and alkali sulphate; after drying, the briquettes are heated in cylinders through which steam is passed, and the H_2S evolved is collected. The fixed product is lixiviated to obtain the alkali aluminate, from which alumina may be precipitated by carbonic acid.

To obtain aluminium sulphide, as a source of aluminium, a mixture of alumina and crushed coke is heated in a current of hydrogen sulphide. The addition of 3—4 per cent. of an alkaline or alkaline-earthly oxide to the mixture facilitates the reaction. Or aluminium sulphate is reduced by hydrogen sulphide "in presence of carbon, oxides, sulphates, or sulphides." The aluminium sulphide, obtained by either process, is mixed with 5 per cent. of lead sulphide, and with lead sulphate equivalent to the sulphur in the aluminium sulphide. On heating the mixture to bright redness, "the sulphide of lead reacts on the sulphate of lead and forms sulphurous acid, which is set free in a pure state, and metallic lead which, acting on the sulphide of aluminium, seizes upon its sulphur and oxidises it by means of the sulphate of lead, thus re-forming a fresh quantity of sulphurous acid and metallic lead, which continues to absorb the sulphur of the aluminium, while the latter is not in the metallic state. A small amount of sulphide of lead is, therefore, sufficient to reduce large quantities of sulphide of aluminium, and thus the use of metallic lead is avoided." This process is claimed as yielding simultaneously, aluminium and sulphurous acid.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Aventurin Glass. H. Mäckler. Thonind. Zeit. 1896, 20, 220.

THE author finds that normal glass of the composition 3SiO_2 , 0.25 K_2O , 0.25 Na_2O , 0.50 CaO when treated with varying proportions of Cu_2O and FeO at a temperature above the fusing point of felspar (cones 10—12 of Seger's series) yields aventurin. For lower temperatures, 0.75 SiO_2 can be replaced by 0.75 B_2O_3 and 5 per cent. Cu_2O and 5 per cent. FeO may be added. The glass cannot be successfully used as a glaze even when heated on the ware together with reducing agents, such as graphite and powdered iron, zinc and tin, in a reducing atmosphere. The production of iron oxide aventurin is easier than that of the material obtained with chromium or copper. By the use of about 20 per cent. of iron with the boric acid glass already mentioned, the author obtained at about the melting point of silver (Seger's cone, No. 09), a transparent yellow glaze containing many golden flakes. The rationale of the separation is to be found in the work of Ebell, who ascertained that in a glass supersaturated with Fe_2O_3 , the greater part of the iron oxide became converted into the more stable compound Fe_3O_4 . Thus, 100 grms. of this glass, treated with 12.9 grms. of FeO and 14.3 grms. of Fe_2O_3 (each corresponding to 10 grms. of iron) gave a fine aventurin glaze. The glaze showed hair-cracks on white ware and a red ware was therefore used, containing 50 per cent. of true clay substance, 45 per cent. of quartz and 5 per cent. of felspar. The ware was fired at the temperature indicated by Seger's cone No. 7, and glazed at that corresponding with No. 09.—B. B.

Enamels. O. Emmerling. Ber. 29, 1549.

THE author, on examining a French enamel, characterised by its extreme whiteness, found, in addition to silica and potash, quantities of lead oxide (52.51 per cent.) and of arsenic acid (3.74 per cent.) but no oxide of tin, the usual colouring matter, or boric acid. The enamel was easily attacked by dilute acids and was therefore, in the author's opinion, unsuitable for use.—H. I.

Ceramic Stone obtained by Devitrification of Glass. Garchey. Comptes rend. 122, 1277.

See under IX., page 545.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Porous Bricks from Bituminous Coal Shale. Dingler's Polyt. J. 1896, 300, 168.

THE bricks are made from the refuse of the coal washers at the "Libuschin" pit, near Kladno, in Bohemia, mixed with an appropriate quantity of clay. They are burnt in ring ovens, and are clinkered throughout, showing small blue fused particles, which seem to impart to the brick resistance to pressure and weather. Both these qualities are reported to be very good.—A. G. B.

Ceramic Stone obtained by Devitrification of Glass. Garehey. Comptes rend. 122, 1277—1278.

GLASSES containing an excess of lime, alumina, or magnesia are the most easily devitrified. The inventor uses bottle glass, which is reduced to powder, placed in a mould, and heated, first to a moderate temperature until pasty, and then for a few minutes in another furnace to a high temperature. The completely devitrified material is then stamped and pressed. The product has the appearance of a building stone.—V. C.

Portland Cement (Raw), Estimation of Lime in. F. Kluge. Chem. Zeit. 20, 372.

See under XXIII., page 559.

PATENTS.

Slurry, Improvements in Arrangements for Drying by the waste Heat from Cement Kilns. W. Joy, Snodland. Eng. Pat. 12,391, June 26, 1895.

THE cement kiln, the waste heat of which is to be utilised, communicates with a drying chamber, above which is a second chamber in connection with the first, and with the chimney. The roof of the second and upper chamber is formed of metal plates, constituting an open slurry-drying floor. A third super-imposed chamber may be used, and the drying flues may be rectangular or arched in section.—B. B.

Wood and the Like, An Improved Substitute for. C. A. Allison, London. From the Marquette Mosaic Co. (Incorporated). Montclair, New Jersey, U.S.A. Eng. Pat. 13,073, July 6, 1895.

WOOD pulp is mixed with asbestos or "steel wool," and a colouring matter such as Venetian red, and the mixture is made into a stiff paste with a solution consisting of bi-chromated gelatin, 20 parts, silicate of soda, 70 parts, "soda tungstate," 10 parts. The surplus moisture is drained off in a perforated mould, and the finished product is sprinkled with calcined carbonate of magnesia. The goods are ultimately pressed hydraulically, dried, grained and varnished (if for outdoor work). The material is said to be fireproof.—B. B.

Cement, the Manufacture of an Improved Waterproof Elastic. W. W. Cabena, London. Eng. Pat. 13,648, July 16, 1895.

100 lb. of old paint skins are boiled at a moderate temperature with 1 gall. of raw linseed oil, and after cooling, the mixture is coloured and bodied up with yellow ochre and lamp black. If lumpy, it may be ground. It is claimed that the cement is elastic and waterproof, and that as it will neither shrink nor crack, it is specially suited for flashings, and for repairing gutters, &c.—F. H. L.

Artificial Stone, Vitreous; Manufacture of. A. Hirsch, Paris, France. Eng. Pat. 14,187, July 25, 1895.

FRAGMENTS of glass, porcelain, igneous rocks, &c. are packed in moulds lined with some refractory substance, e.g., talc, and heated until adherence by partial fusion has occurred. The mould with its contents is annealed, and its surface smoothed or roughened as may be required. Tesserae may be produced by the use of metal partitions.

A smooth under surface for the block or plate may be obtained by placing fragments of some fluxing material, e.g., "fluorspar or fluosilicates," at the corresponding portion of the mould.—B. B.

Artificial Stone, Improvements in the Manufacture of and Apparatus therefor. W. P. Thompson, London. From La Société Anonyme la Néo-Litho, Moll, Belgium. Eng. Pat. 3799, Feb. 19, 1896.

A MIXTURE of lime and sand, containing about 10 per cent. of the former, is filled into moulds and subjected to the action of steam under a pressure of 2—3 atmospheres, afterwards increased to at least 5 atmospheres. The apparatus used consists of a frame, constituting the mould, and a high-pressure cylindrical boiler with interior perforated tubes for the supply of steam, and of rails whereon the mould is run into the steam space.—B. B.

X.—METALLURGY.

Phosphoric Iron Ores in the Blast Furnace, Effect of Additions of Titaniferous Ores to. A. J. Rossi. Eng. and Min. J. 61, 1896, 516.

THE author has endeavoured by a few experiments, with from 200 to 500 grms. of ore, to ascertain whether by mixing titanite and phosphoric iron ores together previous to smelting, the weakening influences of the phosphorus on the metal, when obtained from the latter ore alone, might in any way be counteracted. With phosphoric ore a grey metal was obtained containing 2.862 per cent. of phosphorus and which broke easily, whereas with the mixed ores a grey large-grained metal containing 3.98 per cent. of carbon, nearly all graphitic, 3.229 per cent. of phosphorus, and 0.4 per cent. of titanium, was produced, which withstood several blows before breakage.

It would also appear from these experiments that whilst titanium in an iron ore has a tendency to throw the carbon in the metal produced therefrom into the combined state, the united effect of phosphorus and titanium is to produce a metal in which nearly all the carbon is in the graphitic state, this effect being the greater as the quantities of phosphorus and titanium in the mixtures increase.—A. W.

Fusion Process, The Morosco [with Molten Lead]. Eng. and Min. J. 61, 1896, 495.

THIS process for the extraction of precious metals from calcined ores by bringing them into contact with molten lead is now said to be practicable, the engineering difficulties having been overcome. A plant has been set up at Amador City capable of working 10 tons per day, and giving yields of over 90 per cent. extraction with gold-bearing sulphides and base ores.

THE fine ore, after roasting to get rid of sulphur, arsenic, antimony, &c., whilst at a temperature above the melting point of lead, is automatically fed in a steady stream to the bottom of the bath well. It at once attempts to rise through the bath of molten lead, of over 5 tons, but is met in its upward course by circular perforated plates with arms between, by which it is caught and thrown on to another set of stirrers and so on five times. When it reaches the surface it is discharged automatically by a rapidly revolving disc and passed into a trap box of running water, by which it is cooled before passing to the concentrator. The gold and silver will have alloyed with the lead in the well, and the freed ore, which carries about 44 per cent. of lead with it, is treated for the recovery of the lead in the concentrators.

—A. W.

Silver, Volatilisation of, in Chloridising Roasting.

L. D. Godshall. Eng. and Min. J. 1896, 61, 469—470.

THIS is a reply to criticisms made by Stetefeldt, of a former paper of the author's. In this paper it was asserted that siliceous ores containing more than 6 per cent. of silver can be better chloridised in some furnace other than the Stetefeldt; and that ores containing much lime (15 to 20 per cent.) are also with difficulty roasted in this furnace unless sufficient sulphur be present to convert the whole of the lime into CaSO_4 , and even then the chloridisation

rarely exceeds 60 per cent. Often only 15 to 20 per cent. of the silver is chloridised in the body of the furnace, although about 65 per cent. of the ore may have been roasted; yet, after lying upon the cooling floor of the furnace for three days, the silver in the ore may become chloridised up to 90 per cent.—W. G. M.

Mond Process—Gas applied to the Manufacture of Steel. J. H. Darby. Iron and Steel Inst., Spring Meeting, 1896; the Ironmonger, 282.

See under H., page 529.

Iron and Steel Analysis, Introduction of Standard Methods of. H. J. von Jonstorff. Iron and Steel Inst. Spring Meeting, 1896; the Ironmonger, 1896, 269.

See under XXIII., page 559.

Tin and Copper in Tin Dross, Estimation of. L. Rürup. Chem. Zeit. 20, 105.

See under XXIII., page 560.

Acetylene, Action of, upon Iron, Nickel, and Cobalt reduced by Hydrogen. H. Moissan and Ch. Moreau. Comptes rend. 122, 1210—1212.

See under H., page 530.

PATENTS.

Metallic Alloys, Improvements in the Manufacture of. J. C. Bull and E. M. Lagerwall, Southwark. Eng. Pat. 10,671, May 29, 1895.

The alloys referred to are those known as "white metals," which are composed of lead as a base, combined with tin, antimony, and the like.

A small proportion of an alloy of mercury with tin or lead is added to the molten "white metal" for the purpose of improving its grain, texture or hardness.—J. H. C.

Lead, Silver, Gold, and other Metals, Improvements in the Extraction of from Galena or Sulphides of Lead and Zinc, and from Mattes and Refractory Ores. H. E. Fry, London; J. David, Swansea; and C. Le Doux, Morriston. Eng. Pat. 12,452, June 27, 1895.

The sulphides, mattes, or ores after agglomeration, if necessary, are smelted in a cupola furnace with a flux composed of nitre-cake or other form of bisulphate or sulphate of soda and burnt pyrites, or other form of iron oxide, by which means metallic lead containing the gold and silver, is obtained. Any matte which separates from the liquid slag is collected for subsequent treatment, by roasting and re-smelting or otherwise.—J. H. C.

Iron and Steel, Improvements in the Hearths or Bottoms of Mill and other Furnaces for Heating. A. E. Tucker, Birmingham, and F. W. Harbord, Egham. Eng. Pat. 13,050, July 6, 1895.

The hearths or bottoms are made of a mixture of basic slag and blast furnace slag with, sometimes, an addition of limestone or dolomite.—J. H. C.

Slimes from Ores of Precious Metals, Improvements in Treating. M. Crawford. From R. Keck, Colorado Springs. Eng. Pat. 13,536, July 13, 1895.

Chloride of sodium is added to the cyanide or other solvent employed to facilitate the subsequent filtration and precipitation.—J. H. C.

Gold and other Precious Metals, A Process for Precipitating from Solutions used for Extracting such Metals from their Ores. M. Crawford, Colorado Springs. Eng. Pat. 13,537, July 13, 1895.

The solutions are filtered through granulated charcoal, prepared by saturating it with solutions of alumina, iron, copper, or zinc, with the addition of silicate of soda. The charcoal is subsequently dried, heated to redness, and when cool is ready for use.—J. H. C.

Metals having Different Melting Points, An Improved Method of Separating. H. Lange, Duisburg. Eng. Pat. 23,114, Dec. 6, 1895.

The claim is for "the separation of the different metals forming metallic mixtures, by melting one or all of such metals in fractions or successive stages in a heated fluid [such as melted paraffin] with or without the employment of pressure, or by means of a superheated gas."—J. H. C.

Heating Metal [Iron]. Improvements in and relating to Furnaces for. W. H. Bailey, Piqua, Ohio, U.S.A. Eng. Pat. 4776, March 3, 1896.

This specification describes a double furnace intended for the heating of bars or billets and of sheets, in separate chambers. The flame from the grate plays over a low fire-bridge into a somewhat lofty heating chamber for the reception of the bars, thence over a second high fire-bridge it has access to a larger chamber used for reheating the sheets. The chimney is placed at the far end of the second chamber, and is connected by separate flues with the top of the first chamber and with the bottom of the second. When in full operation, the former flue is closed by a damper, so that the heated gases after passing obliquely upwards across the first chamber, pass diagonally downwards through the second.—W. G. M.

Gold, Apparatus for Separating and Saving. J. Mait, Oakland, California. Eng. Pat. 6242, March 20, 1896.

AURIFEROUS ore, wet or dry, is passed over a sloping metal table, which is kept in constant motion by a lateral oscillation, combined with a vertical "bumping" action. In traversing this table the material passes over a number of transverse troughs in each of which is supported a rake-like row of spoons. The gold thus has the opportunity of separating by gravity in the bottoms of the grooves.

—W. G. M.

Steel, Improvements in the Manufacture of. F. B. East, Landore, and J. R. Wright, Gowerton. Eng. Pat. 7272, April 4, 1896.

AIR or steam, or a mixture of the two, is blown through the bath of metal in an open hearth furnace, by means of cast-iron pipes attached to a swivel joint, and with flexible connections outside the furnace. The pipes are protected by a refractory coating, and deliver the blast at suitable pressure through wide orifices.—W. G. M.

Iron, Improvements relating to the Purifying and Refining of, and Apparatus therefor. H. H. Lake, London. From The Hawkins Steel Co., Detroit, U.S.A. Eng. Pat. 8946, April 28, 1896.

IRON containing a low percentage of carbon is melted in a cupola and allowed to fall in a gentle stream, or in a thin sheet, upon the hearth of a reverberatory furnace through a vertical chamber, of which the fire-bridge forms one wall. Here it passes through the flame playing from the grate to the hearth, and is subjected to the action of blasts of air and superheated steam delivered through different tuyères. The metal thus nearly decarburised, is collected on the hearth of the puddling chamber, and is worked (preferably with oak saplings) to remove all slag, and to ensure thorough puddling to a point short of balling.—W. G. M.

Tin and Terne Plates, Improvements in the Method of, and Apparatus for Preparing. J. D. Grey, Tondou, Glamorganshire. Eng. Pat. 8959, April 28, 1896.

IN lieu of black-annealing, the pickled and washed plates, contained in the washing rack, are transferred to a truck, which is drawn slowly through a drying furnace by means of an endless chain driven by a sprocket wheel. After this treatment, the plates are cold-rolled singly, white-annealed, and finished in the usual way.—W. G. M.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

PATENTS.

Acids and other Corrosive Liquids, Process for Preventing the Chemical Action of on Metal Containers, Conduits, and the Like. C. A. Jensen, London. From A. Sinding-Larsen, Christiania, Norway. Eng. Pat. 12,320, June 25, 1895.

THE object is to dispense with protective linings, and yet to prevent corrosive action. This is done by making the vessel a cathode, supplied with current from without, the anode being immersed in the liquid, and made of a material chemically indifferent.—J. C. R.

Electrical Batteries, Secondary; Improvements in the Manufacture of Positive Plates for. C. H. Weise, Poessneck, Germany. Eng. Pat. 12,417, June 27, 1895.

THE plates, coated with the lead oxide, are immersed in a bath of glycerin, where they harden, with the development of considerable heat and gas. If the hot plates after this are placed in a solution of sulphuric acid of sp. gr. 1.15, the hardness further increases as long as gas is developed. Plates thus treated are easily formed, and have a high capacity, in spite of their hardness. Plates which are practically worn out and have porous surfaces may be similarly treated and hardened.—J. C. R.

Electric Arc Lamps [Retarding Oxidation of Carbons], Improvements connected with. A. C. Seibold, Mount Vernon, E. O. Clark, and W. Sowdon, New York, U.S.A. Eng. Pat. 13,207, July 9, 1895.

It is proposed to diminish the combustion of carbon electrodes by excluding oxygen from the arc by means of a close-fitting translucent globe or shell surrounding the contiguous ends of the electrodes. To prevent the obstruction of the light by the particles of carbon thrown off, and which settle upon the inner wall of the surrounding or enclosing shell or globe, a cylindrical guard (wire gauze) is introduced within the enclosing globe.—J. C. R.

Secondary Batteries [Electrodes], Improvements in or connected with. F. King, London. Eng. Pat. 17,821, Sept. 24, 1895.

TO avoid the rapid formation of sulphate on the surface of the plates when enclosed in porous or perforated diaphragms (consequent on the rapid lowering of the specific gravity of the electrolyte immediately underneath such diaphragms or envelopes), the inventor makes a number of perforations, passages, or pipes extending through the grid or support and finished plate, preferably conical in shape. These perforations or passages are unoccupied by active material or material to be rendered or become active. Eng. Pats. 1731 and 2816 of 1895 are referred to (this Journal, 1896; 121).—J. C. R.

Electrode, A New or Improved Porous Plate, Body, or. W. H. Beck, London. From J. Johnson and J. H. Robertson, Brooklyn, New York, U.S.A. Eng. Pat. 17,825, Sept. 24, 1895.

THE improved electrode is made by mixing an inert, porous, non-conducting substance, preferably pumice stone, with about an equal bulk of molten lead, so that the air contained in the porous substance expands and forms air spaces in the metal. The pasty mass is moulded to the required shape, and the plates are formed in the usual way. A small quantity of either tin or bismuth may be added to the lead in order to lower its melting point.—G. H. R.

Filling Paste of Accumulator Batteries [Aloine Paste], Improvements relating to the Composition of. R. Linde, Berlin, Germany. Eng. Pat. 3091, Feb. 11, 1896.

THE improved filling is made by kneading a solution of aloine or its homologues, in water, alcohol or ether, into a

paste with the lead oxides. It is claimed that aloine forms with lead oxide an almost insoluble salt, which is not decomposed by oxidation during charging, but gives rise to an oxy-acid which binds the active material together, and is also electrically conductive.—G. H. R.

Metallic Sulphides, Process for Working. A. von Siemens, Berlin, Germany. Eng. Pat. 7123, April 1, 1896.

THE fact that the sulphides and sulph-hydrates of the alkaline earth metals form soluble double salts with the sulphides of antimony, arsenic, and mercury, is taken advantage of to employ their lyes for the extraction of these metals from their ores, and the solution so formed can be electrolysed without the use of a diaphragm. The sulphuretted hydrogen, which is given off during the extraction, corresponding to a portion of the sulphur contained in the ore, and that which is given off during electrolysis, corresponding to the remainder of the sulphur, is collected. After all the metal has been deposited, the bath, which contains calcium sulphide, is treated with carbonic anhydride, and the calcium is precipitated as carbonate together with half the sulphur, whilst the remainder escapes as sulphuretted hydrogen and is collected. The calcium carbonate is converted into caustic lime by heating to redness in the absence of air, whilst the sulphur is distilled off, and the carbonic anhydride is ready for use again. The caustic lime and the collected sulphuretted hydrogen are used for the production of fresh calcium sulph-hydrate, thus not only is the whole of the extraction lye regenerated, but the whole of the sulphur in the ore is converted into a useful form. The process is described with reference to the sulphide of antimony, but is also applicable to the sulphides of arsenic and mercury; care being taken in the latter case that the alkaline sulph-hydrate is in excess.—G. H. R.

Electrodes for Accumulators, Improvements in. W. Majent, Berlin, Germany. Eng. Pat. 8695, April 24, 1896.

ROOM for the expansion of the active mass is provided by leaving a hollow space between it and its enclosing frame. This space is formed by placing within the metallic frame a sufficiently thick layer of sugar, salt, sulphate of soda, or other substance soluble in water, and then filling in the active material, and, after the latter has hardened, the soluble substance is dissolved out.—G. H. R.

(B.)—ELECTRO-METALLURGY.

Nickel Plating, Exciting Salts for. G. A. Le Roy. Rev. de Chim. Ind. 1896, 7, [75], 70—71.

THE author has examined four samples of "exciting salts" used for increasing the conductivity of the nickel sulphate solution and obtaining a bright adhesive deposit of the metal. They consisted of:—Ammonium sulphate; ammonium sulphate (98 per cent.) and citric acid (2 per cent.); common salt (85 per cent.) and water (15 per cent.); and, common salt (75 per cent.), boric acid (5 per cent.), citric acid (5 per cent.) and water (15 per cent.).—E. B.

Mercury, Electrolytic Estimation of. E. F. Smith and D. L. Wallace. J. Amer. Chem. Soc. 1896, 18, 169.

See under XXIII., page 569.

PATENTS.

Electro-Plating Ships, Vats, and other Articles; Improvements in and relating to. J. H. Cox, Greenock. Eng. Pat. 10,696, May 30, 1895.

THE object is to coat vessels and other articles which are too large for immersion in an electrolytic bath. The main feature is employing a "belly-band" form of electro-plating bath rendered electrolyte tight by external pressure derived from marginal iron straps fixed temporarily to the vessel. The joint is made with india-rubber cords.—J. C. R.

Metallic Oxides, A Process [Electrolytic] for Reducing certain, by Means of Amalgams of Alkaline Metals. L. Mond, London. Eng. Pat. 12,018, June 20, 1895.

SODIUM or potassium amalgam is employed as a reducing agent for oxides soluble in caustic alkali. Oxide of zinc

in caustic soda is cited. The amalgam is made to form a couple with a cathode of iron or zinc, by being joined up therewith in the electrolyte directly or by a conductor external to the solution. The sodium is oxidised and the zinc is deposited on the cathode, which, to obtain sound and pure deposits, is preferably kept in motion during the action. Part of the caustic soda obtained may be concentrated to solid caustic soda or otherwise utilised, whilst the rest may be used for solution of zinc oxide. A motor or amalgam-producing electrolytic cells may be placed in circuit with the amalgam-decomposing cells. These may be reinforced by current derived from an external source. "In operating, as described, for the oxidation of the sodium and the reduction of the zinc, there is no evolution of hydrogen, and consequently there is no loss of mercury, nor any noxious effects, such as occur where vapour of mercury is carried off with hydrogen."—J. C. R.

Electro-Deposition on Strips, Wire, and like Metal Articles; Improvements in and connected with. Cowper-Coles Galvanising Syndicate, S. O. Cowper-Coles, London, and W. P. Routh, Sutton, Surrey. Eng. Pat. 11,547, April 13, 1896.

This apparatus consists of a number of tanks connected together by tubes which enable the electrolyte to pass from one to the other, and also serve as anodes. The wires or strips to be plated are led from the reels or swifts on which they are wound, and are guided to or from the vessels and through the intervening tubes and passages by rollers, and are kept out of contact with the tubes by perforated supports. As the wires leave the tank they are furnished by passing them between rollers, and are then wound on to another reel. The swifts consist of drums mounted on a spindle, the lower drum having a flange to support the lower coil of wire, and there being between the drums, and secured to the spindle, a piece carrying pins to support the upper coils. When the lower coil is exhausted, these pins can be removed, allowing the upper coil to take its place, and when a fresh upper coil is mounted they are replaced to support it. The brushes by which the electric circuit is completed are made of any conductive material, such as the metal to be deposited, and are arranged to clip the wire and press on it. They are covered with rubber where not in contact with the wire.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Wool Grease, On the Composition of. L. Darmstaedter and J. Lifschutz. Ber. 29, 1174.

This substance $C_{10}H_{20}O$, formerly described as an alcohol, on fuller investigation (this Journal, 1895, 14) turns out to be the lactic decomposition product, $C_{30}H_{50}O_8$, of a new acid $C_{30}H_{50}O_9$, lanocerinic acid. The alcoholic nature of the compound $C_{10}H_{20}O$ appears likewise doubtful. The lanocerinic acid is obtained by saponifying wool-wax, extracting the saponified substance first with petroleum spirit and then with alcohol. The residual soap obtained, is dissolved in dilute alcohol and carefully decomposed with dilute hydrochloric acid. The lanocerinic acid thus obtained is almost insoluble in water and cold alcohol, but is easily soluble in hot alcohol, from which it crystallises in very small plates; m. pt. 104°—105° C. The fused acid contains the elements of 1 molecule of water less than the original substance, and on boiling with dilute inorganic acid, forms an oil which solidifies on cooling, and no longer possesses acid properties. This substance is the above-mentioned lactone. It no longer combines with alkalis; m. pt. 86° C. The extract from the above-mentioned soap, contained in the petroleum ether, seems to consist of alcohols chiefly, three of which have so far been isolated, and one of which is cholesterol (cholesterol).—C. O. W.

Glyceric Acid, New Method of Preparation of. P. Cazeneuve, Bull. Soc. Chim. 1896, 763—764.

This reaction depends upon the fact that glycerin in presence of caustic soda and silver chloride gives glyceric acid, silver, and sodium chloride. The following proportions are employed:—A solution containing 46 grms. of pure glycerin

and 80 grms. of caustic soda (from alcohol) in 500 c.c. of distilled water has added to it 143.5 grms. of silver chloride. The reaction commences in the cold, but is only complete on boiling. The silver chloride turns black and then grey, due to the formation of finely-divided metallic silver. The filtered liquid contains sodium glycerate, sodium chloride, and excess of glycerin, and is evaporated on the water-bath to a syrupy consistency. It is then mixed with 120 grms. of potassium bisulphate, and extracted with acetone free from water. The acetone is distilled in a vacuum to avoid decomposition of the chlorides by the glyceric acid. The residue is treated a second time with pure acetone, and again evaporated in a vacuum, and on the third extraction pure glyceric acid is obtained, only slightly yellowish in colour, and containing a trace of chloride from which it can be freed by means of the lead or calcium salt. The use of pure acetone effects a complete separation from the glycerin, which is quite insoluble in this solvent.—T. A. L.

Fats, Butter, and Oils, Electrical Conductivity of. L. Herlant. Bull. Assoc. Belge des Chim., 10, [2], 48.

See under XXIII., page 562.

Lard, Microscopic Detection of Beef Fat in. T. S. Gladding. J. Amer. Chem. Soc. 1896, 18, [2], 189.

See under XXIII., page 560.

PATENTS.

Oils and like Liquids, Process and Apparatus for Separating [Impurities] and otherwise Treating. G. Mitchell, London. Eng. Pat. 17,239. Sept. 16, 1895.

This apparatus consists essentially of a siphon, the ascending leg of which is surrounded by a heating chamber. The impure oil is fed into the lower part of this leg, and is raised by means of a vacuum pump placed at such a height above the oil chamber that not even with a perfect vacuum could the oil reach its level. The heat causes a difference between the specific gravity of the oil and of the impurities, such that the latter separate, the oil passing over into the other limb of the siphon, which is continued to a lower level than that at which the oil enters. The impurities, if heavier than the oil, are left at the bottom of the containing vessel, or, if lighter, are drawn up above the oil into a tube forming an extension of the ascending leg of the siphon.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

Alizarin Oil, Influence of Composition on the Shade of the Lake Pigments. A. P. Lidow. Zap. imp. russk. techn. obschtsch. 1896, 30, 53.

It is found that the introduction of halogens or a nitro-nitroso group into the alizarin oil exerts no advantageous effect on the resulting colour, but is sometimes positively injurious. The changes of colour resulting when the composition of the oil is modified, tend to show that alizarin oil exerts a chemical action in dyeing, and forms lakes with the dyes and oxides. The fulness of the colour in textiles, when iodised alizarin oil is used, is believed to be due to the low degree of solubility of the fixed oil. On the other hand the introduction of chlorine, or a nitro-nitroso group, renders the oil and lake more soluble.—C. S.

PATENT.

Cement, The Manufacture of an Improved Waterproof Elastic. W. W. Cabena, London. Eng. Pat. 13,618, July 16, 1895.

See under IX., page 545.

(B.)—RESINS, VARNISHES.

Turpentine, Deodorising Oil of. H. Schiff. Chem. Zeit. 20, 361.

The odorous principle is an aldehyde oxidation product of the turpentine, probably represented by the formula $C_{10}H_{16}O_3$. It is formed when the turpentine is stored in an insufficiently closed vessel in a faintly lighted spot, but in

amount does not attain to 1 per cent., on account of its disposition to resinify and cause the oil to dry into a condition in which no reaction occurs on the addition of rosaniline sulphite. The presence of an aldehyde body can be detected by this reagent in the soft resins from various woods. On removing the aldehyde by sodium bisulphite, the oil of turpentine becomes inodorous save for a slight ethereal aroma, but the characteristic smell soon returns when the oil is exposed to air.—C. S.

PATENTS.

Printing Inlaid Patterns upon Linoleum and like Fabrics. A Process for. J. E. and C. S. Bedford, Leeds. Eng. Pat. 11,716, June 17, 1895.

See under VI., page 540.

Varnish [Oil], Improvements in, and in the Mode of Manufacturing the same. E. W. Barnsley, Birmingham. Eng. Pat. 8267, April 20, 1896.

300 GALLS. of old "Baltic" linseed oil are boiled in a copper pan provided with a wire basket containing 60 lb. of pale Turkey umber, the temperature being kept at 230° C. After cooling, 200 galls. are removed and set aside, while the remainder is again heated to 290°–300° C. 84 lb. of gum anime are then melted, mixed with 15 galls. of the thinner oil, the whole diluted with 18 galls. of turpentine, and when cold agitated with 12 lb. of magnesia to every 100 galls. of varnish. After six months, 50 galls. are mixed with five of the thicker boiled oil, and 6 lb. of powdered litharge are sprinkled in and well stirred together. The varnish should be kept another six months at 35° C. before being used.

—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Depilatories, Chemistry of. J. von Schroeder and W. Schmitz-Dumont. Dingler's Polyt. J. 1896, 300, 161–168.

A SAMPLE of liquor from an old, well-plunged lime-pit in a tan-yard was found after filtration through sand, to have a specific gravity of 1.0046 at 17.5° C., and showed a feeble reaction for albumin. The total nitrogen was determined in 100 c.c. by the Kjeldahl method, and the difference between this value and the nitrogen found in the total solid residue was regarded as the nitrogen in the volatile bases; to avoid destruction of nitrogenous matter during evaporation, sodium bicarbonate was added in quantity sufficient to carbonate the lime in the liquor. The albuminoids were precipitated by feebly acidifying with acetic acid and warming. Volatile acids were distilled in steam after acidifying the liquor with sulphuric acid. Estimation of caustic lime proved difficult on account of the organic matter present. Analysis of the sediment which settled from the liquor before it was filtered gave the following figures:—CaCO₃, 8.22; CaO, 43.99; CaO combined with organic matter, 8.82; and organic matter, 38.97 per cent.

Since this contains so much free lime it was concluded that the liquor was saturated with free lime, in which case it would contain 1.299 grms. per litre at 15° C. When shaken with lime, however, the filtered liquor dissolved a considerable quantity showing that lime had been lost during the filtration through sand.

The following table gives the results of the analysis:—

	Grms. per Litre.
Organic solid matter	11.856
Inorganic " "	3.158
Containing CaO*	2.010
" MgO	0.013
" alkali sulphates and chlorides	1.130
Total nitrogen	1.619
Comprising N in solid residue	1.527
" N in volatile bases	0.122

* After having been shaken with lime the liquor contained—

	Grms. per Litre.
Free CaO	1.290
Combined CaO	1.678
Total	2.977

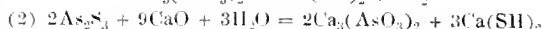
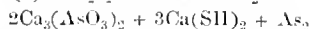
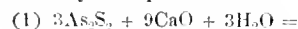
	Grms. per Litre.
Total precipitate by acetic acid	2.022
Comprising fatty acids	0.044
" ash	0.002
" albuminoids (14.21 per cent. N)	1.976
Nitrogen in filtrate from acetic acid precipitate	1.376
Volatile acids (as acetic acid)	0.480
Organic matter not precipitated by acetic acid (containing 13.41 per cent. N)	9.354

The volatile bases present had the odour of trimethylamine and the volatile acids that of caproic acid. The authors do not think that they have sufficient evidence to enable them to pronounce upon the nature of the albuminous organic matter.

Experiments here described in which lime and sodium sulphide were together dissolved in water, led to the conclusion that each of these two compounds retains its individuality when in solution in the presence of the other; hence it may be deduced that the simultaneous application of lime and sodium sulphide for unhairing, whether in form of a solution or of a paste, is beneficial because each exerts its specific action on hide and hair, not because there is a formation of caustic soda by double decomposition as has been supposed. The lime probably also serves to protect the sodium sulphide from decomposition by any carbon dioxide which may be absorbed.

For the proximate analysis of red arsenic, the authors recommend that the arsenious oxide should be extracted from 20 grms. of the sample by digestion at a gentle heat with 200 c.c. of hydrochloric acid (5 per cent.) for 5 hours; the solution may then be oxidised by nitric acid and evaporated to dryness, the residue being heated at 400° C. for 45 minutes and weighed as arsenic anhydride. To separate As₂S₃ from As₂S₅, 10 grms. of the portion from which the As₂O₃ has been extracted may be shaken at the ordinary temperature with 200 c.c. of ammonia (2 per cent.) until no more arsenic is dissolved; an aliquot portion of the solution is evaporated to dryness and the As₂S₃ weighed. A sample of red arsenic thus examined gave:—As₂S₃, 73.56 per cent.; As₂S₅, 26.11 per cent.; As₂O₃, 0.37 per cent.

To investigate the part played by red arsenic in the mixture of it with lime which is commonly used as a depilatory, 40 grms. of lime and 8 grms. of red arsenic were made into a thin magma with 160 c.c. of water, this magma was heated on the water-bath for one hour, then made up to a volume of 3150 c.c. with water, filtered, and the solution analysed. It was found that 4.13 per cent. of the arsenic, 93.50 per cent. of the sulphur, and 15.25 per cent. of the lime remained in solution. The undissolved residue was brown from the presence of uncombined arsenic, so that the chief reactions may be represented by the equations:—



There is, however, the dissolved arsenic to be accounted for, since calcium arsenite was found to be quite insoluble even in presence of excess of lime. Experiments showed that calcium arsenite reacts with a solution of calcium hydrosulphide, with formation of calcium thioarsenite which passes into solution. Supposing the arsenic to exist in this form in the unhairing liquor, it may be calculated from the foregoing figures that 1 litre of the liquor contains 4.355 grms. of Ca₃(AsS₃)₂, 27.780 grms. of Ca(SH)₂ and 1.299 grms. of CaO. It appears then that the sole constituents of the lime and red arsenic depilatory, which can be considered as active, are the calcium hydrosulphide and the small proportion of calcium thioarsenite, unless, indeed, ammonia and amines developed during the sojourn of the hide in the mixture can dissolve any of the calcium arsenite. This point was settled in the negative by the analysis of a liquor which had been used for three weeks for treating kips, when it was found to contain somewhat less arsenic than it did originally, showing that the amines and ammonia which were undoubtedly present had not rendered the arsenic compounds more soluble. The putrid odour of this arsenical lime liquor seems to contradict the common statement that the function of the arsenic is that of an antiseptic.

It remained to ascertain whether the calcium thioarsenite possesses any depilatory properties. For this purpose arsenious sulphide was dissolved in calcium hydrosulphide solution. In this solution, containing $\text{CaS} \cdot \text{As}_2\text{S}_3$, pieces of raw hide were immersed and kept in stoppered vessels for about a month; none of the pieces were materially altered except that each was coloured yellow throughout; the hair was as firm as before immersion, and the hide as soft and elastic. When exposed to the air the pieces lost their yellow colour, consequent on the decomposition of the thioarsenite, and at the same time the hair was loosened. The same effect was observed in the case of pieces of hide left in the thioarsenite solution in open vessels. There was depilatory action, but it was found to be due to calcium hydrosulphide, for the arsenic had all separated as sulphide and the solution contained $\text{Ca}(\text{SH})_2$.

The authors conclude that the activity of arsenical lines is due to calcium hydrosulphide and calcium hydroxide alone.—A. G. B.

XV.—MANURES, Etc.

Slags, Phosphoric, from the Basic Process. F. Jean. Rev. de Chim. Ind. 1896, 7, [75], 80.

THESE have the percentage composition:—Phosphoric anhydride, 8—23; silica, 7—15; calcium oxide, 34—55; magnesium oxide, 3—20; iron oxide, 12—20; manganese oxide, 4—10.

As their employment for enriching land is increasing, L. Grandean proposes that their sale should be made subject to the following conditions:—First, the amount of phosphoric anhydride present, should be guaranteed within limits of 2 per cent., thus, 18—20 per cent., for instance; secondly, the fineness of the grinding should be 75—80 per cent., as ascertained by testing with a sieve, of mesh 100; thirdly, the price should be based upon the content in phosphoric anhydride.—E. B.

Manganous Ammonium Phosphate, A New Manure. Rev. de Chim. Ind. 1896, 7, [75], 80—81.

THIS compound is, it is said, more useful to plant-life than manganous ammonium phosphate. It consists of ammonia (32 per cent.), manganese (25 per cent.), and phosphoric acid (43 per cent.). It is very sparingly soluble in water (1 part, according to Dummer, dissolves in 31,092 parts of cold water).

To prepare it, a solution of acid calcium phosphate is mixed with one of manganese chloride, and the precipitate, after washing, is heated with a solution of ammonium chloride or carbonate.—E. B.

Bone Meal, Phosphoric Acid in; Relation between the Citrate Solubility and Fineness. Braun. Chem. Ind. 1896, 19, 219—221.

THE phosphates soluble in citrate solution, were determined by the method used by Wagner for basic slags, in a number of samples of bone meal. The total phosphoric acid and the fineness of the samples, were also determined. The results show that the citrate solubility increases with the fineness of the meal, varying from 30 per cent. with 0.2 per cent. of fine meal, to 90 per cent. with 99 per cent. of fine meal. The coarsest samples thus contain a moderate amount of soluble phosphoric acid, whilst with a medium fineness of about 50 per cent., the solubility is 60—70 per cent., an amount reached in basic slag only when the fineness is about 80 per cent.—N. H. J. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Beetroots, Loss of Sugar during the Preservation of. Strohmmer, Sucr. Belge 24, 76.

(SEE also this Journal, 1895, 589.) In order to verify the statement of Heintz that beetroots give off carbon dioxide, the author enclosed some in a glass vessel through which he passed a slow current of air previously freed from carbon dioxide. After contact with the beetroot, the air was passed through weighed potash tubes. The increase in the weight of the latter does not, however, represent the

whole of the loss of sugar, part of which appears to be converted into other carbohydrates. When beetroot was kept for a fortnight in a current of hydrogen, it was found to contain 3.3 per cent. of pentoses whilst ordinary beetroot only contains 2.1 per cent., and according to the author pentoses constitute the first product of the transformation of saccharose. The amount of carbon dioxide disengaged depends partly upon the nitrogenous matters present and is greater in proportion to the quantity of albuminoids. The only condition of preservation is cold, at a temperature of 4.5°, beetroot giving off less than half as much carbon dioxide as it does at 17°.—A. K. M.

Sugar, Inversion of, by Salts. J. H. Long. J. Amer. Chem. Soc. 1896, 18, 120—130.

A NUMBER of experiments are described in which the inversion of cane-sugar is brought about by various ferrous, manganous, zinc, aluminium, lead, cadmium, and mercury salts. Thus, in the case of the syrup of ferrous iodide of the pharmacopœia, inversion takes place slowly, even when the preparation is kept in the dark, and at the ordinary temperature. When exposed to the light, the cane-sugar underwent complete inversion in about 2½ months. The rate of inversion is also increased by exposure to air and to increased temperature. At a temperature of 100°, inversion was complete in less than two hours. A number of the results described by the author appear to indicate that the inversion follows the general law shown by Wilhelmy to hold for the action of weak acids on sugar solutions, and in fact the inversion is attributed to the partial hydrolysis of the salts employed.—A. K. M.

Rhamnose, Anhydrous, Crystallised. E. Fischer. Ber. 1896, 29, 324—325.

THE author points out that the constants, $(\alpha)_D$ and melting point of anhydrous rhamnose, as determined by himself, differ widely from the values which Tanret (Comptes rend. 1896, 26) has more recently communicated.—H. T. P.

Lead Bisaccharate [Biplumbic Saccharate], Preparation of, by the Kassner-Wohl Method and its Practical Use in Industry. C. W., Dingler's Polyt. J. 1896, 300, 94—95.

THE author points out that factories employing this process (compare this Journal, 1895, 978; 1896, 125, 287) for the desaccharification of molasses must work at a loss owing to the present prices, and further that the strontium process can only prosper when the price of molasses is low. There is also the unfavourable relation existing between lead and sugar to be taken into account. Thus 800 parts of lead bisaccharate are formed from 342 parts of sugar, so that 1,000 cwt. of sugar would yield 2,320 cwt. of saccharate. Since the latter contains at least 25 per cent. of water, 3,000 cwt. of saccharate require handling. Furthermore there is a considerable amount of wash-water which Kassner states amounts to seven times the weight of the molasses; of this 1.5 parts of the last washings can be used for washing new saccharate, the remaining 5.5 parts have to be evaporated, and this operation represents a cost of 0.5 mark more per 2 cwt. of molasses than with the strontium process.

The following figures show that the precipitation of lead by hydrogen sulphide approaches completion when the juice has a concentration of 13° to 15° Brix. Juice of:—

	Per Cent.	Per Cent.
40° Brix contains 0.01 PbO; by H_2S 0.01 is precipitated.		
30° "	0.04 "	0.01 "
25° "	0.03 "	0.015 "
15° "	0.027 "	0.018 "
13° "	0.027 "	0.022 "

It follows, therefore, that definite concentrations must be adhered to, which is not the case with the strontium process.

The author does not agree with Kassner that loss of lead is impossible with this process. A factory has to employ 2,400 cwt. of lead oxide to separate 1,000 cwt. of sugar from 2,000 cwt. of molasses, and in this quantity of molasses there are at least 20 cwt. each of potassium chloride and sulphate. It is incorrect to state that the

whole of the potassium sulphate passes away in the lye, as half the quantity combines with the oxide of lead. The equivalent ($\text{KCl} + \text{K}_2\text{SO}_4$): PbO represents a loss of 42 cwt. of oxide of lead on 2,000 cwt. of molasses, equal to 600 marks; the lead chloride and sulphate can only be regenerated at a considerable cost.

Since in this process the lead disaccharate is decomposed by carbon dioxide, from 2,000 cwt. of molasses 2,880 cwt. of lead carbonate result. To this amount must be added the simultaneously precipitated calcium carbonate and 39 per cent. of water, so that at least 4,000 cwt. have to be filtered and dried. If it can be assumed that it is possible to previously dry the lead carbonate by waste gases there yet remain 800 cwt. of water to be evaporated, representing a cost of 0.08 mark per 2 cwt. of molasses. There is in addition the cost of heating 3,000 cwt. of lead carbonate to 250°C . which amounts to 15 pf. per 2 cwt.

Attention is directed to the extraordinarily large quantity of wash-water which Kassner needs for the purification of the saccharate, and even if the capacity of the saccharate and lead carbonate as a ready filtering medium is correct, filter stations on a large scale would be necessary. Experiments on small quantities have confirmed the author's assertion on this point, especially in the case of coincident experiments with "strontia bi-saccharate." If sugar, completely free of lead, can be obtained by the Kassner-Wohl process, it is impossible to prevent the accumulation of lead compounds in the residual molasses, and which in consequence would be useless for any other purpose. In conclusion the author objects to the desaccharification of molasses by the lead process on the ground of its expense, the large amount of fuel required, and the bad yields obtained.—J. L. B.

Lead Saccharate, Preparation of, by the Kassner-Wohl Method, and its Practical Use in Industry. Remarks on C. W.'s Article. G. Kassner. Dingler's Polyt. J. 1896, 300, 118—120.

The author draws attention to a printer's error in his former papers, whereby the compound $\text{C}_{12}\text{H}_{22}\text{O}_{11} \cdot 2\text{PbO}$ was termed "lead bisaccharate" instead of biplumbic saccharate.

Referring to C. W.'s criticisms (see preceding abstract), the author considers that definite conclusions as to the consumption of fuel for the evaporation of wash-waters are at present premature. When working with large quantities, the process would be easier to carry out, for the wash-water (not merely the last washings, as supposed by C. W.) would be continually used for covering new saccharate, and the last washings in place of water for the solution of fresh molasses, in consequence, the remaining amount of water to be evaporated would not be more than three times the weight of the molasses, or possibly even less.

Even if C. W.'s figures be correct as showing that the precipitation of lead approaches completion in juices of a concentration of 13° — 15°B ., he has lost sight of the fact that lead is more easily precipitated as sulphide from solutions of sugar which have been previously made slightly alkaline by lime than if the precipitation take place under neutral conditions and after allowing to stand. Under these circumstances, all the lead would be precipitated from 40 per cent. sugar solutions. For this reason the author suggests the use of calcium sulphide in place of hydrogen sulphide. It is, moreover, known that lead is completely precipitated by saturation, provided that the molasses do not contain invert sugar. Here also an addition of lime is advantageous in the event of a re-saturation being necessary. The author states that in one of his experiments he obtained by saturation a 25 per cent. sugar solution which did not contain an appreciable trace of lead. It would be quite possible to use higher concentrations and so diminish the cost of evaporation to which C. W. objected.

If the removal of small quantities of lead by means of calcium or hydrogen sulphide be objected to on account of unpleasant smell or other disadvantages, the metal may be precipitated electrolytically—a process not applicable for the removal of strontium or barium from solutions of sugar. It is necessary that lime should be added, since sugar is not

an electrolyte. Metallic lead is deposited on the cathode and lead dioxide on the anode.

With regard to the heavy loss of lead resulting from the molasses containing potassium chloride and sulphate, the numbers stated in the preceding abstract are incorrect. It has been overlooked that 2 mols. of KCl combine with 1 of PbO , so that the amount of lead in combination would be 28 instead of 42 cwt. The author (Dingler's Polyt. J., 1895, 298, 65) has not denied the partial deposition of lead due to the reaction between the potassium sulphate contained in the molasses and lead oxide. It may be advisable to allow this deposition to continue undisturbed, for less sulphate would be present in the residual lye, which, when calcined, would yield a more valuable potash. The statement that sulphate of lead is expensive to regenerate is also incorrect, for it is only necessary to treat the saturation mud and other products containing lead sulphate in the cold with some of the manufactured alkaline carbonate, to convert it into lead carbonate. The difference in value between potassium sulphate and an equivalent quantity of potassium carbonate is partly compensated for by the purer potash.

If the objection that the residual molasses contain lead be admitted, there is no reason why its removal should not be brought about by the methods above described. Further improvements are in course of preparation, and the author considers that the method, although issued in an imperfect form, will soon be completed, and the details more fully worked out.—J. L. B.

Sugar, Estimation of, by the Copper Method. Kalman. Oesterr. Zeits. Zuckerind. 1896, 25, 43.

See under XXIII., page 361.

Sugars, Influence of Temperature on the Polarisation of. Sachs and Rhonoux. Zeits. Rubenz. 1896, 46, 264.

See under XXIII., page 363.

PATENTS.

Sugar, Melting of, and like Substances, Improvements in and relating to Machinery for. M. Blake, Greenock. Eng. Pat. 12,362, June 26, 1895.

See under I., page 528.

Bagasse, Improved Method and Apparatus for the Treatment of. J. Périchon, Paris, France. Eng. Pat. 7337, April 4, 1896.

The bagasse is placed in two parallel series of vats; and, when soaked for six minutes by liquid supplied from overhead beaters through the medium of two series of sprayers, the juice is run off into corresponding lower troughs, and thence into the heater. It is here warmed prior to being discharged over the bagasse contained in the next vat. This treatment is continued until the end of the series of vats is reached, after which the juice is submitted to defecation.

—J. L. B.

Vegetable Gum adapted to replace Gum Arabic, A Method of Producing. R. Haddan, London. From R. M. y Olivares, Barcelona, Spain. Eng. Pat. 23,555, Dec. 9, 1895.

The juice is extracted from the fruit of the *Mesembrianthemum* (*Mesembryaceae*), by compression, maceration, trituration or solution. It is then filtered and concentrated to the consistency desired.—J. L. B.

Alkaline Saccharates, Improvements in. W. R. Hutton, Glasgow. Eng. Pat. 13,851, July 20, 1895.

ALKALINE saccharates of definite composition are prepared by dissolving the sugar, syrup, or saccharine matter in water. For every 100 parts by weight of sugar, 12 parts of caustic lime, magnesia, lithia, potash, or soda are added. The mixture is then evaporated as required, to a syrup or solid.—J. L. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Yeast, Multiplication of, during the Primary Fermentation of Bottom Fermentation Beer. F. Schönfeld. *Wochen-schr. f. Brau.* 1896, **13**, 421—426.

The experiments described confirm in the main, some results obtained by Mohr (*Wochenschr. f. Brau.* 1886, 216) several years ago. It is shown that the multiplication of the yeast very nearly reaches its limit in three to four days, with an attenuation corresponding with an apparent loss of about 2.5 per cent. of extract. Beyond this, the multiplication is only small and proceeds slowly, reaching its maximum in four to five days with the fermentation of 3.6—5.0 per cent. of extract. Starting with 6.5 to 9.0 cells in a unit volume at pitching, the maximum found during fermentation, varied between 22.1 and 26.6. These results refer to the yeast cells found suspended in the beer. At this stage of the fermentation, however, the yeast begins to deposit, and, taking the deposit into account, a maximum of 28.6 cells was reached in six days. The ratio between the number of cells sown and the yield per unit of volume varied between 1:2.5 and 1:6; this ratio is dependent upon various conditions, but in the main varies inversely with the amount of yeast sown.—A. K. M.

First Runnings and Fusel Oil, Inquiry as to whether the Constituents of, are Products of the Action of Culture Yeasts or of Foreign Organisms. Zeits. f. Spiritusind. 1896, **19**, 136—137.

THE experiments of the authors lead to the conclusion that under certain conditions the culture yeasts employed in distilleries give rise to the formation of amyl alcohol without the co-operation of bacteria; in certain cases they also produce varying quantities of acetic aldehyde, whilst furfural is also a product of their fermentative action. Neither of these substances is, however, a necessary product. Of these secondary products of alcoholic fermentation, acetic aldehyde is most readily formed, and the authors attribute its formation to the oxidation of ethyl alcohol in the nascent state. Furfural was only found in the products of fermentation by distillery yeasts, when acetic aldehyde was present in considerable quantity. *Sacch. mycoderma D.* gave but little acetic aldehyde, and yet produced furfural, whilst *Sacch. mycoderma b* yielded much aldehyde but no furfural. Amyl alcohol was produced in 8 out of 13 experiments with pure yeasts, and although the conditions of its formation have not been ascertained, the authors consider that the following conditions are connected with its formation, namely, the presence of old yeast cells, a high fermentation temperature and lactic fermentation prior to pitching, although the mere presence of lactic acid is without effect. It is also noticed that where furfural is produced, only very small quantities of acetic aldehyde are present, and this suggests the view that anaerobic conditions favour the production of fusel oil. With regard to valerianic acid and the higher fatty acids formed during alcoholic fermentation, the authors believe that these result from the decomposition of the more complex nitrogenous matters present.—A. K. M.

Incandescent Alcohol Lamps for Street Lighting. Zeits. f. Spiritusind. **19**, 143.

See under II., page 530.

Malt, Estimation of Ready-Formed Sugars of. G. H. Morris. *J. Fed. Inst. Brewing*, 1896, **2**, 224.

See under XXIII., page 562.

Malt and Beer Worts, Investigations on Nitrogenous Constituents of. E. Ehrlich. *Der Bierbrauer*, 1895, 115, 161, and 177.

See under XXIII., page 563.

Iron by Means of Potassium Sulphocyanide. The Colorimetric Estimation of Traces of [in Wines]. A. Born-träger. *Chem. Zeit.* 1896, 398.

See under XXIII., page 562.

Fluorine in Beer, Detection of Small Amounts of. W. Windisch. *Wochenschr. f. Brau.* 1896, 449.

See under XXIII., page 561.

PATENT.

Carbonic Acid Gas, Air-free, from Fermentation; Improvements in or relating to the Collection and Utilisation of [Aeration of Beer], and Apparatus therefor. A. J. Boulton, London. From the Pabst Brewing Company, Milwaukee, Wisconsin, U.S.A. Eng. Pat. 3098, Feb. 11, 1896.

THE fermenting vats on the upper tier are of the ordinary open kind, but are provided with removable hoods fitted into their open tops, and suspended from sheaves: a valved tube passes from the top of each hood to a gas main. In the next lower tier the vats are permanently closed, and are connected at the top to branch gas-collecting tubes. A slight pressure is maintained throughout the system above the atmospheric pressure, to prevent in-leakage of air. In the third tier from the top, vats are shown in each of which the hood is adapted at the rim to enter an annular trough external to the vat, the trough being supplied with water, serving as a liquid seal. An extensible gas-holder is provided, a compressor, and a carbonator; also a storage tank, whence beer may be drawn to the carbonator, whence it passes to a filtering apparatus, and thence to a racking bench, to be drawn into shipping kegs. The carbonic acid, before being used to aerate the beer, is passed through purifiers, kept free from air, in which sterilising agents or suitable chemicals are placed; the gas then goes to a condenser provided with a reducing valve, and with a coil through which brine or a cooling medium circulates, whereby moisture is removed from the gas, which is then fit for use in the carbonator.—E. S.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Copper in Vegetables, Occurrence of. V. Vedrödi. *Chem. Zeit.* 1896, 399—400.

THE author has carefully determined the amount of copper in various vegetables grown on a soil containing copper. His results are given in the following table:—

	Year 1894.		Year 1895.	
	Min.	Max.	Min.	Max.
Winter wheat...	80	710	200	680
Summer wheat...	190	630	190	230
Rye	60	290	10	30
Barley	80	120	10	70
Oats	40	190	40	200
Buckwheat	160	640	150	160
Linseed	120	150	110	150
Peas	60	100	60	110
Soja beans	70	100	70	80
Lupins	80	130	70	280
Mustard seed ...	70	130	60	70
Capsicum	790	1,350	230	490

The above figures represent milligrams of copper per kilo. of substance.—A. L. S.

Wheaten Flour, Method for Detecting Aniline Blue Colouring Matters in. C. Violette. *Bull. Soc. Chim.* 1896, **15**, 456.

See under XXIII., page 561.

Butter and Lard, Use of the Calorimeter in Detecting Adulterations of. E. A. de Schweinitz and J. A. Emery. *J. Amer. Chem. Soc.* 1893, **18**, [2], 174.

See under XXIII., page 560.

Sugar Bush. O. Hesse. *Annalen*, **290**, 317.

See under XX., page 555.

(B).—SANITATION: WATER PURIFICATION.
PATENTS.

Liquids, Improved Means of Purifying [Sewage]. R. Malabar, Liverpool. Eng. Pat. 8362, April 27, 1895.

A NUMBER of perforated floors are arranged one above another, each floor carrying one or more layers of filtering material. An air space is left between the filtering material on each floor and the floor next above it, and into this space fresh air is either admitted by louvres in the walls or is driven in by means of a fan. A suitable filtering material for sewage or impure water consists of alternate layers of burnt ironstone and fibrous turf. With slight modifications, the same arrangement may be used for filtering mineral or other oils.—L. A.

Precipitating and Filtering Tanks [Sewage], Improved. T. B. Wilson, Manchester. Eng. Pat. 9903, May 20, 1895.

At the bottom of an ordinary precipitation tank, parallel rows of glazed earthenware or concrete pipes, of triangular section are laid, forming, with their edges in contact, a series of V-shaped channels. Abutting against and opposite to perforations in the sides of these basal pipes are the ends of a number of smaller porous or perforated pipes, also of triangular section, arranged in parallel rows, and discharging into the larger basal pipes, at an angle to the horizon of 45°, and extending above the water level of the sewage tank at their upper ends, which are open to the air. A tank filled up with pipes arranged in this manner forms the last of a series working on the continuous-flow system. The precipitate or sludge collects in the V-shaped channels, and the clear filtrate passes into the interior of the pipes, and both are conveyed away by suitably arranged conduits.—L. A.

Separating Solid or Semi-Solid Substances from [Sewage] Sludge or other Fluid or Semi-Fluid Matters, Improved Means and Apparatus for. W. Birch, Manchester. Eng. Pat. 13,857, July 20, 1895.

RELATES to improvements in the apparatus described in Eng. Pat. 6535 of 1892 (this Journal, 1893, 460), whereby the tendency of the endless band to run over the edge of the revolving drum is counteracted, and the motion of the scrapers is made rapid and continuous instead of intermittent.—L. A.

(C).—DISINFECTANTS.

Formaldehyde Gelatin. H. K. van Vloten. Chem. Zeit. 20, 407.

To prepare formaldehyde gelatin in such a form that it can be reduced to a smooth powder which may be introduced into wounds without producing irritation, fine gelatin is dissolved in four times the quantity of water, and the solution placed in a warmed vessel, wherein the necessary quantity of a 40 per cent. formaldehyde solution is stirred in. In this dilute solution the reaction proceeds slowly, so that there is time to beat up the liquid to a foam with an egg whisk. After standing a short time, the liquid portion subsides and the foam, which behaves exactly like dried frothed egg albumin, may be transferred to another vessel before it becomes set.—C. S.

PATENT.

Disinfection, An Improved Method of. D. Sjöström, Stockholm. Eng. Pat. 23,130, Dec. 3, 1895.

FOR the disinfection of articles liable to be damaged by air heated above 100° C., or by steam, the ordinary gaseous disinfectants, such as chlorine, sulphur dioxide, &c. are used, but at temperatures between 50° and 95° (50° to 60° for furs, 80° to 90° for bed-clothes, 65° to 95° for furniture). By this method, less of the gas or vapour is required than by working at the ordinary temperatures, and there is less risk of damaging the articles to be disinfected.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Paper (Cellulose), Influence of Temperature and Time Heating on. N. A. Rieszow. Wiestn. obschtn. techn. 1896, 2, 179.

A SPECIAL paper made of flax was examined in a Russian Government laboratory in the following manner:—A comparison was instituted between the paper in its normal state and pieces from the same sheet which had been exposed to definite temperatures for various times. A test piece thus kept for 95 hours at 100° C. had the same tensile strength as the original paper, but its extension became smaller as the water content of the paper decreased. At 110° C., after 7 hours, the strength as well as the extensibility of the paper decreased, and the falling off increased with the length of the test. At 135° C. the paper was still more rapidly injured, and 23 hours' exposure to 143° C. sufficed to diminish the strength about 33 per cent., and the extensibility about 70 per cent. Further experiments went to show that this action of heat obtains with pure paper fibre ("cellulose") and is not sensibly influenced by the treatment with alkali and bleach which the actual paper had undergone.—B. B.

Paper, The Texture of. Abstract from Behrens Mikrochem. Anal. d. Fasern. Papier Zeit. 21 [11], 323.

THE examination of paper by direct reflected light enables one to obtain an idea as to the texture of its surface. Highly glazed paper contains a large quantity of starch-size, and filling materials, which to a large extent hide the fibres from view. These materials are thus removed from the fibre. A strip of paper 10–15 mm. broad and 15–20 mm. long, is moistened with ammonia and then with a few drops of water, after which it is boiled for about 30 seconds. Care should be taken not to derange the fibres and the condition of the solution in which the paper was boiled, will indicate the amount of sizing materials present. After boiling, the ammonia solution is drained off and absorbed by blotting paper and the paper washed with alcohol and gently dried. The examination is performed with reflected light and with a lens magnifying 40–60 times. Considerable difference will be seen between the original paper and that from which the size has been removed, the latter showing numerous irregularities upon the surface and even small holes, passing through the paper. Waterproof and photographic papers, and also paper used for water-colour paintings are exceptions, their texture being even and regular. Machine-made papers show an imperfect parallel arrangement of the fibres in one direction, which accounts for the unequal strength and extensibility when tested lengthwise and crosswise.—S. P. E.

Sizing in Paper, the Effect of Sunlight upon. "B." Papier Zeit. 21, [16], 492.

Animal size renders paper tougher and stronger than rosin size, consequently animal sized paper is more durable and with it an inferior pulp may be employed. The action of sunlight upon rosin-sized paper destroys the effect of the size, making it resemble unsized paper, the action being considered by some to be physical. The author, however, is of opinion that it is due to a decomposition of the size, although the actual chemical change is not clearly understood. From a number of experiments upon various samples of paper, including the best normal papers, which had been made with rosin-size, it was proved that sunlight rapidly destroyed the size and furthermore this destruction was more rapid in the case of highly glazed and satin-surfaced papers than with unglazed papers. The side exposed to the light became like an unsized paper, whilst the unexposed side remained unacted upon sufficiently to prevent ink from being absorbed. A pure animal sized Austrian normal paper withstood the action of the sunlight best. Papers sized with rosin and tannin size withstood the sunlight better than those with rosin size alone, the former being only partially reduced to the unsized condition after months exposure.—S. P. E.

PATENTS.

Paper Pulp, Improvements in Apparatus for treating. L. de Naeyer, Willebroeck, Belgium. Eng. Pat. 12,461, June 27, 1895.

The apparatus consists of a rectangular tank divided into three compartments by two perforated partitions placed lengthwise. The two outside compartments are supplied with stirring plates which are vibrated by means of a rocking shaft. The perforations in the partitions are of such area as only to allow the finely-divided pulp to pass through into the central compartment, when the rough pulp passed into the outer compartments is agitated by the stirring or rocking plates.—O. H.

Paper and Millboard, Improvements connected with the production of Pulp for use in making. E. Davies and H. M. H. Goodfellow, London. Eng. Pat. 3288, Feb. 13, 1896.

SPENT hops are pressed (if not already pressed at the brewery), passed into a horizontal trough containing a conveyor, during passage through which the hops are separated and the seeds loosened from the petals and stalks, thence into an inclined revolving cylindrical sieve, whereby the seeds and dirt are removed, and finally into an ordinary beater for conversion into paper pulp. A blast of air is used to separate the dirt from the seeds.—B. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Rumex Nepaleusis (Wall.), *Roots of*. O. Hesse. Annalen, 1896, 291, 305—312.

THE plant is common in Madras and in other parts of India and is sometimes used by the natives for medicinal or dyeing purposes. The author describes the isolation of three crystallisable substances from its roots, to which he gives the names Rumicin, Nepodin, and Nepalín, the latter being present in by far the largest quantity.

Rumicin, $C_{15}H_{10}O_4$, is extremely like the chrysophanic acid of rhubarb; it differs from it only in its melting point (186° — 188°).

Nepalín, $C_{17}H_{14}O_4$, forms orange-coloured needles melting at 136° C., which are not volatile, dissolve readily in solutions of caustic alkalis, sparingly in those of alkaline carbonates, and yield a diacetyl derivative.

Nepodin, $C_{15}H_{10}O_4$, forms long brittle greenish yellow prisms melting at 158° ; it is soluble in aqueous solutions of alkaline carbonates and yields a diacetyl derivative. The plants of the genus *Rumex* thus yield a series of bodies different from those obtained from plants yielding rhubarb, the bodies found in the latter being chrysophanic acid $C_{15}H_{10}O_4$, Emodin $C_{15}H_{10}O_5$, and Rhein $C_{15}H_{10}O_6$.—T. E.

Artemisin. Ber. ii d. Jahr. 1894, 3—6.

ARTEMISIN, $C_{15}H_{12}O_4$, is according to Merck obtained from the last mother-liquors furnished in the manufacture of santonin from the seeds of *Artemisia maritima*. It is freed from the santonin by re-crystallisation from chloroform, being deposited combined with 1 mol. of the solvent, which is evolved at 90° . It melts at 200° , gradually turns yellow in the air, and is more readily soluble in water and in dilute alcohol than santonin. Heated with soda 10 parts and acid water 40 parts, a fugitive carmine red colour is produced, and like santonin it gives the same colour with alcoholic soda. Artemisin is apparently a hydroxy-santonin.

Alkaloids, Derived from Certain Species of Cactaceæ. A. Heffter. Ber. 1896, 29, 216—227.

Pellotine.—This alkaloid was described in an earlier paper (this Journal, 1895, 381). The formula then assigned to it is corrected to $C_{17}H_{13}NO_2$. From the mother liquors, the remaining pellotine is conveniently separated as the sparingly soluble double salt, $C_{17}H_{13}NO_3 \cdot HCl$, $HgCl_2$. On addition of mercuric chloride, a resinous precipitate at first appears, from which the liquid should be decanted. After 1—2 days,

the double salt is deposited and may be re-crystallised from boiling water. It is thus obtained in snow-white tabular crystals. Pellotine yields an oily benzyl derivative, but does not furnish a simple methyl derivative. By the action of methyl iodide, there results a mixture of pellotine methyl iodide, $C_{14}H_{11}NO_3I$, and methyl pellotine methyl iodide $C_{15}H_{12}NO_3I$. The latter crystallises from water in colourless prisms—m. pt., 225° C.—and furnishes, when treated with silver oxide, the corresponding ammonium base.

Alkaloids of Anhalonium Lewinii, Hennings, or Lophophora Lewinii, Rusby.

Dried slices (known as "Muscle Buttons") of this plant form a considerable item of trade in Northern Mexico, being utilised by the native Indians for narcotic purposes. Lewin (Arch. f. expt. Path. u. Pharm. 24, 401) was the first to indicate the presence in this drug of poisonous alkaloids; and more recently, the author (ibid. 34, 65) has extracted therefrom two bases, whilst Lewin (ibid. 34, 374) has described a third alkaloid, *Anhalonine*.

By the following process, the author has isolated in all, four alkaloids:—The coarsely powdered drug was repeatedly extracted with 70 per cent. alcohol, and the extract, after distilling off alcohol, filtered, made ammoniacal, and exhausted, at first with ether, finally with chloroform. These extracts were worked up separately. The ether extract was dissolved in water, neutralised with sulphuric acid, filtered, and alternately concentrated *in vacuo* and treated with alcohol, so long as crystals continued to separate. The combined crops were dissolved in boiling water and the solution decolorised by animal charcoal. On cooling, the sulphates of two new alkaloids, differing in crystalline form, were deposited, *Anhalonidine sulphate* in fine felted needles, intermixed with *Mezcaline sulphate* in long lustrous prisms. The main filtrate, deprived of alcohol, was exactly precipitated with barium chloride and again concentrated, as long as crystals could be obtained. The latter were found to consist of anhalonine hydrochloride (Lewin). The mother-liquor, still containing alkaloidal substances, was then mixed with a large excess of alcoholic mercuric chloride. After some time a crystalline precipitate was deposited. This was re-crystallised from dilute alcohol, decomposed by hydrogen sulphide, the solution made alkaline with ammonia, and extracted with ether. The extract, neutralised with hydrochloric acid and evaporated *in vacuo* over sulphuric acid, solidified when covered with absolute alcohol, to a mass of fine needles, consisting of the hydrochloride of a fourth (new) alkaloid, *lophophorine*. No other bases could be detected. The chloroform extract contained almost exclusively mezcaline. The yield of alkaloids was about 1.1 per cent., distributed as under:—Mezcaline, 0.46 per cent.; crude anhalonidine, 0.39 per cent.; anhalonine, 0.22 per cent.; and lophophorine, 0.03 per cent.

Mezcaline.— $C_8H_8N(OCH_3)_3$. The base, obtained by adding ammonia to a solution of the sulphate, and extracting with chloroform, crystallises in small white needles melting at 151° C. It is readily soluble in water, benzene, chloroform, and alcohol, with difficulty in ether and petroleum spirit.

Mezcaline Sulphate.— $C_{11}H_7NO_3 \cdot H_2SO_4 + 2H_2O$ forms thin, flat, shining prisms, up to 2 cm. in length. It is readily soluble in hot water, with difficulty in cold water or alcohol. An aqueous solution (1:300) yields the following reactions:—Potassium mercuric iodide, white amorphous precipitate, which soon becomes crystalline; iodine in potassium iodide, precipitate of fine steel-blue needles; potassium bismuth iodide, amorphous scarlet precipitate. Crystalline precipitates are also furnished by picric acid, $HgCl_2$, $AuCl_3$, and $PtCl_4$. By the latter, however, only from fairly strong solutions of the alkaloid.

Anhalonidine.— $C_{16}H_{12}NO(OCH_3)_2$. The crude alkaloid, obtained as described, is contaminated with mezcaline, from which it is best separated, although the process is somewhat wasteful, by fractional crystallisation of the platinum double salts. The mezcaline compound, being decidedly the more soluble of the two, remains in solution. Anhalonidine crystallises in small yellow needles, m. pt. 160° C., and is readily soluble in water and the usual organic solvents. Its sulphate and hydrochloride form felted needles and

colourless plates respectively, and are both easily soluble in water. An aqueous solution of the hydrochloride is dextro-rotatory.

Reactions (solution, 1:300). Potassium mercuric iodide, pale yellow amorphous precipitate, soon changing to aggregates of small prisms; iodine in potassium iodide, precipitate of thin light brown needles; gold chloride, long thin yellow plates; potassium bismuth iodide, phospho-molybdic and phospho-tungstic acids, red and yellow amorphous precipitates respectively.

Anhalonine.— $C_{12}H_{13}NO_3$. Lewin's account of this alkaloid is in general confirmed, although the author finds its melting point somewhat higher— $85.5^\circ C.$ as against $77.5^\circ C.$ The base is much less soluble in water than of the preceding, and is at once precipitated in snow-white needles on addition of ammonia to solutions of its salts. The hydrochloride forms long colourless prisms, readily soluble in hot water, with difficulty soluble in cold water or alcohol. The solution is levo-rotatory.

Reactions (with solution 1:300). $HgCl_2$, long white needles; potassium mercuric iodide, white precipitate, rapidly becoming crystalline; potassium bismuth iodide, amorphous vermillion precipitate.

Lophophorine.— $C_{13}H_{17}NO_3$. The base separates in oily drops when potash, &c. is added to a solution of the hydrochloride. It is readily soluble in organic solvents, but does not crystallise. The hydrochloride is soluble in water and alcohol, and crystallises from the latter in microscopic needles.

Reactions (with solution 1:300). $AsCl_3$, light brown amorphous precipitate, which, after a time, is partially converted into yellow leaflets; picric acid, yellow spherules of fine needles; $HgCl_2$, warty masses of fine white needles; iodine, potassium mercuric iodide, phospho-tungstic, and phospho-molybdic acids produce coloured precipitates. All the preceding bases (including pellotine) yield, when moistened with strong sulphuric acid, a citron yellow coloration, changing to violet on the application of heat. With nitrosulphuric acid a deep violet tint, changing to brown, is obtained.

Physiologically, lophophorine is by far the most active of the above alkaloids. 0.27 mgrm. produced strong convulsions in a frog, whilst 1.1 mgrm. proved a fatal dose.

—H. T. P.

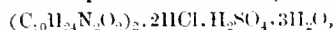
Raphanol, New Compound obtained from the Root of Raphanus Niger or Black Radish (Crucifera) and from some other Plants of the same Family. The Essence of Raphanus Niger. H. Moreigne. Bull. Soc. Chim. 1896, 797—806.

By distilling the root of raphanus niger with steam, there passes over together with the essence a small quantity of a white solid which is separated by filtration through cotton-wool and extraction with ether. The yield of the new product is very small, only 4—5 grms. being obtained from 200 kilos. of the root. The yield of oil is about the same. The new substance crystallises in thin mother-of-pearl plates, and when pure it is odourless and melts at $62^\circ C.$ It is insoluble in water, soluble in ether, chloroform, benzene, and petroleum ether, and somewhat soluble in absolute alcohol, less so in 90 per cent. alcohol. In alkalis and acids at the ordinary temperature, it is insoluble, but it dissolves in boiling acetic acid. Analysis, &c. indicate the formula $C_{20}H_{32}O_4$. The author considers that the product is present in the root and is not formed during distillation. He has obtained the same substance from other crucifers, such as red radish, turnip, ordinary radish, cress, cochlcaria officinalis, &c. The oil obtained from raphanus niger, together with the raphanol, is reddish yellow, has an acid taste and peculiar smell, different from that of the oil of mustard or horse-radish, and hence it does not contain potassium myronate. The oil contains sulphur but no nitrogen, and distils at about $300^\circ C.$ with decomposition, the distillate smelling of cod-liver oil. Unlike mustard oil, it does not combine with ammonia in an alcoholic solution, which under these conditions forms thioisamine.

—T. A. L.

Quinine, The Chlorhydro-Sulphate of. M. Georges. J. Pharm. Chim. 1896, VI. 3, 589.

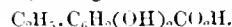
This salt, under the microscope, appears as a mixture of some fine crystalline needles with a considerable quantity of small amorphous granules. The aqueous solution of a commercial sample, which, of those examined, most nearly corresponded in composition with the formula—



was evaporated *in vacuo* and submitted to fractional crystallisation. Analyses of the products obtained satisfied the author that the so-called quinine chlorhydro-sulphate can hardly be a distinct chemical compound; that the commercial article contains varying quantities of basic salt and thus should not replace the neutral hydrochloride for therapeutical purposes.—A. C. W.

Sugar Bush. O. Hesse. Annalen 290, 317—321.

This shrub, *Protea mellifera*, grows abundantly in South Africa and blossoms in January and February. It owes its name to the sweet sap which can be expressed from its flowers. The extract, after mixing with ginger is evaporated to the consistency of molasses and used as a preserve or in cases of laryngeal catarrh. The leaves, twigs, or flowers give, on extraction with ether, a crystalline residue intermixed with gum, containing a phenol and an acid soluble in water. The former is nothing else than hydroquinone and is contained to the extent of about 2—5 per cent. in the plant. The acid, which can be isolated best by means of the lead salt and separation with sulphuric acid, forms white granular crystals melting at $187^\circ C.$ with evolution of carbonic acid. From its analysis, formula of its lead salt, and its reactions with various reagents, the author concludes that the substance which he calls proteic acid is the next higher homologue to homoproteoatechnic acid, and is, in fact, ethylproteoatechnic acid, having the formula—



—T. A. L.

Pyranine. A. Piutti. J. Pharm. Chim. 16, 298—299.

PYRANTIN, *p*-ethoxyphenylsuccinimide, is obtained by melting together either the hydrochloride of *p*-amidophenetol and succinic acid, or phenacetin and succinic acid, and extracting the resulting substance with boiling alcohol, from which the pyranine crystallises out on cooling in colourless prismatic needles, which melt at $155^\circ C.$ It is insoluble in ether, very slightly soluble in cold water, but more so in hot. It splits up into succinic acid and *p*-phenetidine when treated with hydrochloric acid or when heated with potassium acid sulphate. Chromic acid gives a ruby-red coloration with a solution of pyranine in hydrochloric acid, which has been diluted with water. If pyranine be melted with potassium hydrate, the product dissolved in water and a little calcium hypochlorite added, a red coloration is obtained. Ammonia and chlorine water give a yellow colour with an aqueous solution of pyranine. When treated with alkalis, salts of *p*-ethoxyphenylsuccinamic acid are formed.

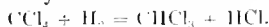
Both pyranin and this sodium salt possess marked antipyretic action.—J. G. W.

Alcohol and its Derivatives; Report for the Year 1895. M. Klar. Die Chem. Ind. 1896, 19, 159.

Chloroform.—Commercial chloroform, as at present produced, is sufficiently pure for use as an anæsthetic. It has been recently prepared in an especially pure condition, it is said, by an electrolytic method. A 20 per cent. solution of sodium chloride is heated to boiling in an enamelled vessel provided with two leaden electrodes, and a current of acetone led through it simultaneously with the passage of an electric current. The acetone is chlorinated by the chlorine evolved during electrolysis, and the chlorinated product converted into chloroform by the caustic soda set free; 190 kilos. of acetone yield 190 kilos. of chemically pure chloroform.

Chloroform is also prepared from carbon tetrachloride, which is made by saturating carbon bisulphide with dry chlorine. The SCl_2 formed in this operation is converted into S_2Cl_2 by the addition of half as much sulphur as the

carbon bisulphide used, and the carbon tetrachloride (boiling below 130°) is separated by fractional distillation, and purified by distillation with steam. 100 kilos. of carbon bisulphide yield 170 kilos. of CCl_4 and 150 kilos. of SCL_2 . The carbon tetrachloride is reduced to chloroform by the action of zinc and hydrochloric acid—



L. Allain finds that the addition of a little (0.1 per cent.) sulphur to chloroform prevents its decomposition in a very complete way.

Chloral Hydrate.—According to E. Schaer, chloral alcoholate, as such, is very slightly soluble in water. It dissolves slowly, being converted into the hydrate. Similarly chloral hydrate is converted into alcoholate when dissolved in alcohol. Douglas states that a moderately concentrated solution of potassium carbonate is a good antidote for chloral poisoning, provided the poison has not reached the blood.

Bromoform.—G. Vulpius finds that pure bromoform has the specific gravity 2.904 at 15°; it is more unstable than chloroform, and for pharmaceutical purposes it is therefore advisable to mix it with 1 per cent. of alcohol; the specific gravity of this mixture is 2.885 at 15°; it boils at 148° and solidifies at 7°.

Iodoform.—A substance recently placed on the market, called "iodoformin," is said to possess no ill odour. According to E. Konteschweller, it is a compound of hexamethylene tetramine (Urotropin) and iodoform. It forms compounds with metals, that with mercury, being already an article of commerce. The smell of iodoform may conveniently be removed from hands, &c., by moistening them with an alcoholic solution of Urotropin.—T. E.

Terpene Alcohols, Extraction of, from Essential Oils. A. Haller. *Comptes rend.* 1896, 122, 865—869.

THE percentage of the terpene alcohol contained in the oil is first determined, after which the part of it which is present in the form of ester is hydrolysed by means of alcoholic potash. The product, after washing and drying over anhydrous sodium sulphate, is treated by one of the two following processes:—

(1.) The essence, alone or diluted with a hydrocarbon, is heated with the quantity of succinic or phthalic anhydride required to form an acid ester. After cooling and filtering, the liquid is extracted with a concentrated solution of sodium carbonate. The aqueous solution is then extracted with ether, and heated with excess of caustic soda on the water-bath, or acidified. The product in either case is completely hydrolysed by alcoholic potash, washed, and rectified.

(2.) The essence is dissolved in ether or benzene, and treated with a quantity of sodium equivalent to the alcohol which it contains, after which succinic or phthalic anhydride is added; the sodium salt of the acid ester is then extracted with water and treated in the same way as in (1).

The second method is applicable to essences containing alcohols which are dehydrated by acids; aldehyde may be removed by bisulphite. Geranium oil from Bourbon, containing 67.2—68.8 per cent. of geraniol, yielded 79 per cent. of the total quantity by the first, and 25—50 per cent. by the second method. An African geranium oil yielded 50.5 per cent. of its geraniol by the first, and 61.1 to 77.8 per cent. by the second method. American essence of mint (containing 52.5 per cent. of menthol) yielded 84 per cent. of the menthol by method (1). Citronella oil yielded 51 per cent. of the alcohol contained in it by method (2), and oil of spike also yielded 50 per cent., chiefly linalool and borneol.—T. E.

Glycerophosphates, Contribution to the Study of. G. Delage. *les Nouveaux Remèdes*, 1896, 12, 217.

GLYCEROPHOSPHATES may be prepared readily and in a state of purity by a process of which the following is a typical example. One part of phosphoric acid of 60 per cent. strength is mixed with $1\frac{1}{2}$ parts of glycerin, and heated until acrolein is evolved; this substance is given off at about 170°—190° C. The syrupy liquid product is allowed to cool, and is poured into a liquid consisting of

precipitated chalk, suspended in five times its weight of water. After long standing, the precipitate is filtered off, and the filtrate precipitated by the addition of half its volume of 90 per cent. alcohol. By this means a flocculent precipitate of calcium glycerylphosphate is thrown down, whilst another salt of similar or identical composition remains in solution and can be obtained in a gelatinous state by warming the solution. The precipitate is dissolved in water and reprecipitated by alcohol, and dried at the lowest possible temperature over sulphuric acid. A white powder, showing a crystalline structure when examined under the microscope, is ultimately obtained. It is soluble in 20 parts of water, and its solubility is greatly influenced by fluctuating conditions. The author has prepared various other glyceryl phosphates in a similar manner. Those of magnesium, lithium and strontium were obtained in the dry state; those of potassium and sodium only in solution. The ferric salt is, on drying, a white powder, but after a time becomes vitreous and yellowish. All the salts may be dialysed, a property favourable to their therapeutical use; they are fairly stable when dry, but are easily decomposed in solution.—B. B.

Bismuth Bichloride. V. Thomas. *Bull. Soc. Chim.* 1896, 758—760.

OF the two series of halogen salts of bismuth known, one corresponds to the general formula BiR_3 , whilst the other has the formula BiR_2 , in the case of the chloride, the sub-bromide and iodide according better with the formula Bi_2R_3 . The action of water, air, and nitrogen peroxide on the halogen compounds of bismuth BiR_3 takes place in a simple manner, and the author has investigated the action of these reagents on the bichloride. Bismuth bichloride is prepared by careful treatment of bismuth with chlorine. It forms a black crystalline mass which does not melt at 300° C. When finely powdered and washed with water until the latter is no longer acid to litmus paper, a powder is obtained which consists of a mixture of bismuth and its oxychloride, the reaction taking place according to the following equation: $3\text{BiCl}_3 + n\text{H}_2\text{O} \approx \text{Bi} + 2\text{BiOCl} + 4\text{HCl} + (n-2)\text{H}_2\text{O}$. By heating bismuth bichloride to about its melting point, the residue consists of bismuth oxychloride, if purified by treatment with dilute nitric acid. Probably the reaction takes place in two stages, bismuth trichloride and bismuth being formed first.—T. A. L.

Vanillin, Methods of Preparation of. J. Altschul. *Pharm. Central H.* 1895, 16, 721.

THE author classifies the various methods for the preparation of vanillin as follows:—

- (1.) By oxidation of the aliphatic side chains in—
 - (a.) Coniferin, Glucovanillin, Olivil, Acetomovanillilic acid, Acetofervulic acid;
 - (b.) Eugenol, Iso-eugenol, Acetengenol, Engenol acetic acid, Acetiso-eugenol, Benzyliso-eugenol, Methyleneiso-eugenol, Iso-eugenolphenylacetic acid, Iso-eugenolitoic acid.
- (2.) From *p*-nitro-*m*-methoxybenzaldehyde prepared from toluene (as *p*-nitro-*m*-chlorotoluene), cinnamic acid (as *m*-methoxycinnamic ester), benzaldehyde (as *m*-amidobenzaldehyde).
- (3.) From the bimetallic salts, the monoacetyl compound, the benzyl compound, and the sulphobenzene compound of protocatechuic aldehyde by the introduction of a methyl group into this latter.
 - (1.) From guaiacol—
 - (a.) By the introduction of an aldehyde group by the action of chloroform and caustic potash;
 - (b.) By the conversion into guaiacol carboxylic acid, the introduction of the aldehyde group and separation of CO_2 ;
 - (c.) By conversion into guaiacol dicarboxylic acid, treatment with chloroform and alkali, and removal of the orthocarboxyl group.—J. T. C.

Glyceric Acid, New Method of Preparation of. P. Cazeneuve. *Bull. Soc. Chim.* 1896, 763.

See under XII., page 548.

Citronellal (Citronellaldehyde) Group of Compounds. Occurrence of, in Essential Oils. F. Tiemann and R. Schmidt. Ber. 1896, 29, 903.

See under XXIII., page 564.

Alcohol, Estimation of Essential Oils in, by Means of Common Salt. M. Koutechouff. Bull. de la Soc. d'Encouragement, 1896, 571.

See under XXIII., page 561.

PATENT.

Vanillin, Improvements in the Manufacture of. O. Pren, Vienna, Austria. Eng. Pat. 7692, April 11, 1896.

EUGENOL or iso-eugenol is converted into an acetyl derivative, which is then oxidised by chromyl chloride, CrO_2Cl_2 , and the resulting vanillie ether on saponification gives a good yield of vanillin. One molecular proportion of acetyl-eugenol or acetyl-iso-eugenol is dissolved in five times its volume of carbon bisulphide or chloroform. To this is then carefully added a solution containing two molecular proportions of chromyl chloride, also diluted with five times its bulk of the same solvent, the temperature being kept below 40°C . After standing over night the mixture is filtered and the chocolate-brown precipitate obtained, may be worked up by various methods, the following being a typical example:—The precipitate is dried at about 50°C . to drive off the solvent, and is then stirred into 6–10 times its weight of water, when acetyl-vanillin separates as a resinous mass. On warming this latter with a small excess of sodium hydrate, on the water-bath, saponification takes place, and after cooling and acidification with dilute sulphuric acid, the vanillin may be extracted with ether, and separated from the ethereal solution by means of an alkaline bisulphite, this compound being finally decomposed with dilute sulphuric acid. The crude vanillin is then purified.

—T. A. L.

XXI.—PHOTOGRAPHY.

Laccase, its Oxidising Power. G. Bertrand. Bull. Soc. Chim. 1896, 791–793.

See under XXIII., page 561.

PATENT.

Photographic Prints, Improvements in Chemical Compositions to be used for Preparing the Surface of Suitable Material for. P. E. Schoenfelder and E. Kehle, Newark, N.J., U.S.A. Eng. Pat. 6651, March 26, 1896.

A METHOD is claimed for the preparation of a "self-toning" photographic film, this film requiring only to be fixed after the exposure. $1\frac{1}{2}$ oz. of a collodion, made by dissolving 300 grains of pyroxyline in 1 lb. each of absolute alcohol and ether, are mixed with 10 drops of a solution of 15 grains of the chloride of gold, platinum, iridium, rhodium, osmium, or palladium dissolved in $\frac{1}{2}$ oz. of 40 per cent. alcohol. Three grains of an organic acid (e.g. citric acid), 15 of silver nitrate, and $1\frac{1}{2}$ of the chloride of barium, strontium, or zirconium, each dissolved separately in a small quantity of spirit, and 2 drops of glycerin or castor oil are then added in succession to complete the emulsion. The surface must be thoroughly dried before use. After printing, the paper, &c. is fixed in 1:15 thiosulphate. A similar emulsion can be made in gelatin, the other ingredients being then dissolved in water.—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives, The Annual Report (Twentieth) of Her Majesty's Inspectors of, for 1895.

THIS being the 20th year since the Explosives Act came into force, the inspectors in their annual report, recently issued, give a short review of the principal changes which have occurred during this period in addition to the work of the past year.

The growth of the trade in explosives during the 20 years, has been very great. In 1875 there were only 55 factories, now there are 134. Dynamite was then practically the

only nitroglycerin compound for blasting purposes in the market, and all made in one factory, whereas now it has been largely replaced by gelignite, gelatin-dynamite, &c., 12 varieties of which compounds are made in nine factories.

Smokeless powders had not been introduced then, now there are 14 factories licensed for their manufacture. Four new factories were licensed last year.

The following have been added to the list of authorised explosives:—Dahmenite A, Electronite (Nos. 1 and 2), Emerald Powder, Faversham Powder, Pigou's Military Smokeless Powder, Pigou's Sporting Smokeless Powder, Roburite No. 3, Rosslyn Smokeless Powder No. 1, Rosslyn Blasting, Low Tension Electric Fuses (No. 5 Definition), Low Tension Electric Detonator Fuses.

It has been decided that gunpowder cartridges enclosing sealed tubes containing liquid ammonia may be treated as gunpowder blasting cartridges pure and simple (not containing their own means of ignition). It is added, however, that the point is not free from doubt and the "decision must be regarded as susceptible of modification by light of experience or in consequence of a decision of a court of law."

In regard to the mixing of dry cap composition, all the manufacturers who prepare it in this state have adopted the "jelly bag" system, and it has been found to work most efficiently and safely.

The amount of foreign nitroglycerin compounds imported was 880,070 lb., compared with 539,802 lb. in 1894, and the amount of dynamite has risen from 23,000 lb. to 56,000 lb. The number of detonators imported during the year was 6,981,000, against 9,765,400 in 1894. A large percentage remains in foreign hands, but now there are six factories for the manufacture of detonators in this country.

Dr. Dupré states in his report, which is given *in extenso*, that for the first time since the chemical examinations have been undertaken there have been no rejections among explosives proper; although there is still room for improvement, the defects noticed were not of a sufficiently grave character to demand the condemnation of any explosive.

Some samples of coloured stars had to be rejected on account of their containing both chlorate and sulphur in their composition contrary to Order in Council, No. 15, which came into force on Jan. 1, 1895. "In relation to this," Dr. Dupré says, "I should like to draw the attention of firework makers to the practice of using, sometimes a not inconsiderable proportion, of gunpowder containing sulphur, as a priming for stars. This is not, I believe, against the above-mentioned Order as at present drawn, but as, at least, one accident has been directly traced to the mere contact of a chlorate with a sulphur mixture it might be well, if possible, to replace the ordinary gunpowder containing sulphur by a powder free from such."

A sample of gun-cotton about 25 years old, and contained in a tin canister, perforated in several places by corrosion, the gun-cotton in contact with the metal being stained dark reddish-brown, was examined and gave the following results:—

Nitrocellulose, insoluble	95.46	Heat test one hour.
" soluble	3.50	Nitrogen 13.2 per cent.
Mineral matter	1.61	
	100.00	

showing that the gun-cotton was of remarkably good quality although manufactured so long ago.

The following important alterations in the tests applied to explosives have been adopted.

The heat test for gun-cotton and non-gelatinised gun-cotton preparations has been made more stringent by raising the temperature to be employed from 150° to 170°F ., leaving the time, viz., 10 minutes, unaltered.

The temperature for the heat test to be applied to all horny or semi-horny explosives consisting mainly of gelatinised gun-cotton (such as Walsrode powder) and gun-cotton mixed with nitroglycerin (such as cordite and ballistite), has been raised to 180°F .

The number of accidents by fire or explosion known to the Department during the year was 152, causing 40 deaths

and injuring 167 persons, but four-fifths of the accidents causing death or personal injury occurred in the use of explosives and under miscellaneous conditions to which the controlling provisions of the Act do not apply.

A short account is given of each of the principal explosions at home and abroad and also of outrages and attempts.

Experiments were carried out with a view to ascertaining—

(1.) If the magazine clothing supplied by the Government (*viz.*, lasting cloth jackets, and stout woollen cloth army trousers) possessed the necessary quality of unflammability when cordite (or other nitro-compound) was present; and (2) the relative value for this purpose of different fabrics.

The results appear to justify the following conclusions:—

1. That lasting cloth, treated or untreated, is not unflammable.

2. That chemical treatment has very little effect in diminishing the inflammability of woollen fabrics.

3. That chemical treatment cannot be depended on for rendering thin cotton fabrics unflammable.

4. That the protective value of any material, treated or untreated, is largely affected by its thickness.

5. That stout Osnaburgh, chemically treated, is unflammable under all reasonable conditions, and serviceable.

6. That stout woollen cloth (such as is used for army trousers, whether with or without treatment, is unflammable, under all reasonable conditions, and serviceable."

The "chemical treatment" referred to is either treatment with a solution of tungstate and phosphate of soda or a solution of tungstate of soda alone.

Further experiments were made with other materials and of all those tried the most satisfactory in every respect is "white duck" as supplied to the Army Clothing Department when treated with a solution proposed by the Lancashire Explosives Co. The solution is prepared as follows:—

Ammonium sulphate, 8 parts.	Dissolve, then add starch,
Ammonium carbonate, 2½ "	stir well, and boil.
Boric acid, 3 "	The fabric should be dry
Borax, 1½ "	before steeping in this
Water, 200 "	solution.

—W. M.

Smokeless Powder, The Pyrocollodion, of Mendelëff.
P. Kouindjy. Bull. de la Soc. d'Encouragement pour l'Industrie Nationale, 94, 1100—1113.

EXPERIMENTS have been carried out during the years 1890—1895 by M. Mendelëff on behalf of the Russian Government with the object of producing an improved smokeless powder, and the results of these experiments are described in a report recently published in the *Journal de la Marine Russe*.

The most important substances used hitherto in the manufacture of smokeless powders, are the two chief products of the action of nitric acid on cellulose, *viz.*, pyroxylin and collodion cotton. In the so-called "pyroxylin" powders, a mixture of these two substances is employed, in which pyroxylin is the explosive and collodion cotton the gelatinising factor. Other smokeless powders, *e.g.*, cordite and ballistite, are made from collodion cotton and nitro-glycerin. Collodion cotton, as usually prepared, contains 12.5 per cent. of nitrogen, and pyroxylin 12—14 per cent. Eder has shown that by precipitating certain varieties of nitro-cellulose from their solutions in suitable solvents, a definite compound pentanitro-cellulose can be obtained containing 12.7 per cent. of nitrogen. Mendelëff has succeeded in preparing, by the action of nitric and sulphuric acid upon cellulose, a new nitro-derivative intermediate between pyroxylin and collodion cotton and therefore named by him "pyrocollodion." This substance contains 12.5 per cent. of nitrogen and is not identical with Eder's pentanitro-cellulose, for whilst the latter has the formula $C_{12}H_{14}(NO_2)_5O_{10}$, pyrocollodion is $C_{30}H_{38}(NO_2)_{12}O_{25}$.

In a series of practical trials carried out with small arms and cannon of every description, and described in detail in the report, the pyrocollodion powder was compared with other smokeless and non-smokeless powders. The

substance is easily gelatinised and can be made into the form of laminae consisting of a homogeneous translucent mass similar to glue or celluloid, it is very stable, and on explosion leaves no residue whatever. Other advantages of the new powder are said to be as follows:—

(1.) It is of uniform composition, and by its use a uniform initial velocity of the projectile is obtained.

(2.) This velocity may be varied at will by varying the size of the grains of powder; with large grains it is possible to obtain a very high velocity without injury to the cannon.

(3.) By increasing the size of the grains the powder may be made to burn very slowly; this is indispensable for cannon of large calibre.

(4.) The velocity is greater than is produced by other powders.

Pyrocollodion powder was found to give satisfactory results in every case in which it was tried, both as regards velocity and range of the projectile, and it appears to be equally suitable for naval and military purposes, for large and small cannon, for shells, and for small-arms.—R. B. B.

PATENT.

Fuses or Match-cords, Improved Manufacture of. M. Wagner, Berlin. Eng. Pat. 7711, April 11, 1896.

THE aim of this patent is to produce a fuse that will burn without flame, and at the same time to increase the certainty of ignition. A suitable fibre, either nitrated or not, is impregnated with a drying oil and a salt containing much water of crystallisation, *e.g.*, magnesium sulphate, sodium carbonate, alum, &c., or with albuminous bodies or glue. To attain the second object, diazo compounds of the benzene or naphthalene series are made use of, more especially diazobenzene sulphonic acid and its chromium and bromine derivatives. The whole fuse may be waterproofed and rendered still safer in the presence of fireproof by the employment of chromium glue, in which case it must be exposed to light to render the coating thoroughly insoluble.

—F. H. L.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Photometry, A Suggested Remedy for a Source of Error in Official. L. T. Wright. J. Gas-Lighting, 67, 1896, 1213—1214.

THE author points out that in the instruction of the London Gas Referees the operator is told to burn the gas at 5 ft. per hour and then multiply the photometric reading obtained by the factor of correction due to temperature and pressure. He maintains, however, that the number so obtained is not necessarily the same as, and may often vary by 3—4 per cent. from, the result obtained by actually burning 5 ft. normal, this latter being evidently intended by the Act of Parliament. The error in the present method is due to the difference of efficiency of the argand burner when consuming different quantities of gas.

The author considers that more constant and reliable results would be obtained if the volume of gas at the conditions of temperature and pressure of the test which would equal 5 cb. ft. normal, were first calculated and then consumption regulated to that rate. More reliable results than at present would also be obtained if the gas were always consumed at a rate sufficient for the flame to just fill the chimney, and then correction for quantity made; or if, with any rate, the admission of air to the argand were regulated, as by the latter means the maximum efficiency of the gas may also be obtained.—L. T. T.

Acoustic Analysis of a Mixture of Air and another Gas (or of two Gases of different Densities). E. Hardy. Bull. de la Soc. d'Encouragement, May 1896, [5], 653—665.

WHEN air of the same composition and temperature is blown into two identical pipes, like organ-pipes, they produce the same note; but if one of the two pipes be fed with air containing even a small proportion of a gas of different density it

gets out of tune and beats are produced. Other things being equal, the number of beats produced in a given time is proportional to the amount of the foreign gas in the mixture. This is the principle upon which the author's method of acoustic analysis is based.

One of the two pipes may be enclosed in an envelope containing pure air which never mixes with the atmosphere outside; this pure air goes from the pipe back into the blower and is again forced into the pipe. The second pipe is fed with air from the surrounding atmosphere. If this consists of pure air the two pipes will be in unison. But if the apparatus be placed in a mine containing marsh-gas, they will no longer give the same note. The number of beats in a given time will, under proper conditions, be proportional to the amount of marsh-gas present. Obviously the removal of any carbonic acid is one of the requisite conditions; small variations in the amount of nitrogen present do not appreciably affect the result. The gases with which the two tubes are fed must be at the same temperature and in the same hygrometric state (e.g., both saturated with water-vapour).

The method can be employed for determining acoustically the amount of carbonic acid contained in furnace-gases. With organ-pipes giving 128 (double) vibrations per second, each hundredth part of carbonic acid in the furnace-gas produces about three beats in 10 seconds.—D. E. J.

INORGANIC CHEMISTRY.—QUALITATIVE.

Carbon Dioxide. Liquid; Methods for Experimental Examination of. B. Schwalbe. Zeits. phys. u. chem. Unterr. 1896, 9, 1.

DIRECTIONS are given as to the best method of obtaining samples from the cylinders. Solid carbon dioxide sprinkled on ignited petroleum extinguishes the flame. The but slight chemical activity of the snow may be demonstrated by adding concentrated ammonia, or an ammoniacal solution of barium chloride. That only a trifling sensation of cold is felt on touching solid carbon dioxide is accounted for by Leidenfrost's phenomenon, which may be illustrated by sprinkling the snow on water, when it is buoyed up by adhering bubbles of gas. To demonstrate the tension of compressed carbon dioxide an experiment is described in which a column of mercury is forced up by the expanding gas. By placing the solid substance in a flask, fitted with a cork through which passes a tube, and half filled with water, a small fountain is produced by the expansion.

Considerable friction occurs when the escaping liquid carbonic acid comes in contact with the wooden walls of the outlet-opening. When a cloth bag is used, friction of solid carbonic acid against wood and cloth takes place, and electric sparks are often observed during the preparation of solid carbonic acid. It may be demonstrated thus that the solid carbonic acid is negatively charged, whilst the cloth is positively charged with electricity.—C. A. M.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Chlorides, Hypochlorites, and Chlorates, Volumetric Analysis of Mixtures of. A. Carnot. Bull. Soc. Chim. 1896, 15, 393—397.

THE hypochlorous, chloric, and hydrochloric acids are successively determined in the same portion of the mixture.

The hypochlorous acid is estimated in the usual manner by titration with sodium arsenite.

The chloric acid is then estimated by means of ferrous ammonium sulphate. To this end, an excess of the latter salt (at least 20 times the weight of the chloric acid present) is added, the solution is heated almost to boiling, and 5 c.c. of sulphuric acid, diluted with 15 c.c. of water, are gradually added. Then the flask, which contains the solution, is closed, and its contents, when cold are titrated with potassium permanganate.

Lastly, the chlorine, now wholly present in the form of hydrochloric acid, is estimated by titration with silver nitrate. This is added in excess, and the excess is determined by means of ammonium thiocyanate, the end-point

of the reaction being indicated by the red coloration produced by the interaction of this salt with the ferric salts in the solution.—E. B.

Chlorides, Chlorates, and Perchlorates, Analysis of Mixtures of. A. Carnot. Bull. Soc. Chim. 1896, 15, 397—399.

THE hydrochloric and chloric acids are estimated in either one or two portions of the sample.

In the former case the amount of hydrochloric acid present is first ascertained by titration of the neutral solution with silver nitrate, in the presence of sodium or potassium arsenate, instead of potassium chromate, for the definition of the end-point, as the last-named salt interferes with the succeeding estimation of the chloric acid.

The determination of the chloric acid is accomplished with ferrous ammonium sulphate, as described above (see the preceding abstract).

To estimate the perchloric acid, another portion of the mixture (sodium, potassium, or calcium salts) is taken, and mixed with 4—5 parts of pure quartz sand. The mixture is then placed in a platinum crucible, covered with a layer of sand 1—2 cm. deep, and heated for 20—30 minutes, so that the bottom of the crucible attains a red heat. The chloride thus formed, along with that originally present, is then volumetrically estimated.—E. B.

Portland Cement (Raw), Estimation of Lime in.

F. Kluge. Chem. Zeit. 20, 372.

A rapid and sufficiently accurate volumetric method for technical purposes consists in calcining 2 grms. of the raw material under examination (powdered so fine that 85 per cent. will pass through a 5,000 mesh sieve), in a smooth platinum crucible for 10 minutes in the full flame of a Bachelin blowpipe. After cooling for 5 minutes and weighing, the mass is emptied into a beaker containing 50 c.c. of hot distilled water, and is boiled therein for 1 minute, 40 c.c. of sulphuric acid (of $\frac{2}{3}$ normal strength) being thereupon run in and the boiling continued for a minute longer. After washing the crucible thoroughly with 50 c.c. of distilled water at room temperature, the titration is effected by means of potassium hydroxide solution (also of $\frac{2}{3}$ normal strength) with 20 drops of phenolphthalein (0.5 per cent. solution) as indicator. The volume of acid consumed in the primary reaction, calculated to the weight of calcined substance, gives a co-efficient for determining the lime, varying with different raw materials on account of the different proportions of alkalis in the total alkaline matter, but constant for each. The co-efficient will in each case have to be established by previous experiments.

—C. S.

Iron and Steel Analysis, Introduction of Standard Methods of. H. J. von Jon-torff. Iron and Steel Inst., Spring Meeting, 1896. The Ironmonger, 269—279.

AFTER instancing some gross discrepancies in the analysis of iron and steel in various and even in the same laboratories, and mentioning the work done and the results published by the various commissions of the world, formed to endeavour to obtain standard methods of analysis, the author turns to the problem itself and says it is evident that its solution must be preceded by an accurate knowledge of the causes that bring about the present differences in analytical results. These he classifies under eight headings, each of which he considers in full detail, viz.:—(1) Gross errors in the analysis; (2) Impure reagents; (3) Errors due to the apparatus, &c.; (4) Errors due to the operations; (5) Errors due to the analytical methods; (6) Personal errors; (7) Errors due to differences in the calculation of the analyses caused by the values of the atomic weights on which they are based; and (8) Want of homogeneity of the sample.

In the course of section 8 the fundamental importance of obtaining a fair sample of the material is emphasised, and in speaking of the irregular distribution of the elements in iron and steel the following two proposals are submitted:—(a) That it is best entirely to exclude average samples of metals; it is better to examine a number of separate samples and to calculate the average from these results;

and (b) in the case of grey or mottled pig-iron the whole of the quantity broken down should be used when determining the carbon.

In aiming at accurate analysis, however, it must be admitted that there are occasions when extreme accuracy is superfluous. The necessity of accuracy will depend on the purposes to which the analysis is to be applied, and these may be divided into, (1) Analyses which are intended for use in controlling the work in the factory; (2) Trade analyses; (3) Analyses which are to show the reason why the material under examination possesses certain properties, or whether it is suitable for certain definite purposes; and (4) Analyses connected with scientific investigation. Relative accuracy is adequate for controlling works operations where rapidity is the chief factor; and probably there is sufficient accuracy in analyses for trade purposes where they are controlled by specifications as to percentage limits, and to certain specified methods of analysis, but it is quite different in the cases of 3 and 4. In these something more even than mere chemical composition, however accurate, is becoming necessary, since the elements are now known to exist in so many different forms and combinations. Taking this into consideration, the field for investigation becomes so enormous that it will probably be found sufficient at present to settle three points, viz.: (1) investigations relating to the want of homogeneity in the samples, and to some decision as to the method of sampling; (2) examining the methods for the determination of the main constituents—that is, of carbon, silicon, manganese, sulphur, phosphorus, copper, and slag; and (3) the arrival at and agreement, if only temporary in character, as to the value of the atomic weights to be adopted for analytical calculations.—A. W.

Kermes. The Assay of. P. Lagüe. J. Pharm. Chim. 16, 341—343.

THE official assay of kermes consists of determinations of the yellow sulphide of antimony and of the iron salts, no notice being taken of the presence or amount of antimony oxide. For the estimation of this constituent the author treats with an aqueous solution of tartaric acid, preferably hot, and precipitates the antimony oxide, which enters into solution, by sulphuretted hydrogen. The antimony sulphide is dried at 100° C. and weighed. The sodium contained in the kermes as sulpho-antimoniate is also estimated. Kermes from various sources gives very different results when analysed in this way.—J. G. W.

Tin and Copper in Tin Dross. Estimation of. L. Rürup. Chem. Zeit. 20, 406.

To estimate the copper and tin in the dross from (molten) tinning baths in a rapid (2½ hours) and fairly accurate manner, 500 grms. of an average sample are fused in a Hessian crucible with cream of tartar, soda, and lime (Kerl's flux) in a blast furnace, until the slag runs easily, and, after cooling down, separating, and boring the regulus, treating 1 grm. of the borings with 25 c.c. of nitric acid (1·2 sp. gr.) and 10 c.c. of concentrated nitric acid, by warming on the air-bath. The precipitated metastannic acid is removed, washed, dried, incinerated, and weighed. The filtrate, containing copper and iron, is evaporated to dryness, taken up with 15 c.c. of 50 per cent. sulphuric acid, and the copper removed from the diluted solution by electrolysis. The results of six analyses of the same sample show that the greatest variation of the method, in the case of tin, was 0·18, and for copper 0·02 per cent., results which are more regular than are obtained by the wet method.—C. S.

Mercury. Electrolytic Estimation of. E. F. Smith and D. L. Wallace. J. Amer. Chem. Soc. 1896, 18, 169—170.

THE determination of mercury in cinabar by electrolysis of a cyanide solution, is a rather lengthy process, owing to the necessity of first dissolving the mineral in acid, the excess of which has afterwards to be removed. The authors have therefore tested the method first proposed by Smith, and which consists in electrolytically precipitating the mercury from its solution in an alkaline sulphide. They

recommend weighing the mineral in a platinum dish, dissolving it in 20—25 c.c. of a solution of sodium sulphide (sp. gr. 1·22), diluting to 125 c.c., and then electrolysis at 70° with a current of $N.D_{100}=0\cdot12$ ampère. The time allowed for the deposition of the mercury never exceeds three hours, and accurate results are obtained.—A. K. M.

ORGANIC CHEMISTRY.—QUALITATIVE.

Magenta and Acid Magenta, Distinction between. Schiff's Reaction. P. Cazenave. J. Pharm. Chim. 1896, 3, [11], 595.

ROSANILINE salts decolorised by sulphurous acid give a violet coloration with an alcoholic solution of form- or acetaldehyde. Under the same conditions acid magenta assumes the rose tint of the original colouring matter. The latter dyestuff does not dissolve in amyl alcohol in presence of alkali, as does rosaniline hydrochloride, and better resists oxidation by manganese dioxide and very dilute acids.—A. C. W.

Schiff's Reaction. G. Urbain. Bull. Soc. Chim. 1896, 15, 455—456.

WHEN aldehydes act upon rosaniline which has been decolorised with sulphurous acid, condensation takes place, with the production of aldehyde-rosaniline compounds, of violet or blue colours, which are unaffected by sulphurous acid.

The condensation of an aldehyde and rosaniline may be effected by means of hydrochloric acid, the aqueous solution, which is at first colourless, becoming in the course of 24 hours intensely blue-coloured.

V. Meyer has pointed out (Ber. 3, 2243) that Caro obtained a violet-red condensation compound from rosaniline and chloral, which he was unable to produce from chloral hydrate. This is not easily obtained, owing to the facility with which chloral in the presence of water becomes hydrated. It may, however, as the author finds, be readily formed in the following manner:—A few drops of Schiff's reagent, with a little ether, are placed in a test-tube, and a small quantity of chloral is added. On shaking the tube, the ether is coloured violet. Chloral hydrate under the same conditions does not give any coloration.—E. B.

Lard, Microscopic Detection of Beef Fat in. T. S. Gladding. J. Amer. Chem. Soc. 1896, 18, 189.

THE following method is recommended for the preparation of crystals of lard and beef stearin for microscopic examination:—Dissolve 5 c.c. of melted lard in a mixture of absolute alcohol (10 c.c.) and ether (5 c.c.); place a plug of cotton wool in the mouth of the flask and set aside in a cool place for about half an hour, when the stearin will crystallise out, leaving the olein in solution. Filter quickly and wash the crystals with a mixture of alcohol and ether (10:5). Allow the crystals to dry in the air, return them to the flask, dissolve in 25 c.c. of ether, insert cotton-wool plug, and place the flask in a slanting position in a large beaker of water. Keep this in a cool place over night; the ether evaporates very slowly and crystals of stearin are gradually deposited.—A. K. M.

Butter and Lard, Use of the Calorimeter in Detecting Adulterations of. E. A. de Schweinitz and J. A. Emery. J. Amer. Chem. Soc. 1896, 18, [2], 174—179.

THE determination of the heat of combustion of pure butters compared with that of mixtures of butter with oleomargarin is found to be of considerable value in detecting adulteration. Three samples of pure butter from different sources gave on combustion 9·327, 9·362, and 9·320 calories per grm. of butter, the samples being first prepared by washing, melting, filtering, and drying at 100°. A number of commercial oleomargarins have also been tested, and with these the number of calories per grm. vary between 9·574 and 9·95.

In the case of lard, if the number of calories comes out low, this would indicate that the article was either a compound or that it was from the caul, intestines, or head of the animals, and this point could be settled by means of

the iodine number and cotton-seed oil test. The determination of the heat of combustion of lard gave the following results, expressed in calories per gram. :—

Lard, leaf	95621
" caul fat	95573
" intestinal fat	95581
" heads	95563

—A. K. M.

Fluorine in Beer, Detection of Small Amounts of.
W. Windisch. *Wochenschr. f. Brau.* 1896, 419—450.

ONE litre of beer is freed from carbonic acid, filtered, and boiled. The hot beer is poured into a cylinder, and 100 c.c. of hot lime water are added; a voluminous precipitate is formed; this is collected and washed and introduced into a small platinum dish. The dish and its contents are then gradually heated to incandescence, and the contents, when cold, moistened with three drops of water and 1 c.c. of concentrated sulphuric acid. The dish is heated on the water-bath and covered with a watch glass which has been coated with wax, and a few scratches made on the wax coating; if fluorine compounds have been added to the beer, hydrofluoric acid will be liberated, and will etch the glass.—A. L. S.

Wheaten Flour, Method for Detecting Aniline Blue Colouring Matters in. C. Violette. *Bull. Soc. Chim.* 1896, 15, 156.

A SHEET of filter-paper is placed upon the surface of water, and a little of the sample to be examined is sprinkled over it. If the sample contain any coal-tar colouring matter, such as is employed for counteracting the faint yellow colour of flour, dark-coloured specks soon make their appearance on the paper. These rapidly increase in size, forming, after a little while, blue spots several mm. in diameter, with dark centres.—E. B.

Laccase: its Oxidising Power. [Discrimination of certain Photographic Developers.] G. Bertrand. *Bull. Soc. Chim.* 1896, 791—793.

IN continuing his researches on laccase (this Journal, 1895, 374 and 1074), the author has subjected a number of substances (alcohol, paraldehyde, glucose, urea, &c.) to the action of laccase in presence of oxygen, but finds that the oxidising action only takes place with aromatic compounds, and especially with those containing at least two OH or NH₂ groups situated in the ortho- or preferably in the para- position. Hence a certain relationship exists between this action and the photographic developing power of certain of these compounds. Thus, *p*-amidophenol, which is a good developer, is rapidly oxidised in presence of laccase and air; whilst *m*-amidophenol, which does not develop, is scarcely acted on. The same difference exists between *p*- and *m*-phenylene diamine. It would appear that the oxidisability of these polyphenols depends upon the facility with which they yield quinone, and it is to be remarked that whilst phloroglucinol [(OH)₃=1:3:5] is scarcely acted on, pyrogallol (1:2:3) rapidly absorbs oxygen; and the same is also true of protocatechuic acid [CO₂H:OH=1:3:4], gallic acid—



and more especially of hexaphenol, C₆(OH)₆. Thus also, this reaction serves to distinguish laccase from other soluble ferments.—T. A. L.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Sugar, Estimation of, by the Copper Method. Kaiman. *Gesterr. Zeits. Zuckerind.* 1896, 25, 43.

THE cuprous oxide arising from the reduction of Fehling's solution by solutions of sugar, is filtered on to ignited asbestos contained in a glass tube, and washed with hot water. The asbestos plug is then removed by means of a glass rod, and placed in 50 c.c. of a solution consisting of 100 grms. of ferric sulphate, 100 c.c. of concentrated sulphuric acid, and 909 c.c. of water. The tube is rinsed out and the amount of reduced ferric salt titrated with ^N/₂₀ potassium permanganate solution, the titre of which is

calculated in terms of copper :—56 grms. iron = 63 grms. oxalic acid = 63.3 grms. copper. The whole operation takes about 15 minutes. (See also Neitzel, *Oesterr. Ungar. Zeits. Zuckerind.* 1893, 16.)—J. L. B.

Caffeine in Tea, Estimation of. A. Petit and P. Terrat. *Bull. Soc. Chim.* 1896, 811—815.

THE authors, considering current methods unsatisfactory, submit the following :—25 grms. of the powdered tea are mixed with 75 c.c. of boiling water and allowed to stand 15 minutes with occasional agitation. The mixture is then evaporated on the water-bath until the tea is only just moist, when the whole is extracted with chloroform, the extraction being continued until the residue left after distilling off the chloroform and taking up with boiling water gives, after filtering, neither a precipitate nor turbidity, with tannin solution. The chloroform is then evaporated, the residue dissolved in boiling water, filtered, and the solution evaporated on the water-bath. Generally the caffeine so obtained is sufficiently pure to be weighed directly, but if it be necessary to free it from chlorophyll it is dissolved in the cold in 15 c.c. of 10 per cent. sulphuric acid, filtered, the acid neutralised with ammonia and evaporated to dryness, the residue being extracted with chloroform, which is evaporated at a very low temperature. Almost equally satisfactory results are obtained by the use of 60 or 80 per cent. alcohol for extracting the dry tea, whilst the yield of caffeine is only very small if 98 per cent. alcohol be used. The compound or compounds of caffeine existing in the tea only decompose in presence of water, and recombine when the moist tea is dried. The same process can be employed for estimating the amount of caffeine in coffee, kola, maté, or guarana.—T. A. L.

Alcohol, Estimation of Essential Oils in, by Means of Common Salt. M. Kontcheroff. *Bull. de la Soc. d'Encouragement*, 1896, 571—589.

THIS method, which is similar in principle to that of Röse, consists in diluting the sample of alcohol to a strength of 60 per cent. by volume, adding exactly 1 per cent. by volume of amyl alcohol (to assist in the extraction of the oils), and shaking the mixture in a special apparatus with 3.5 vols. of saturated brine. The volume of the oily layer which rises to the surface, diminished by a constant due to the amyl alcohol added, is a function of the volume of essential oils contained in the sample, and, by reference to a

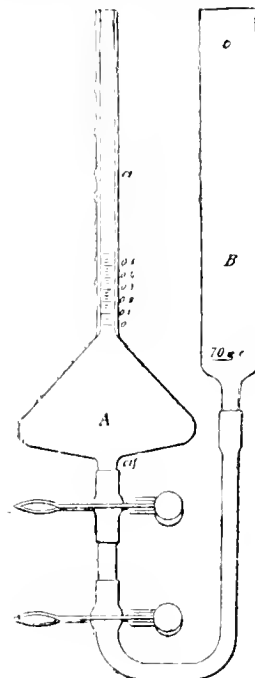


table empirically constructed by a method detailed in the paper, gives at once the percentage.

The apparatus consists of a conical vessel A, having a capacity of 150 c.c., with a long capillary neck, *a*, graduated in 0.005 c.c. divisions. This vessel is joined to the level tube, B, by a flexible connection, as shown in the figure. The vessel, A, is detached and inclined, whilst 20 c.c. of the sample of alcohol, prepared as stated above, is introduced through the neck, *a*; it is then connected to B, which contains the salt solution. On opening the clips, the requisite volume of salt solution flows into A. The salt solution and alcohol are then well shaken together for two minutes, allowed to stand 20 minutes for the separated oil to rise, and then, by admitting mercury through B, the clear oil is forced up into the capillary neck and measured.

As amylie alcohol is not a simple body, the author finds that the volume to be subtracted from the oily layer varies with different samples, and hence the curves and tables given in the paper must be modified by each operator according to the nature of the amylie alcohol which he employs. The essential oils are also very variable in composition, such bodies as isobutylie and propylie alcohols, ethers, aldehydes, &c. occasionally predominating. The author states that the influence of these bodies is inconsiderable, but he describes experiments which show that their presence may completely modify the results obtained. M. Bardsy, therefore, in a critical note preceding the abstract, considers that this method is not more accurate than that of Rösse, though likely to be useful in special cases, as it affords, for instance, an approximate and rapid method of comparing samples containing a large proportion of amylie alcohol.—L. A.

Fats, Butters, and Oils: Electrical Conductivity of. 1. Herlant. Bull. Assoc. Belge des Chimistes, 10, [2], 48—54.

It is proposed to take advantage of the difference in specific resistance to the passage of an electric current exhibited by solutions of fats saponified by an excess of potash, in comparison with a solution of normal alcoholic potash. To insure comparable results it is necessary to work with exact quantities of fat and potash, saponify constantly in the same manner, maintain a constant temperature, and always keep to the same strength of solution. Working with 10 grms. of purified fat (by extraction) and 45 c.c. of normal alcoholic potash, saponified by heating for half an hour on the water-bath under an inverted condenser, and making up the solution to 250 c.c. with distilled water, the author found the specific conductivity of three pure butters to approximate to 0.00650 at 18°C., whereas margarine ranged from 0.008221 to 0.008489, cotton-seed oil 0.008629, arachis oil about 0.00870, sesamé oil 0.008779, and olive oil 0.009927. The presence of sesamé or arachis oil in margarine gave the higher figures.

The specific conductivity decreases when the solutions are kept, especially in the case of butter, which fell off 0.009217 in six weeks.

The author considers that by the aid of a sufficiently large number of determinations it will be possible to set up an average conductivity for butter and for margarine, and thereby detect adulteration.—C. S.

Sulphur in Illuminating Gas and Coal, Determination of. C. E. Mabery. Amer. Chem. J. 18, 207—215.

For gas-testing, the combustions are made in a glass tube 45.5 cm. long, constricted at 30 cm. from the forward end. The jet, of hard glass tube, is connected with a gas-meter, a pinch cock and a wash-bottle containing a little water being interposed for the better regulation of the gas supply. The air current enters through another tube, which communicates with the outside of the laboratory, and the rate of flow is kept up by an exhaust of some kind. For the absorption of the products of combustion, a U-tube, 34 cm. high and 25 mm. internal diameter, partly filled with broken glass, is used, containing $\frac{1}{100}$ -normal caustic soda solution, this strength being found to retain the sulphuric acid perfectly. Titration is effected by $\frac{1}{100}$ -normal sulphuric acid, with methyl-orange as indicator. The results obtained do not

vary beyond the limits of error, the oxidation and absorption being complete, as was shown by the fact that the addition of hydrogen peroxide to the caustic soda solution effected no change in the results. The author is convinced, from numerous determinations made with asphalts, coal-tar, petroleum products, and gas, that the method leaves nothing to be desired on the score of simplicity and precision for organic bodies leaving no inorganic residue.

In examining coal, the combustion is performed in a tube of very hard glass (in length 10 cm. beyond and 25 cm. behind the constriction), the substance being inserted in a platinum boat. A rapid stream of air is allowed to enter at the constriction and a slower current (to carry the volatile matters forward and assist the combustion) from behind. The U-tube contains 30 c.c. of decinormal (or $\frac{1}{2}$ -normal) caustic soda, the titration being performed as in the examination of gas, but with correspondingly stronger acid. Some care is needed during the distillation of the volatile matter, which for 0.5 grm. of coal will take 20 minutes, a further 10 minutes being required for burning off the fixed carbon. For coke, a current of oxygen is preferable to air.

Suitably modified, it might, in the opinion of the author, be possible by this method, with an inert gas, to distil off the volatile matter and weigh the fixed carbon before completing the sulphur determination.—C. S.

Iron, The Colorimetric Estimation of Traces of [in Wines, &c.], by means of Potassium Sulphocyanide. A. Bornträger. Chem. Zeit. 1896, 398—399.

One hundred c.c. of the wine to be examined are evaporated and the residue completely reduced to ash. This is dissolved in water acidified with 5 c.c. of dilute hydrochloric acid (sp. gr. 1.1), and the solution made up to 100 c.c. To this is added one-tenth of its volume of a 10 per cent. solution of potassium sulphocyanide, and the colour of this is compared with that of a solution of ferric chloride (0.01 grm. Fe in 1 litre), to which the same proportion of potassium sulphocyanide solution has been added.

The ferric chloride solution is prepared by dissolving 0.1 grm. of piano-wire in dilute hydrochloric acid, oxidising with nitric acid, evaporating with excess of hydrochloric acid, dissolving in water with just sufficient hydrochloric acid to give a clear solution, and then, after the further addition of 100 c.c. of dilute hydrochloric acid, making up to 1 litre. For making the estimation, 10 c.c. of this solution are taken, 2 c.c. of dilute hydrochloric acid added, and the whole diluted to 100 c.c.

The author has found that the salts commonly present in wine-ash do not affect the accuracy of this method.

It may be added that the comparison of the colours of the solutions is conveniently effected by diluting the darker solution until the colours of the two become the same.

—A. L. S.

Malt, Estimation of Ready-formed Sugars of. G. H. Morris. J. Fed. Inst. Brewing, 1896, 2, 224—244.

The following experiments were carried out in order to find a method by which the true ready-formed sugars could be easily and directly determined for commercial purposes. In the first place, the author ascertained the time required to extract the whole of the ready-formed sugars without the products of diastatic action. For this purpose, ground malt was digested with water, portions of the extracts were withdrawn at stated intervals, and the specific gravities were determined after filtration; it was found that the maximum extraction is finished in two hours, and practically nothing enters into solution during the third hour. At the end of this time, however, there is a considerable increase, arising from diastatic action and from maltose entering into solution. To show that there was no diastatic action during the three hours, comparative mashes were made, one with 0.05 per cent. salicylic acid solution, the other with water. Portions of the first mash were taken at 30 minutes' intervals up to three hours, were filtered at once, the filtrate boiled, again filtered, made up to the original volume, and the specific gravity taken. The aqueous mash, after standing three hours, was treated in the same way. The results showed that there was a gradual extraction which decreased

in amount as the time of digestion was prolonged, and that the specific gravity of the three hours' water mash was about the same as that of the salicylic acid mash at the end of two hours. Consequently, the 0.05 per cent. solution of salicylic acid had a greater extractive power than water, and by means of special experiments the author found that a 0.2 to 0.25 per cent. solution of salicylic acid was required to extract an amount of matter similar to that taken up by water.

When malt was extracted for three hours with water at temperatures of 60°, 70°, 80° F., the matter entering into solution was greater between 70° and 80° than between 60° and 70°, and this arises from the action of diastase on the eroded starch granules.

The above-mentioned experiments demonstrate that, to obtain accurate comparative results, it is necessary to conduct all extractions at one definite temperature for a constant time; and, as a precaution, a solution of salicylic acid sufficient to stop diastatic action may be employed in place of water.

An unsuccessful attempt was made to estimate the ready-formed sugars of malt by determining the loss of gravity which an aqueous malt extract, prepared under standard conditions, undergoes on fermentation. The sugars of the aqueous extract were next compared with the total sugars extracted by alcohol and determined by O'Sullivan's method. The ready-formed sugars in the cold-water mash were estimated by difference and fermentation; in addition to this, the cane sugar was estimated by inversion with yeast, the cupric reduction taken after inversion, and the results, when necessary, corrected for unfermentable, reducing, and optical substances. A close agreement exists between the cane sugar in the alcoholic and aqueous extracts from the same malts. The ready-formed sugars determined by fermentation are greater in the aqueous than in the alcoholic extract; this is also the case with the total sugars estimated after inversion by cupric reduction. These results indicate that there are some other carbohydrate substances insoluble in alcohol but soluble in water, which the author believes are formed simultaneously with the true sugars in the germinating grain; and the same conditions which favour the production of an excess of sugars also favour an excess of these substances. It is therefore not correct to designate the mixture of sugar and carbohydrate matter "ready-formed sugars"; the term "ready-formed soluble carbohydrates" is accordingly employed by the author for the constituents of a cold aqueous extract of malt other than nitrogenous matter, ash, and acid. There is a fairly constant relation existing between the ready-formed soluble carbohydrates determined by difference and the true sugars of a malt, which may be employed for calculating the one into the other. Since no such relation appears to exist between the ready-formed soluble carbohydrates and the sugars determined by fermentation from the cupric reduction, the latter methods may also give inaccurate and misleading results.—J. L. B.

Malt and Beer Worts, Investigations on Nitrogenous Constituents of. E. Ehrlich. *Der Bierbrauer*, 1895, 145—147, 161—163, 177—179.

THE nitrogenous constituents of barley-malt and wort are generally divided into three groups, albumins, peptones, and amides. The last two are derived from the first by the action of the enzyme peptase, and they differ by their greater solubility and power of diffusion. This change, which is known as peptonisation, is of considerable importance in brewing operations, as certain albumins (glutin), which impede or prevent the clarification of beer, are modified and converted into compounds, valuable as yeast foods.

The author has investigated methods of separating the three groups of nitrogenous substances, the influence of the period of germination on the growth of the barley, the effect of washing on the nitrogenous constituents of the wort, and the behaviour of the different nitrogenous bodies towards yeasts.

The possibility of a separation of the different groups of nitrogenous compounds is dependent on their behaviour towards certain reagents. Whilst the albumins are precipitated from their solutions by lead and copper salts, tannin and phosphotungstic acid, the peptones are precipitated only by the last two and the amides by neither.

The total nitrogen was estimated in the residue from 20 c.c. of a wort. 250 c.c. of the same wort were boiled with basic lead acetate, and, after cooling, made up to 500 c.c.; when it had stood for seven or eight hours, the precipitate was filtered, hydrogen sulphide passed into the sulphate, the lead sulphide filtered off, and the nitrogen determined in 40 c.c. of the filtrate. The numbers obtained represent the nitrogen from peptones and amides, and the difference between this and the total nitrogen of the wort, the nitrogen due to albumin. 20 c.c. of tannin solution were next added to 80 c.c. of the filtrate containing peptones and amides; when the solution had remained 12 hours after the removal of the lead, it was filtered, and the nitrogen estimated in the filtrate; it represents that due to amides.

To effect a separation with copper hydroxide and phosphotungstic acid, 20 c.c. of the wort were diluted to 100 c.c., warmed, 10 c.c. of copper hydroxide added, and allowed to stand for 24 hours. The albuminoid precipitate was filtered, 55 c.c. of the filtrate containing the peptones and amides were evaporated, and the nitrogen determined in the residue. To 50 c.c. of the original wort, 10 c.c. of a 10 per cent. solution of sulphuric acid and 50 c.c. of 10 per cent. phosphotungstic acid were added; after 20 minutes the precipitate of albumin and peptone was filtered, and the nitrogen estimated in the residue obtained from 44 c.c. of the filtrate. A comparison of the results reveals the fact that basic lead acetate precipitates more nitrogenous substances than copper hydroxide, and phosphotungstic acid more than basic lead acetate and tannin together.

The peptones and amides appear to have the same value as nutrient material for yeasts, and in this respect are much better than albumin.

Experiments on the influence of germination on the soluble nitrogenous substances of the barley, show that peptonisation of the albumins takes place; and the longer the period of germination, the greater is the amount of nitrogenous bodies rendered soluble. Peptonisation also proceeds during the mashing process, the most favourable temperature being 50° C.—J. L. B.

Sugars, Influence of Temperature on the Polarisation of. Sachs and Xhonneux. *Zeits. Rübenz. Ind.* 1896, 46, 264.

WACHTEL (Oesterr.-Ungar. Zeits. für Zuckerind. und Landwirth. 1878, 7, 42) has observed that sugar solutions polarising 95 per cent., exhibited an average difference of rotation of 0.27° between 10° and 18° C., and he assigned the cause to the expansion of the quartz wedge of the polariscope. Wartze found (*Deutsch. Zuckerind.* 16, 503) in similar solutions a difference of 0.10° for every 2° C. between 2° and 40° C. The authors have made an exhaustive series of experiments on sugar solutions polarising about 95 per cent. between the temperatures of 14° and 26° C., and have confirmed Wartze's numbers. If the flasks containing the sugar solutions be made up to 100 c.c. at the same or even a higher temperature than that at which the solutions are polarised, the differences in the readings are considerably decreased, and this is the case also with diluted sugar solutions. The normal quartz plate employed as a control, gave rotations of 97.8, 97.9, 98.0, 98.1, for 10°—20°, 20°—30°, 30°—40°, 40°—50° C. respectively, thus showing that the influence of temperature is of little account.—J. L. B.

Silk, Weighting Materials in: The Quantitative Estimation of. H. Silbermann. *Chem. Zeit.* 20, 472—473.

THE author has previously described (*Chem. Zeit.* 18, 744—745; this Journal, 1894, 907) the methods of qualitatively examining the weighting materials in silk, and in the present paper he gives directions for their quantitative estimation.

White or Light-coloured Silk.—The sample is boiled several times in distilled water, and in the solution, after inverting cane-sugar by boiling with hydrochloric acid, sugar is estimated by means of Fehling's solution, magnesium

salts by precipitation with sodium phosphate, and sodium sulphate by means of barium chloride. The silk is then reduced to ash, and the ash, after weighing, is dissolved in hydrochloric acid; if tin be the only metal found in this solution, the weight of the ash multiplied by 1.13 gives the weight of hydrated stannic oxide present on the fibre. Another method of estimating the tin consists in igniting the silk with caustic soda and potassium nitrate in a porcelain crucible. (A platinum vessel should not be used, since there is a danger that with insufficient access of air, a reduction to metallic tin might take place with consequent formation of an easily fusible platinum-tin alloy.) The melt is dissolved in water, acidified, precipitated with H_2S , and the sulphide ignited and weighed as SnO_2 .

A special sample of the silk is boiled with dilute hydrochloric acid to dissolve any tannin lakes of tin or other metals, and in the solution, tannin is tested for by the addition of an excess of sodium acetate and a ferric salt. If tannin lakes be present, the estimation of the weighting materials consists in (1) precipitation of tannin from the aqueous solution with gelatin; (2) estimation of tannin in this precipitate, and of sugar, &c. in the filtrate; (3) successive treatment of the silk with dilute hydrochloric acid and sodium carbonate, and precipitation of tannin from both solutions by means of gum solution; (4) ignition of the silk and estimation of metallic weighting. If the ash be not completely soluble in hot moderately concentrated hydrochloric acid, it may contain barium sulphate or silicic acid; if both are present, they may be separated by dissolving the latter in hydrofluoric acid. These substances are estimated by well-known methods.

Dark-coloured Silk may contain in addition to the above weighting materials, compounds of iron and chromium. The ash is ignited with $NaOH$ and KNO_3 whereby tin and chromium are converted into stannates and chromates respectively. These are dissolved out with water, and Fe_2O_3 remains as an insoluble residue; the filtrate is acidified with hydrochloric acid, tin precipitated by H_2S and chromium from the filtrate by $NaOH$.

Black Silk.—The quantitative estimation may be made in two ways, either the weighting is entirely removed from the silk, and estimated by the loss in weight, or the amount of pure silk substance in the sample is calculated from the result of a nitrogen estimation. The latter method gives more accurate results, but is less easy to carry out. According to the first method, the sample is boiled alternately in solutions of caustic soda (20 grms. per litre) and hydrochloric acid (250 grms. per litre), each treatment being repeated 5–6 times. Naturally a certain loss of silk substance must occur, thus causing the amount of weighting to appear too high. By this treatment all foreign substances are removed except a small quantity of metallic compounds (afterwards estimated by ignition) and mere traces of tannin and colouring matter. The silk, if souple or *écru*, is finally scoured with soap, dried and weighed. In all cases the difficulty arises of estimating the loss in weight of the silk on “boiling-off.” This may be taken approximately as 25 per cent. for “boiled-off” silk, 8 per cent. for souple, and 10 per cent. for fancy yarns.

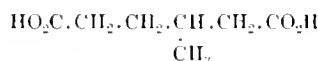
By far the most satisfactory method is the estimation of nitrogen. Weighting materials which contain nitrogen, *e.g.*, gelatin and Prussian blue, are entirely removed by alternately boiling with alkaline carbonate and acid, with the precaution that for souple or *écru* silk, ammonia or ammonium carbonate must be used, and not sodium carbonate. The silk is then dried to a constant weight (about 2 grms.), divided into single fibres, and mixed with soda lime; the mixture is ignited in a combustion tube and the ammonia collected by means of HCl , and estimated volumetrically or as the platinum double salt; or the nitrogen may be estimated by Kjeldahl's method. Pure silk contains 17.6 per cent. of nitrogen; for souple and *écru* this of course includes the fibron and sericin. The amount of weighting is then estimated by difference. The analysis must be very carefully carried out, special care being taken that the reagents used contain no nitrogenous impurities.

Silk fabrics should be separated into warp and weft and these separately analysed; the weft as a rule is much more heavily weighted than the warp.—R. B. B.

Citronellal (Citronellie Aldehyde) Group of Compounds.
Occurrence of, in Essential Oils. F. Tiemann and R. Schmidt. Ber. 1896, 29, 903–926.

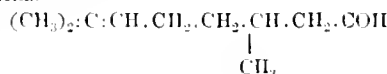
THE major portion of this paper is devoted to experimental and theoretical considerations relating to the chemical structure of citronellal, citronellol, &c. (this Journal, 1891, 158, 382; 1892, 935; and 1894, 417). The facts principally bearing on this question are:—

1. Citronellal (as also citronellol, citronellie acid, &c.), on oxidation with chromic acid, yields acetone and β -methyl-adipinic acid—



2. Citronellal, when heated with acetic anhydride, is converted into an isomeric cyclic alcohol, which agrees in most of its properties with, and is shown to possess the same structure as, pulegol. These facts point to the following formulae:—

Citronellal—



Citronellol—



Incidentally, it is shown that citronellol exists in two optically-opposed modifications, which, on oxidation, yield the corresponding *d*- and *l*- β -methyl-adipinic acids ($\alpha = +2$ in 33 per cent. aqueous solution in 100 mm. tube). These acids are in other respects identical, both melting at 84° – 85° C.; but, when mixed in equal proportions and crystallised, an inactive (racemic) form is obtained, which is somewhat less soluble in water, and melts at 93° – 94° C.

Of greater interest is the discovery that citronellol, like geraniol, is a constituent of many essential oils, notably of geranium oils, rose oil, &c., and frequently also of the “geraniol” prepared from them. That these oils contain, besides geraniol, an alcohol, $C_{10}H_{20}O$, has indeed been recognised by other observers (this Journal, 1896, 292), and in the case of rose oil the alcohol in question has been isolated and is known as “rhodinol.” It appears, however, that rhodinol must be regarded as *l*-citronellol, since it yields on oxidation *l*- β -methyl-adipinic acid and is optically the antipode of *d*-citronellol. The following method of detecting and estimating citronellol in admixture with geraniol is stated to give very satisfactory results:—A solution of 100 parts of the sample under examination in 100 parts of absolute ether is cooled and added very gradually to a solution (cooled to -10° C.) of 60 parts of phosphorus trichloride in 100 parts of ether. During this operation the temperature must not be allowed to rise above 0° C. The mixture is allowed to stand for 4–5 days at the ordinary temperature, and is then poured out on crushed ice, the ethereal layer washed several times with ice-water and agitated vigorously with dilute caustic soda solution, which extracts from it citronellol (in the form of a chlorinated phosphorus ester-acid), leaving behind geranyl chloride, &c. The soda solution is shaken once or twice with ether to remove impurities, rendered strongly alkaline, and steam-distilled in order to separate the liberated citronellol. The yield of citronellol is quantitative from samples containing not less than 20 per cent. of geraniol. *d*-Citronellol may be readily prepared in this way from citronella oil. The latter is first treated with sodium amalgam in order to reduce the citronellal present, and the above process directly applied to the resulting mixture of alcohols. Appended are some results obtained by the method:—

Turkish Rose Oil.—The alcohols present (80 per cent.) consisted of:—Geraniol, 75 per cent.; *l*-citronellol, 25 per cent. The latter exhibited the following properties:—B. pt. 113° – 114° C. under 15 mm. pressure; sp. gr. at 20° C. = 0.8612; refractive index, $n_D = 1.45789$; $\alpha = -4^{\circ} 20'$ in 100-mm. tube (*d*-citronellol, b. pt. 117° – 118° under 17 mm. pressure; sp. gr. at 17.5° C. = 0.8565; refractive index, $n_D = 1.45659$; $[\alpha]_D = +4^{\circ} 0'$).

Spanish Geranium Oil.—Total alcohols, 70 per cent., consisting of:—Geraniol, 65 per cent.; *d*- and *l*-citronellol, 35 per cent., the *l*-modification predominating.

African Geranium Oil contains 75 per cent. of alcohols, composed of geraniol, 80 per cent.; *d*- and *l*-citronellol, 20 per cent.

Reunion Geranium Oil.—Alcohols, 80 per cent., containing geraniol, 50 per cent.; *d*- and *l*-citronellol, 50 per cent. (contaminated with traces of an alcohol resembling, and probably identical with, linalool). Reunilol, obtained by Hesse from reunion geranium oil, and considered by him to be a distinct alcohol, was found also to be a mixture of geraniol and citronellols, the *l* variety predominating.

—H. T. P.

Depilatories, Chemistry of. J. v. Schroeder and W. Schmitz-Dumont. Dingler's polyt. J. 1896, **300**, 161.

See under XIV., page 543.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Bidiphenylene Ethylene and Bidiphenylene Ethane.

C. Graebe and H. Stindt. Annalen, 1896, **291**, 1—8.

In a previous communication (this Journal, 1893, 186) one of the authors referred to the red hydrocarbon $C_{26}H_{12}$ obtained by De la Harpe and van Dorp by passing fluorene over lead oxide. He also described its preparation in detail, and the authors, in repeating the experiments, succeeded in obtaining most successful results as far as yield is concerned. It was found that the formation of bidiphenylene ethane takes place in the first part of the reaction; this compound is then further oxidised into the ethene body. When bidiphenylene ethene is fused with potash, *o*-diphenylcarboxylic acid is obtained. It forms white crystals, melting at 110° . Nitric acid gives rise to the formation of an additive compound, crystallising in yellow needles, which melt at 184° — 185° . It is reconverted into the red hydrocarbon on boiling in an alcoholic solution of potash. The *dibromide* mentioned in the former paper is decomposed when heated in steam at 150° , with partial formation of the ether of bidiphenylene ethene.

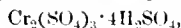
Bidiphenylene ethane, $C_{26}H_{14}$, is obtained by heating fluorene with lead oxide at 250° — 280° for two hours. It melts at 246° (corr.), dissolves sparingly in alcohol and ether, more readily in hot benzene and glacial acetic acid.

—D. B.

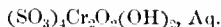
Sulphochromous Acid, a New Chromium Compound.

A. Recoura. Bull. Soc. Chim. 1896, **15**, 315—321.

A new compound, termed by the author sulphochromic hydrate, is formed by heating chromic sulphate (1 mol.) with sulphuric acid (4—6 mols.) at 115° — 120° for 1—2 days; or by heating chromotetrasulphuric acid—

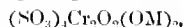


(Comptes rend. 1893, **9**, 586), at 140° — 150° , so long as sulphuric acid is evolved. In the latter case, the compound is obtained as a grey powder, of the formula—



It differs from the chromosulphuric acids previously prepared, in the following respects:—

- (i.) Its aqueous solution is opalescent and nearly colourless.
- (ii.) On standing in a closed vessel, its aqueous solution gelatinises.
- (iii.) A freshly prepared solution when heated to 100° , gelatinises, and then deposits a flocculent precipitate.
- (iv.) A pale green precipitate is produced on adding any strong acid to its aqueous solution.
- (v.) It precipitates all metallic elements and ammonia, the precipitates having the general formula—



in which M represents a monovalent element.

The bases in these precipitates are combined with the chromic hydroxide and not with the sulphuric acid.

Sulphochromic hydrate is a powerful acid. It displaces sulphuric acid from its salts.—E. B.

Sodium Thiosulphate, Solubility of, in Alcohol.

P. Parmentier. Comptes rend. 1896, **122**, 135—137.

THE three modifications of sodium thiosulphate (ordinary, modification of m.p. 32° , and superfused) vary in their solubility in alcohol. Thus, in 80 per cent. alcohol they dissolve in the ratio of 11.4:10.6:7.1, these being the numbers of c.c. of a 0.1 per cent. solution of iodine required to oxidise 10 c.c. of the filtered alcoholic solutions. In the case of the superfused salt, the solubility is influenced by mass action, the solubility increasing with the volume of alcohol employed.—E. B.

Schlippe's Salt, Preparation of. L. Prunier. Journ.

Pharm. Chim. **16**, 289—290.

Purified antimony sulphide is melted with a third of its weight of sulphur. The product, principally consisting of pentasulphide, is cooled, powdered, and heated to boiling with a solution of crystallised sodium monosulphide (2 parts in 5 parts of water). The penta-sulphide combines with the sodium sulphide forming sodium sulphoantimoniate (Schlippe's salt). The solution is cooled, filtered off from a trace of black oxysulphide and evaporated down, when the Schlippe's salt crystallises out.—J. G. W.

Magnesia, A Basic Nitrate of. G. Didier. Comptes

rend. 1896, **122**, 935—936.

To a solution of 200 grms. of the hydrated neutral nitrate of magnesia in 150 c.c. of water, maintained at 100° C., 10 c.c. of pure caustic magnesia,—obtained by calcining the bicarbonate for some hours at 350° — 400° C.,—were gradually added. The greater part of the magnesia dissolved, the temperature of the liquid was then raised to 150° and the solution filtered. On cooling in well-corked flasks, the solution remained for some time in a state of supersaturation, but gradually became almost solid from the formation of a flocculent precipitate. Separated by filtration with the pump and subsequently pressed between filter-paper, this precipitate had the composition $3MgO$, N_2O_5 , $5H_2O$. Cold water decomposes this salt completely into magnesium nitrate and magnesium hydrate. Absolute alcohol has a similar effect.—L. T. T.

New Orydase or Soluble Oxidising Vegetable Ferment.

G. Bertrand. Bull. Soc. Chim. 1896, 793—797.

It is well known that the juice of beet root rapidly turns red and finally black on exposure to air, and this property is shared by the juice from other vegetable roots, such as dahlia, potato, and from certain fungi, such as *russula nigricans* (mushroom). The coloration is due to the oxidation of the tyrosin under the influence of a soluble ferment different from laccase, which the author terms tyrosinase. This substance, which is very unstable, cannot be extracted from beet- or dahlia-root; but certain fungi, such as *russula foetens*, *r. virescens*, *r. cyanoxantha*, &c., when macerated and extracted with water, give a solution which blackens tyrosin with absorption of oxygen. Tyrosin, however, can be extracted from the juice of dahlia tubers, and is identical with that of animal origin. The yield is about 0.5 gm. from a litre of extract.—T.A.L.

New Books.

JAHRBUCH DER ELEKTROCHEMIE. Berichte über die Fortschritte des Jahres 1895. Im wissenschaftlichen Theile, bearbeitet von Dr. W. NERNST; Im technischen Theile, bearbeitet von Dr. W. BORCHERS. II. Jahrgang. Verlag von Wm. Knapp, Halle a.S. 1896. Price 12s. H. Grevel and Co., 33, King Street, Covent Garden, London, W.C.

8vo volume in paper cover, containing preface, table of contents, text filling 280 pages, and illustrated with 197 engravings, and alphabetical indexes of authors and subject-matter. Part I., or the portion of the work relating to the Science of Electrochemistry, for which Dr. Nernst is responsible, contains 36 pages; whilst Part II., which has been written by Dr. Borchers and relates to Electrochemical Technology, extends from page 39 to page 280.

The classification adopted, indicates the nature and general trend of the work, and is as follows:—I. SCIENTIFIC

PORTION.—Electrolytic Conductivity and Dissociation. Theory of Galvanic Current Production and Polarisation. Electro-capillarity. Instruments for Electrochemical Measurement. II. Special and Technical Electrochemistry. Production of Electrical Energy. Accumulators. Electromagnetic Preparation. Electrothermic Apparatus and Methods. Metalloids. Metals. A. Special Metallurgy. B. Investigations and Propositions of General Character. C. Metallurgical Processes. Inorganic Compounds. Organic Compounds. Each of the various chapters connected with Electrochemical Technology ends with an appropriate list of patents, German, American, and British.

CHEMISCH-TECHNISCHES REPERTORIUM. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. EMIL JACOBSEN. 34. Jahrgang. 1895. Zweites Halbjahr. Zweite Hälfte. Schluss. Mit in den Text gedruckten Illustrationen. Hermann Heyfelder, R. Gaertner's Verlagsbuchhandlung, Schöneberger-str. 26, Berlin, S.W. H. Grevel and Co., 33, King Street, Covent Garden, London.

The second issue for the second half-year of 1895 of Dr. Jacobsen's Repertory of Chemical Technology, containing reports of the progress of the following branches of chemical industry:—I. Food-stuffs. II. Paper. III. Photography. IV. Residuals; Manures; Disinfection and Sanitation. V. Soaps. VI. Explosives and Matches. VII. Preparation and Purification of Chemicals. VIII. Chemical Analysis. IX. Apparatus, Machinery, Electrotechnology and Thermo-technology. X. Appendix. Adulteration of Trade Products, &c. New Books.

This being the closing number for 1895, an alphabetical index is given. The volume contains 234 pages of matter, and is illustrated with woodcuts.

NITRO-EXPLOSIVES. A Practical Treatise concerning the Properties, Manufacture, and Analysis of Nitrated Substances, including the Fulminates, Smokeless Powders, and Celluloid. By P. GERALD SANFORD, Consulting Chemist to the Cotton Powder Co., Limited. Crosby, Lockwood, and Son, 7, Stationers' Hall Court, Ludgate Hill. 1896. Price 9s.

This work, an 8vo volume, bound in cloth, is devoted to the subject of the properties, manufacture, and methods of analysis of the various nitro-explosives. It numbers 264 pages of subject-matter, illustrated with 43 wood engravings, and terminates with an alphabetical index of subject-matter. The subject-matter is divided into chapters, which treat of the following leading themes, taken in the order given:—I. Introduction. II. Nitroglycerin. III. Dynamite. IV. Nitro-cellulose, &c. V. Nitrobenzol, Roburite, Ballite, Picric Acid, &c. VI. The Fulminates. VII. Smokeless Powders in General. VIII. Analysis of Explosives. VIII. Firing Point of Explosives. IX. Determination of the Relative Strength of Explosives.

CHEMISTRY IN DAILY LIFE. Popular Lectures. By Dr. LASSAR-COHN, Professor in the University of Königsberg. Translated by M. M. PATTERSON MUIR, M.A. H. Grevel and Co., 33, King Street Covent Garden, London. 1896. Price 6s.

This work commences with the translator's preface, and a table of contents, after which follow the text, covering 316 pages, and the alphabetical index. The work is illustrated with 21 wood cuts. As stated by the translator, "This book embodies the substance of a course of lectures delivered by Dr. Lassar-Cohn, to a society in Königsberg, modelled on the celebrated Humboldt Academy of Berlin." There are 12 lectures in all, and the leading idea in each of these will be found in the following synopsis of contents:—LECTURE I. Breathing, Physics and Chemistry, Air, Combustion, &c. II. Nature of Flame, Candles, Illuminating Agents, &c. III. Food of Plants, Manuring, Food of Men and Animals, &c. IV. Mixed Diet, Butter, Margarine, Starch, &c. V. Quantity of Food to be Consumed, Fermentation, Wines, Alcohol. VI. Wine Vinegar, Wood Vinegar, Acetic Acid,

Explosives, &c. VII. Tanning, Leather, &c., Dyestuffs and Dyeing, &c. VIII. Oil Painting, Oils, Varnishes, and Inks, &c. IX. Potash and Soda, Sulphuric Acid. X. Glass, Mirrors, Clay, Bricks, Mortars, &c. XI. Noble and Base Metals, Ores, Metallurgy. XII. Alloys, Coinage, Alkaloids, Methane, Acetylene, Artificial Febrifuges, &c.

FORTSCHRITTE DER THEERFARBENFABRIKATION UND VERWANDTER INDUSTRIEZWEIGE. 1890—1894. An der Hand der systematisch geordneten und mit kritischen Anmerkungen versehenen Deutschen Reichs-Patente. Dargestellt von Dr. P. FRIEDLÄNDER, Vorstand der chemischen Abtheilung des k.k. technologischen Gewerbemuseums in Wien. Dritter Theil. Verlag von Julius Springer, Berlin. H. Grevel and Co., 33, King Street, Covent Garden, London. 1896. Price 2s.

LARGE 8vo volume in paper cover, containing dedication (to Prof. Ad. von Baeyer), preface, table of contents, and subject-matter filling 1024 pages. The work ends with a full alphabetical index of subject-matter, preceded by one of patentees, and this again by a list of patents taken out in the period 1890—1894, with references to the abstracts of these patents given in the body of the work. The work as a whole is a compilation of all the patents relating to dyestuffs, the materials therefor, and to various other organic chemicals. The classification is as follows:—Intermediate Products of the Coal-Tar Industry (page 1 to 66). Di- and Triphenylmethane Colouring Matters (page 67 to 187). Anthracene Colours (page 188 to 273). Indigo Blue (page 274 to 287). Acridine (Quinoline) Colours (page 288 to 297). Quinone-imido Colours (page 298—401). Naphthalene Derivatives (page 402 to 520). Azo Colours (page 521—801). Nitro- and Nitroso Colours (page 802 to 812). Pharmaceutical Products (page 813 to 998). Appendix (page 999 to 1017).

With regard to the azo colours generally, these may be more particularly sub-divided as follows:—Wool Dyestuffs (534 to 602). Diazo Dyestuffs Dyeing on Mordants (608 to 650). Cotton Dyestuffs from Benzidine, Tolidine, &c. (652 to 733). Cotton Dyestuffs of the Bismarck Brown type, Primuline Colours, &c. (737 to 800). The Pharmaceutical Products may be more particularly classified as follows:—Hydroxycarbonic Acids (821 to 843). Pyrocatechol and its Derivatives (844 to 869). Iodised Compounds (869 to 877). Scented Substances (878 to 900). Saccharine and Similar Bodies (900 to 906). Compounds of the Phenacetine Type (908 to 921). Pyrazol Derivatives (925 to 945). Piperazine and its Homologues (946 to 955). Quinoline- and Isoquinoline Derivatives, &c. (957 to 997).

A DICTIONARY OF CHEMICAL SOLUBILITIES. INORGANIC. By ARTHUR MESSINGER COMEY, Ph.D. Macmillan and Co., London and New York. 1896. Price 15s.

8vo volume, containing preface, explanatory preface, list of abbreviations and references, and subject-matter covering 515 pages.

In the preface it is pointed out that whilst Peter Shaw, of London, in 1731, first planned a list of Solubilities, based on the fact that "water as a menstruum dissolves more of one body and less of another," it was many years later before Prof. F. H. Storer, of America, first undertook to carry out the idea. This he did in his "Dictionary of Solubilities of Chemical Substances," published in 1864. The limited edition of this work was, however, soon exhausted, and the book went out of print. Hence, as the author shows, after the lapse of 30 years, practically a new work needed compilation. No less than 120 journals, dictionaries, &c., are mentioned as works of reference. The author points out that it has been found impracticable to draw a sharp line between solution and decomposition, and the term "Soluble" has in general been used where a solution of some sort is formed by the action of the solvent. The author draws attention to the prevailing lack of homogeneity of the existing nomenclature, and states that "his aim has been in all cases to follow the best usage rather than to make an absolutely homogeneous system of nomenclature out of the existing confusion." With regard to the formulae, those used have in most cases been those adopted by the authors from whom they have been taken.

DIZIONARIO DI MERCOLOGIA AD USO DEL COMMERCIO. ARTI ED INDUSTRIE. Descrizione, caratteri, provenienza, estrazione, usi ed applicazioni dei prodotti naturali e dell'industria, saggi per identificarli e riconoscerne le sofisticazioni, con speciale riguardo ai loro dazi doganali. Del Dott. VITTORIO VILAVECCHIA, con la collaborazione dei Dott. G. FARRIS e Prof. C. HANNAU. A. Donati, Genoa, Italy. H. Grevel and Co., 33, King Street, Covent Garden, London. 1896. Price 15 frs.

ITALIAN Dictionary of Chemical Technology in the form of a large 8vo volume, in paper covers, with preface, table of explanations and abbreviations, and subject-matter filling 785 pages, an alphabetical index concluding the work. Besides the Italian names of the substances described, and immediately following them, are also given the French, German, and English names. For example, the heading for Aluminium Salts is thus given:—**Aluminio** (Salt di). (Sels d'Aluminium. Aluminium-salze. Aluminium Salts.)

Trade Report.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

PRODUCTION OF SALT IN RUSSIA.

The United States Consul-General at St. Petersburg states that when deposits of salt were discovered at Bardymkul, in the region of Ferghana, Turkestan, in the fall of 1895, Belgian capitalists without delay sent out their engineers to investigate the strength of the beds, and to report thereon. The examination not only confirmed what was claimed before, but proved the beds to be richer than at first described. The engineers estimated that an area of 2 square versts (1 verst = 0.663 mile) contained a milliard poods (36,112,000,000 lb.) of salt. As soon as the engineers submitted their report, the capitalists procured, at the close of 1895, a permit from the Russian Government for the working of these salt beds. This they readily received, because just at that time the new regulations of the Ministry of the Interior, concerning the leasing of Government salt beds, came into force. The company began work in January 1896. The salt is gained by dynamite explosions, then put into bags, and sent by camels to Samareand, 239 miles, and thence, by the Transcaspiian Railway, distributed to the different towns on this line; and, also, over Usun-Ada, as far as A-trakhan, and to Kura, mainly for salting caviar. The salt is of excellent quality, as, according to an analysis, it is superior to the best quality of English salt. It is especially fit for salting caviar and sausage casings, because it leaves no spots after the salting. Russia imports about one and half million poods (54,168,000 lb.) of foreign salt through the ports of the Baltic Sea, which this company hopes to supply, because it expects to be able to deliver the Russian salt at St. Petersburg at 2.40 roubles per pood. This price will be the same as is paid for the best English salt, with the difference that the English salt contains a percentage of other chemical substances, whereas the Bardymkul salt is entirely pure. It is the intention of this company to supply India with salt. India offers an immense market, having no salt of its own. It is stated that the 80,000,000 poods (2,888,960,000 lb.) which are yearly imported are not sufficient to supply the demand. Salt costs in India, without the duty, 3.87 roubles per pood. Under these conditions the company will have an excellent chance for a large sale of salt in India, because it can have the salt transported at cheap rates through Samareand, Usun-Ada, Baku, Batoum, &c. It will have a still better chance when the Samareand-Kokand-Marghelan Railway, with a line to Krasnovodsk, on the Caspian Sea, is built, for the salt beds will be only from 13 to 15 miles from the railroad station at Potar of the new line, and 1,100 miles by rail from Usun-Ada. On the Transcaspiian Railway a new reduced tariff of 23.45 copecks per pood is now in force for all kinds of freight from Samareand to Usun-Ada, and from the latter place to Baku the freight on salt amounts to only 4 copecks per pood. Such cheap rates will give the Bardymkul company an advantage in both the home and foreign markets.

EXPORTS OF CAOUTCHOUC FROM PARA (BRAZIL).

Board of Trade Journal, July 1896, 72.

A despatch has been received from H.M. Chargé d'Affaires in Brazil, enclosing table of the exports of caoutchouc from Para during the past 30 years, which has been prepared from official sources.

Years.	Value.
	Milreis.
1865-66	3,810,914
1870-71	6,563,196
1875-76	5,191,001
1880-81	11,491,709
1885-86	14,312,000
1890-91	19,067,528
1891-95	37,417,374

GENERAL TRADE NOTES.

PARA RUBBER IN CEYLON.

Board of Trade Journal, July 1896, 94.

The *Ceylon Observer* notes that an interesting experiment in the cultivation of Para rubber is being made on the Halwatura estate, in the Kalutara district. About a year ago Messrs. Finlay, Muir, and Co. purchased some 50,000 plants, which were planted on Halwatura by Mr. Hendry. The trees, it is said, show a surprising growth and, like those on the Government's experimental plantation in the same district, promise well.

CHROME MINES IN TURKEY.

Chamber of Commerce Journal, June 1896, 107.

The working of chrome mines, which are largely found in Macedonia, has, according to the French Consul at Salonica, taken a certain development by reason of the facilities for transport resulting from the creation of railways, which have enabled exporters to deliver this ore at the ports of embarkation on conditions permitting them to compete on various markets with other producing countries. The chrome mines at present worked are mostly situate in the Monastir and Kossovo regions of Macedonia, and the ore extracted contains, according to analyses to which it has been submitted, some 45 to 55 per cent. of oxide of chrome. The best qualities give the following composition:—Oxide of chrome, 55 per cent.; protoxide of iron, 13 per cent.; alumina, 10 per cent.; magnesia, 15 per cent.; and silica, 7 per cent. In poorer ores there is less oxide of chrome, alumina, and magnesia, and consequently more iron and silica. Germany takes first place as a customer for the ores, followed by England and Austria; a long way after France takes a few tons. Salonica is the chief dealing place, each year's export reaching to 10 or 82 thousand tons, which are sold at an average rate of 107 frs. 50 c. per ton f.o.b. in one of the ports of the importing country. The several conditions of payment are: 75 per cent. of the value against documents, and the remainder after analysis by an expert agreed by the parties. An increase or decrease of 3 frs. in the value per degree of richness of the ore is made according as the expertise shows the ore to be richer or poorer. Macedonian chrome, in addition to its richness in oxide, is said also to possess the further advantage of being very friable.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 30th June	
	1895.	1896.
	£	£
Metals.....	1,745,315	1,675,956
Chemicals and dyestuffs	451,207	497,063
Oils.....	631,503	614,539
Raw materials for non-textile industries.	3,676,176	4,469,017
Total value of all imports	33,894,584	35,229,255

SUMMARY OF EXPORTS.

Articles.	Month ending 30th June	
	1895.	1896.
	£	£
Metals (other than machinery)	2,374,712	3,074,016
Chemicals and medicines.....	688,798	681,237
Miscellaneous articles.....	2,822,368	2,840,879
Total value of all exports.....	17,800,100	20,550,053

IMPORTS OF METALS FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Copper:—				
Ore..... Tons	10,039	4,569	55,006	73,807
Regulus..... "	12,498	5,123	301,355	123,348
Unwrought..... "	5,907	5,200	212,162	239,868
Iron:—				
Ore..... "	350,062	504,856	231,530	352,455
Bolt, bar, &c. "	6,947	7,712	54,412	58,388
Steel unwrought..... "	759	2,351	8,280	16,906
Lead, pig and sheet..... "	12,125	12,808	120,237	138,898
Pyrites..... "	50,929	47,792	84,125	82,741
Quicksilver..... Lb.	407,100	40,427	39,196	3,393
Silver ore..... Value £	..	..	155,970	110,172
Tin..... Cwt.	57,253	45,170	179,988	135,856
Zinc..... Tons	7,047	6,985	105,075	114,504
Other articles... Value £	..	..	197,409	205,350
Total value of metals	..	..	1,745,945	1,675,956

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Alkali..... Cwt.	32,631	18,715	11,592	10,990
Bark (tanners', &c.) ..	38,913	45,063	17,858	21,007
Brimstone..... "	37,871	12,858	8,006	2,832
Chemicals..... Value £	..	..	108,145	131,671
Cochineal..... Cwt.	56	167	329	1,049
Catch and gambier Tons	795	1,256	17,875	27,985
Dyes:—				
Alizarin..... Value £	..	..	21,455	21,215
Anilin and other..... "	..	..	28,466	39,125
Indigo..... Cwt.	3,107	4,680	37,936	53,790
Nitrate of potash..... "	16,979	25,576	15,434	21,117
Valonia..... Tons	2,967	2,953	33,062	31,521
Other articles... Value £	..	..	150,209	135,061
Total value of chemicals	..	..	451,207	497,063

IMPORTS OF OILS FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Cocoa-nut..... Cwt.	14,333	13,342	17,901	15,849
Olive..... Tons	1,514	1,765	53,268	55,616
Palm..... Cwt.	153,491	107,062	169,845	107,355
Petroleum..... Gall.	9,938,350	13,191,061	205,670	218,624
Seed..... Tons	2,445	1,983	52,093	40,811
Train..... Tons	2,403	1,173	41,749	21,178
Turpentine..... Cwt.	26,450	53,354	25,585	50,527
Other articles... Value £	..	..	71,692	74,588
Total value of oils...	..	..	631,503	614,539

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Bark, Peruvian... Cwt.	2,388	1,204	3,352	2,195
Bristles..... Lb.	275,936	100,388	10,913	15,762
Caoutchouc..... Cwt.	20,594	31,064	204,142	335,541
Gum:—				
Arabic..... "	4,469	10,069	10,675	23,111
Lac, &c. "	6,987	8,853	40,445	41,221
Gutta-percha..... "	3,018	5,267	25,288	46,813
Hides, raw:—				
Dry..... "	46,959	29,615	117,543	76,959
Wet..... "	108,104	51,066	231,320	115,812
Ivory..... "	592	781	20,481	33,652
Manure:—				
Guano..... Tons	5,812	6,669	55,612	27,249
Bones..... "	3,086	2,947	13,680	10,571
Nitrate of soda..... "	5,660	6,295	48,269	48,089
Phosphate of lime..... "	27,683	22,188	50,504	31,315
Paraffin..... Cwt.	26,829	56,222	28,980	52,008
Linen rags..... Tons	1,956	1,860	18,210	17,012
Esparto..... "	13,098	17,052	55,196	27,249
Pulp of wood..... "	28,021	27,180	126,588	138,809
Rosin..... Cwt.	173,357	146,155	45,197	33,753
Tallow and stearin..... "	265,411	219,117	306,479	220,784
Tar..... Barrels	8,770	5,982	4,178	2,950
Wood:—				
Hewn..... Loads	185,003	256,291	328,563	518,224
Sawn..... "	191,034	739,886	1,052,017	1,700,236
Staves..... "	12,425	15,101	36,021	52,760
Mahogany..... Tons	1,862	2,732	12,986	23,433
Other articles... Value £	..	..	789,138	855,509
Total value .....	..	..	3,676,176	4,499,017

Besides the above, drugs to the value of 73,847, were imported, as against 91,984, in June 1895.

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Brass..... Cwt.	9,270	3,840	31,479	39,127
Copper:—				
Unwrought..... "	37,104	42,589	84,514	105,055
Wrought..... "	19,651	23,358	53,855	69,893
Mixed metal..... "	20,735	7,814	44,564	19,065
Hardware..... Value £	..	..	103,483	189,389
Implements..... "	..	..	142,379	126,492
Iron and steel..... Tons	265,111	359,575	1,627,453	2,269,873
Lead..... "	5,190	5,141	58,271	62,221
Plated wares... Value £	..	..	21,289	29,602
Telegraph wires..... "	..	..	19,572	19,680
Tin..... Cwt.	9,877	9,274	33,662	30,667
Zinc..... "	16,880	17,850	10,445	12,782
Other articles... Value £	..	..	60,743	75,770
Total value .....	..	..	2,374,046	3,034,046

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Alkali..... Cwt.	439,155	368,448	114,502	94,983
Bleaching materials..... "	111,977	102,372	39,860	34,299
Chemical manures..... Tons	23,590	20,117	148,262	121,894
Medicines..... Value £	..	..	84,210	89,422
Other articles... "	..	..	281,964	340,639
Total value .....	..	..	668,748	681,237

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 30TH JUNE.

Articles.	Quantities.		Values.	
	1885.	1886.	1885.	1886.
Gunpowder..... Lb.	1,600,300	788,000	23,425	23,158
Military stores... Value £	..	..	396,761	179,657
Candles..... Lb.	2,157,300	2,013,000	34,728	29,732
Carburettone..... Value £	..	..	83,940	96,874
Cement..... Tons	41,763	36,324	67,714	66,772
Products of coal Value £	..	..	112,306	119,510
Earthenware ... ..	..	..	110,877	112,286
Stoneware..... ..	..	..	12,509	18,548
Glass:—				
Plate..... Sq. Ft.	151,515	113,183	8,103	6,868
Flint..... Cwt.	7,730	9,036	17,061	19,389
Bottles..... ..	58,865	61,758	28,334	29,241
Other kinds..... ..	17,277	18,567	13,498	15,227
Leather:—				
Unwrought	18,019	12,308	145,116	116,366
Wrought Value £	..	..	29,619	27,009
Seed oil..... Tons	4,219	4,583	87,042	87,927
Furcloth..... Sq. Yds.	1,687,700	2,054,800	61,045	82,751
Painters' materials Val. £	..	..	132,828	156,544
Paper..... Cwt.	79,513	91,479	127,282	141,047
Rags..... Tons	3,776	4,015	22,365	22,300
Soap..... Cwt.	593,961	65,065	60,053	64,438
Total value..... ..	..	..	2,822,368	2,840,870

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 13,141. F. Stretch, E. J. Kennedy, and J. Watson. Improvements in apparatus for cooling liquids. June 15.
- 13,279. R. A. Lister and G. E. Suoxell. Improvements in or connected with centrifugal dryers. June 16.
- 13,386. F. Grumbacher. Improved aeration and fermentation apparatus for yeast, indigo, and the like. Complete Specification. June 17.
- 14,001. C. J. Brown. Improvements in condensing and cooling apparatus. June 24.
- 14,478. F. Dehaitre. Improvements in apparatus for drying and finishing fabrics. June 30.
- 14,575. W. R. M. Semple. Improvements in apparatus for heating water and other liquids. July 1.
- 14,609. M. Stanbrook. Apparatus for cooling air for use in refrigerating. July 2.
- 14,774. O. Guttmann. Improvements in apparatus for mixing or obtaining reactions between liquids and gases. Complete Specification. July 3.
- 14,951. E. J. Duff and J. Brock. Improvements in evaporating brine and other solutions, and in apparatus therefor. July 6.
- 14,952. T. Glover and J. Brock. Improvements in and apparatus for evaporating solutions with multiple effect. July 6.
- 15,335. E. H. Holmes and W. B. Woodruff. Improvements in gauges. July 10.
- 15,374. J. Pogson. Improvements in surface condensers. July 11.
- 15,469. J. Spencer, H. S. Smallman, and T. H. Spencer. A new or improved annealing and drying furnace. July 13.
- 15,488. F. H. Haviland, A. Holloway, J. B. Collier, and W. H. Murch. A new or improved furnace. July 13.
- 15,572. C. H. Lloyd. Apparatus for consuming smoke from furnaces. July 14.

- 15,671. W. Waddell and D. Waddell. See Class II.
- 15,682. B. T. Laey. Improvements in roasting furnaces. Complete Specification. July 15.
- 15,721. W. H. Watkinson. Improvements in steam boilers and in vessels for heating and cooling fluids. July 16.
- 15,745. K. R. Smith. An improvement in superheaters. July 16.
- 15,757. P. M. Justice.—From H. F. Atkinson. Improvements in apparatus for injecting vapour or gas into furnaces. Complete Specification. July 16.
- 15,797. E. C. Mills. An improved apparatus for cooling water for condensing and other purposes. July 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 13,896. F. Bornemann-Zix. Apparatus for the production of superheated steam. June 3.
- 15,581. D. Richards. Filtering material. June 24.
- 15,765. H. H. Lake.—From E. de Moerloose. Improved process of chemical decoloration and apparatus for use therein, applicable for the treatment of grain and other substances. July 15.
- 20,426. P. C. Hewitt. Evaporators. July 22.
- 24,007. J. Y. Johnson.—From E. Bailly. Machines for crushing or reducing lime, cement, minerals, and the like. July 8.

1896.

- 10,431. J. Fielden. Apparatus for drying wool and other fibrous material. June 24.
- 11,739. O. Guttmann. Apparatus for softening and purifying water. July 8.
- 12,643. E. Porak. Method of and apparatus for washing and compressing sulphurous acid and other gases or fumes. July 15.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 13,147. J. E. Atkinson and J. M. Labouchere. Improvements in automatic apparatus for the manufacture of acetylene gas. June 15.
- 13,223. F. Bongère. Improvements in the manufacture of candles. June 16.
- 13,255. W. L. Voelker. Process of manufacturing hoods or mantles for incandescent gas-lights. Complete Specification. June 16.
- 13,256. W. L. Voelker. Hoods, mantles, or gratings for incandescent gas-lights. Complete Specification. June 16.
- 13,385. W. P. Thompson.—From V. Briquet and Co. Improvements in burners for acetylene gas. June 17.
- 13,398. H. Guépin. Improvements in acetylene gas-lamps. June 17.
- 13,511. A. E. Bowers. Improvements in regulators and gas-holders for acetylene gas. June 18.
- 13,557. F. H. Haviland, A. Holloway, and J. B. Collier. An improved apparatus for generating, purifying, storing, and supplying at a uniform pressure acetylene gas. June 19.
- 13,648. J. Musso. Portable and hygienic incandescent lighting wherein the evaporation of hydrocarbons is produced under pressure. Complete Specification. June 20.
- 13,659. J. F. Duke. Improvements in the manufacture of mantles or incandescing bodies for incandescent gas-lamps. June 20.
- 13,736. H. Cuinat. An automatic generating apparatus for production of acetylene or other gas. June 22.
- 14,009. E. Fatham. Improvements in means for obtaining light and heat. June 24.
- 14,213. A. Pengeot. A new system of air carburetter. Filed June 26. Date applied for April 13, 1896, being date of application in France.

14,278. F. P. J. Ackermann. Improvements in apparatus for producing acetylene gas. Complete Specification. June 27.

14,365. C. Killing. Improvements relating to incandescence bodies for incandescent gas-lighting. June 29.

14,448. N. Caro and W. Sahlmann. Improvements in the manufacture of incandescent bodies, or mantles, for lighting purposes. Complete Specification. June 30.

14,740. P. Cannell-Bunn. Improved mantles for gas and other burners. July 3.

14,773. W. B. Hartridge. An improvement in the manufacture of fuel blocks. July 3.

14,845. R. Langhans. Improvements in the manufacture of incandescent media for use in incandescent gas-lighting. July 4.

14,929. A. H. J. Schülke. New or improved apparatus for the production and combustion of acetylene for illuminating purposes. Complete Specification. July 6.

14,936. A. Zendroni. Improvements in the manufacture of briquette fuel. July 6.

14,941. H. Strache. The manufacture or preparation of improved odorizing substances for artificially imparting odour to gases. July 6.

14,943. H. Strache. An improved process and apparatus for the removal of sulphuretted hydrogen from gases or gaseous mixtures. July 6.

15,037. W. F. Stanley. Rendering candle and the like wicks waterproof. July 7.

15,064. G. F. Redfern.—From La Compagnie Continentale d'éclairage par le gaz acétylène et ses applications industrielles. Improvements in apparatus for the production of acetylene. July 7.

15,122. F. H. Haviland, A. Holloway, J. B. Collier, and W. H. Mureh. An improved apparatus for generating acetylene gas. July 8.

15,139. G. Isaac. A process for rendering acetylene gas inactive when brought into contact with metals with which it forms explosive compounds. July 8.

15,160. E. Oldenbourg.—From R. Mondos. New or improved method of and apparatus for preparing illuminant appliances employed in the production of light by incandescence. July 8.

15,167. M. Meyer. Improvements in incandescent light burners. Complete Specification. July 8.

15,189. G. W. Weatherhogg. Improvements relating to the burning of hydrocarbons for heating and lighting purposes, and to apparatus therefor. July 9.

15,254. J. Gale. Means for the prevention of explosion in the use and transport of petroleum and like inflammable oil. July 9.

15,324. C. Schuidt. Impregnating fluid for incandescent mantles. July 10.

15,332. A. R. Nisard and A. Serigiers. Improvements in incandescent mantles for gas and other burners. July 10.

15,338. E. Mann. Improved apparatus for the production of ozone. July 10.

15,343. W. A. Tilden. Improvements in the manufacture of oxygen from the atmosphere. July 10.

15,500. R. J. Eiffe.—From F. Meyer and Co. Improvements relating to the preparation of incandescence bodies. July 13.

15,567. C. Weygang. Improvements in the manufacture of artificial fuel. July 14.

15,651. D. Whalley and J. Hacking. Improvements in acetylene gas store generators. July 15.

15,671. W. Waddell and D. Waddell. Improvements in assisting combustion, preventing smoke, and economising fuel, and in the means employed therefor. July 15.

15,962. F. S. Thorn and C. Hoddle. Improvements in apparatus for generating, storing, and cooling acetylene gas. July 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,764. A. J. Boulton.—From C. Dellwick. Process and apparatus for producing water-gas. July 22.

14,460. H. Howell. Apparatus for the production of combustible gas. June 24.

14,682. J. Bowing. Coking processes. July 8.

15,048. W. Foulis. Apparatus for the manufacture of gas. July 15.

15,659. The Economical Gas Apparatus Construction Co., Lim., and L. L. Merrifield. Apparatus for the manufacture of carburetted water-gas. July 8.

19,183. T. R. Shillito.—From C. M. Rompler and H. Axmann. Means for automatically regulating the mixture of gas and air for incandescent gas-lighting and for heating purposes, and for suppressing the noise made by the inrush of air when incandescent gas-lights are turned low. July 1.

23,170. F. Thuman. Gas generators. July 8.

1896.

3142. F. S. Thorn and C. Hoddle. A new and improved acetylene gas generator and container. July 8.

6008. F. S. Cripps. Apparatus for evaporating oil or other liquids, and mixing the vapours produced with coal-gas. July 8.

6999. A. Hussener. Horizontal coke ovens. July 15.

7226. G. G. Schroeder. Gas-enriching apparatus. July 1.

8304. C. Bourquin, J. Besson, and P. H. P. de Reneville. Manufacture of briquette fuel. July 8.

9922. J. Sibley. Apparatus for making, lighting, and heating gas. June 24.

10,822. H. Kirkham. Improvements in scrubber washers for removing impurities from gas. June 24.

11,706. E. F. J. C. Bauweraerts. Process and apparatus for purifying acetylene gas. July 15.

12,683. H. A. Daroy. Manufacture or production of acetylene gas and apparatus therefor. July 15.

13,255. W. L. Voelker. Process of manufacturing hoods or mantles for incandescent gas-lights. July 22.

13,256. W. L. Voelker. Hoods, mantles, or gratings for incandescent gas-lights. July 22.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

13,118. A. Bang.—From G. A. Dahl. Improvements in the production of dyestuffs for wool. June 15.

12,743. H. Imray.—From F. Petersen. Manufacture of substantive cotton dyestuffs from benzidine sulpho acids. Complete Specification. June 22.

13,744. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of new disazo, trisazo, and polyazo colouring matters. Complete Specification. June 22.

14,114. I. Levinstein and Levinstein, Lim. Improvements in and connected with azo colouring matters. June 26.

14,115. I. Levinstein and Levinstein, Lim. Production of a naphthylendiamine-mono-sulpho acid and of colouring matters derived therefrom. June 26.

14,563. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. The manufacture and production of mordant-dyeing colouring matters and of intermediate products relating thereto. July 1.

14,931. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improvements in the manufacture of pyrocatechin-sulphonic acid and intermediate products. July 6.

14,955. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. The manufacture and production of new products and colouring matters from aromatic nitro derivatives. July 6.

15,294. W. E. Heys.—From The Chemische Fabrik vormals Sandoz. The manufacture or production of polyazo colouring matters. July 10.

15,412. A. Savage. A compound mixture for cleaning and dyeing wearing apparel. July 11.

15,493. G. Cerekel. Preparation of ortho-sulphamine benzoic acid. Complete Specification. July 13.

15,527. W. H. Claus, A. Rée, and L. Marchlewski. Manufacture of new amido bases and azo colouring matters therefrom. July 14.

15,687. O. Imray.—From H. Traub and Co. Manufacture of organic compounds of carbonic acid. July 15.

15,953. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. The manufacture and production of new dyes relating to the oxyphenanthronaphthazine series, and of new intermediate products and materials therefor. July 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,488. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of chemical compounds and dyestuffs derived from phenolic bodies. June 24.

14,494. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brünig. Manufacture of azo colouring matters. June 24.

14,687. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The production of dyestuffs. June 10.

16,217. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of colouring matters of the rosinduline series. July 1.

17,260. B. Willcox.—From The Badische Anilin und Soda Fabrik. Manufacture of dis- and polyazo dyes by oxidation. July 1.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

13,209. T. Ford. Improvements in the manufacture of woven fabrics. June 16.

13,273. A. S. Oetzmann and S. J. Narracott. Improvements in the manufacture of inlaid fabrics for covering floors and other surfaces, and in apparatus used for this purpose. June 16.

13,707. T. E. Briggs and E. Webb. Improved apparatus for polishing and drying yarns, threads, twines, or cords. June 22.

13,815. W. Warburton. Improved method of extracting vegetable fibres. June 23.

14,090. L. Johnstone and D. Scott. Improvements in or relating to cellulose, and in the manner and means of applying same for dressing or finishing textile fabrics, also applicable to other purposes. June 25.

14,760. G. C. Dymond.—From Erste Deutsche Patent-Linoleum-Fabrik. Improved calendering machine for the production of running linoleum with inlaid coloured stripes. July 3.

14,880. S. H. Hodges. Improvements in the art of segregating the fibres contained in peat. July 6.

15,893. J. Waugh.—From Amos and Co. Improvements in the method of waterproofing fabrics made of fibre, paper, tissues, and the like. July 18.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

13,138. E. Heberlein. Improved process and apparatus for the production of colours with silk-like gloss on vegetable fibres and textile fabrics; also on wool, india-rubber, leather, wood, metal, and other substances. Complete Specification. June 15.

13,366. L. Armanni. Improvements in and relating to receptacles for colouring or dyeing materials. June 17.

14,252. A. Endler. A new or improved process for bleaching cotton and cotton goods. Complete Specification. June 27.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,032. W. Hepworth Collins. Apparatus and plant for scouring, bleaching, dyeing, impregnating, digesting, drying, carbonising, and otherwise treating cotton, wool, silk, jute, reed, china grass, and other fibrous materials in a raw, manufactured, or partly manufactured state. June 17.

1896.

8318. C. M. White.—From The Electro Waterproofing and Dye Fixing Co. Art of fixing dyes in fabrics. June 24.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

13,244. A. Crossley and H. A. Allport. Improvements in the manufacture of ferric oxides. June 16.

13,446. F. H. Bowman, J. J. Howitt, J. Knowles, and T. A. Reid. Improvements in and relating to the manufacture of carbonates of soda. June 18.

13,844. J. Brock and F. Hurter. Improvements in recovering sulphur from sulphuretted hydrogen. June 23.

13,881. W. R. King and E. Wyatt. An improved process for the manufacture of calcium carbide. Complete Specification. June 23.

14,002. O. Imray.—From Goerlich, Wichmann, and Co. Manufacture of cyanate salts. June 24.

14,389. J. Morrison, W. H. Richmond, and J. Brock. Improvements in obtaining caustic lime from lime mud. June 29.

14,507. M. Levy. A process of producing muriate of ammonia. June 30.

15,489. F. H. Haviland, A. Holloway, J. B. Collier, and W. H. Murch. An improved method of and apparatus for the production of calcium carbide. July 13.

15,525. A. J. Boulton.—From L. H. Freutz. An improved process for the manufacture of hydrogen and carbonic acid or carbonic oxide. July 13.

15,834. A. J. Outheniu Chalandre. Improvements relating to the electrolysis of soluble salts, especially applicable for the production of chlorine. July 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

6009. W. McD. Mackey and J. F. Hutcheson. Manufacture of sodic cyanide. July 1.

13,456. W. Raydt. Process for obtaining carbonic acid from gas mixtures in the dry way, and apparatus therefor. July 1.

13,826. C. Dreyfus. Manufacture or production of nitric acid and apparatus therefor. June 24.

13,827. C. Dreyfus. Apparatus for the manufacture or production of hydrochloric acid. June 24.

14,618. H. R. Lewis. The manufacture of ammonium carbonate and acid ammonium carbonate from certain waste or by-products, and apparatus for use in such manufacture. July 15.

14,912. A. J. Holt and G. Millard. Manufacture of bisulphide of carbon and apparatus therefor. July 1.

15,326. A. Wolf and W. S. Blythe. Treatment of galvanisers' flux skimmings. June 24.

15,369. T. L. Willson. Production of calcium carbide. June 24.

15,807. J. W. Stevens. Treatment or utilisation of kelp liquors. July 8.

15,813. F. M. Lyte. Production of chlorine. July 1.

17,066. M. Goldschmidt. Preparation or manufacture of formates and nitrites. July 15.

1896.

6290. D. Penlikoff. See Class X.

9358. —Pictet. Process and apparatus for the production of carbide of calcium. July 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

13,676. J. B. Vernay. Improvements in machines for manufacturing bottles and other articles of glass. Complete Specification. June 20.

13,823. W. Macrae. Improvements in the production of decorative stained glass or imitations thereof. June 23.

14,901. K. W. R. Goerisch. Manufacture of sulphate glass. July 6.

14,927. T. Hausermann. See Class X.

14,953. H. Propfe. Improvements in the manufacture and production of water-glass with valuable by-products of the said manufacture. July 6.

14,967. J. Wheeler. Improved manufacture of glass suitable for use as a substitute for ground glass and for other purposes. July 6.

15,804. J. Davis and A. J. Davis. Improvements in the method of producing coloured glass lights for lenses, also applicable for other suitable purposes. July 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

24,283. F. Albrecht.—From W. Knapp. Process for the production of coloured pictures, writing, or the like on glass, porcelain, enamel, or sheet iron. July 22.

1896.

46. A. Kopp's Sohn. Manufacture of articles of glass. July 1.

11,856. H. Cartledge. Construction of potters' kilns. July 8.

12,923. B. A. Knappett and J. F. Charlesworth. Shading and colouring glass, &c. July 15.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

13,649. R. F. Strong. A new or improved process for the treatment of peat and other ligneous substances for producing paving blocks, slabs, tiles, slates, conduits, and fuel. Complete Specification. June 20.

14,248. T. C. Blanchflower. Improvements in building bricks and the like. June 27.

14,568. J. C. Roberts. The manufacture of an improved plastic compound. July 1.

14,666. M. Volinski. Improvements in the manufacture of briquettes. July 2.

14,673. F. D. T. Lehmann and P. N. Kohlsaat. Improvements in kilns for burning bricks, tiles, lime, and the like. Complete Specification. July 2.

14,828. T. W. Main. Improvements in the manufacture, construction, and arrangement of interlocking reversible sectional paving. July 4.

14,835. A. Van Berkel and J. B. Hamond. Improvements relating to the manufacture of artificial wood and stone for building and other purposes. July 4.

15,316. S. P. Davies.—From G. Frederick. An improved composition for use on streets, roads, pavements, and the like, and on the surfaces of wood and metal. July 10.

15,520. K. Hergenbahn. Process for the preparation of masonry (in marble, granite, syenite, sandstone, and the like) for pillars, pedestals, door and window cases, monuments, and the like, or other objects. Complete Specification. July 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,264. H. H. Hoelkin. Improvements in the manufacture of concrete paving slabs, and apparatus therefor. June 24.

1896.

10,841. H. Schneider. Manufacture of paving materials and slabs. June 24.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

13,163. C. C. Schirm and A. Silbermann. Improved method of producing an even silver ground for underlaying enamel. Complete Specification. June 15.

13,169. B. Mohr. Treatment of sulphide ores for the separation of zinc from the lead and other metals. June 15.

13,187. B. Kleber. Process for the manufacture of weather-proof gypsum, stone, or bricks. Complete Specification. June 15.

13,337. J. David and C. le Donx Glais. A method for the recovery of zinc from slags containing this metal. June 17.

13,371. O. Frölich. Improved process for extracting metals from pyritic ore by the treatment of with chlorine, and for recovering the chlorine employed. June 17.

13,422. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 18.

13,423. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 18.

13,424. C. Sharland.—From L. R. Seammell. An improved process for the treatment of refractory gold and silver ores. June 18.

13,451. L. Pszczolka. Improvements in the Bessemer or Thomas process for the treatment of low qualities of crude iron. June 18.

13,460. J. W. Chenhall. Improvements in the treatment of ores. June 18.

13,476. W. H. Trengrove. Improvements in annealing articles of steel and malleable iron. Complete Specification. June 18.

13,565. J. W. Spencer. Improvements in face-hardening metals. June 19.

13,641. C. F. Claus, jun. Improvements in or relating to the treatment of tin or antimony ores and the separation of the gold and silver contained therein. June 20.

13,756. A. V. Newton.—From A. Nohel. Improvements in metallurgy. June 22.

14,006. C. Parnacott. An improved manufacture of metallic alloy. June 24.

14,222. A. E. Tucker and T. V. Hughes. Improvements in ferro-sodium fluxes. June 26.

14,223. A. E. Tucker and T. V. Hughes. Improvements in and connected with the alloying of metals. June 26.

14,387. H. L. Sulman and H. F. Kirkpatrick-Picard. Improvements in or relating to the extraction of precious metals from their ores. June 29.

14,388. H. L. Sulman and H. F. Kirkpatrick-Picard. Improvements in or relating to the recovery of precious metals from their solutions. June 29.

14,479. A. F. Cothias. Improvements in and in the manufacture of metallic alloys. Complete Specification. June 30.

14,493. J. Garnier. Processes and apparatus for classifying, amalgamating, and cyanising gold and silver ores. Filed June 30. Date applied for May 7, 1896, being date of application in France.

14,622. A. Wolski. Improvements in blast furnaces. July 2.

14,751. P. A. Newton.—From A. Nobel. Improvements in armour plates. July 3.

14,857. H. Pilkington. Improvements in the manufacture of steel. July 4.

14,862. S. Daw. Improvements in the extraction of metals from zinciferous sulphide ores. July 4.

14,927. T. Hausermann. A process for dyeing or ornamenting objects of metal, porcelain, or the like. July 6.

14,957. C. James. An improved process for the reduction of argentiferous and auriferous copper ores, matters, or compounds without loss of the copper, silver, or gold. Complete Specification. July 6.

15,041. L. Doig.—From The Russel and Erwin Manufacturing Co. A method or process of annealing metals. July 7.

15,056. L. de Rigaud. An improved process and apparatus for the extraction of gold and platinum from their ores. July 7.

15,159. C. James. An improved process for the extraction of copper from sulphuretted ores or compounds. Complete Specification. July 8.

15,385. D. Colville, jun. Improvements in the manufacture of composite armour plates. July 11.

15,523. T. D. Nicholls. Improvements in converters for treatment of copper matte or other materials by the Bessemerising process. July 13.

15,542. W. H. Howard. Improvements in and relating to the desilverisation of lead bullion. Complete Specification. July 14.

15,612. J. Pourtales.—From W. Strieby and S. Crosdale. Improvements in the precipitation of precious metals from solution. July 14.

15,685. W. Muir, H. W. Handcock, and A. H. Dykes. Improvements in extracting gold from ores or materials containing it. July 15.

15,699. G. Duceau. New metallic alloy. July 15.

15,707. B. H. Thwaite. Improvements in the production of hardened surfaces and in the hardening of steel armour or other plates. July 16.

15,749. O. Inray.—From E. F. Turner. An improved regenerative process for the treatment of sulphide ores. July 16.

15,833. J. P. van der Ploeg. Improvements in or relating to the extraction of gold from ores and other compounds, the recovery of gold extracted from the treated ores, &c., and the recovery of the chemicals used in the process. July 17.

15,946. J. A. Mays. Process for reducing lead. July 18.

15,947. J. A. Mays. Process of and apparatus for reducing and separating metals from zinc and lead ores. July 18.

15,965. R. H. Peak. Improvements in process of converting ferric oxide into magnetic oxide of iron. Complete Specification. July 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

12,692. A. J. Boulton.—From P. A. Gasse. Treatment of refractory ores. July 1.

13,534. E. A. Ashcroft. Treatment of zinc-bearing ores and zinc-bearing products. July 15.

13,858. A. J. Boulton.—From T. Prioux, C. Prioux, and C. Hugot. Improvements in or relating to soldering metals. July 22.

14,162. E. G. Appleby.—From L. F. Gowans. Treatment of ores and the like by the cyanide process, and in appliances therefor. July 1.

15,426. S. Taylor. A new or improved manufacture of compound metallic plates, sheets, and strips for various purposes. July 8.

15,656. W. H. James. Process for the extraction of precious metals from their ores and compounds. June 24.

15,954. W. P. Thompson.—From La Société pour l'extraction integrale et economique de l'or, Procédé de Rigaud. Gold-extracting processes and apparatus therefor. July 1.

17,256. R. Lewis. Finishing tin andterne plates. July 22.

23,950. C. Parnacott. Manufacture of metallic alloys. July 15.

1896.

6290. D. Peniakoff. A process for the production of double aluminium sulphides (or sulphurets) with alkaline metals or metals of (the nature of) alkaline earths. June 24.

10,997. J. Jones. An improved method or process for the treatment of gold-bearing antimony ores. July 1.

13,476. W. H. Trengrove. Improvements in annealing articles of steel and malleable iron. July 22.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

13,200. A. G. Stromberg. Improvements in or applicable to the charging of accumulators. June 15.

13,407. C. Kellner. Improvements in electrolytic apparatus. June 17.

13,520. C. Pollak. Improvements in plates for accumulators or secondary batteries. Complete Specification. June 18.

13,521. P. Jensen.—From H. Cappelen and D. Cappelen. Improvements in the manufacture of carbon anodes for electrolytical processes. Complete Specification. June 18.

13,646. W. H. Smith and W. Willis. Improvements relating to electric accumulators or storage batteries, and to the manufacture of plates or electrodes therefor. June 20.

13,688. A. E. Bonna, A. Le Royer, and P. van Berchem. Improved electrical apparatus for the treatment of air, gases, and vapours. June 20.

13,689. A. E. Bonna, A. Le Royer, and P. van Berchem. Improved electrical apparatus for the treatment of air, gases, and vapours. June 20.

13,690. A. Le Royer, A. E. Bonna, and P. van Berchem. Improvements in electrolytic apparatus. June 20.

14,367. C. A. Hales. An improvement in electro-deposition of metals and metallic alloys. June 29.

14,393. P. Jensen.—From H. C. F. Stormer. Improvements in anodes for electrolytic purposes. June 29.

15,129. F. W. Golby.—From O. Arit. A process and apparatus for effecting electrolysis. Complete Specification. July 8.

15,433. H. Weymersch and A. McK. Cardwell. An improved preparation of electrolyte for use in semi-dry primary or secondary electric batteries. July 11.

15,517. R. Sauerwald and H. Grüne. Improvements in electric batteries. July 13.

15,696. E. Casper. Improvements in the manufacture of tubes by electro-deposition. July 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,902. G. Fabbro. Plates for secondary batteries. June 24.

16,736. J. Pfleger. Apparatus for extracting gold and silver from cyanide solutions by electricity. June 24.

- 16,737. J. Pileger. Electrical apparatus for extracting gold and silver from cyanide solutions. July 1.
17,821. F. King. Secondary batteries. May 27.

1896.

- 13,079. W. P. Thompson.—From C. C. Lesenberg. Dry batteries. July 22.
13,521. P. Jensen.—From H. Cappelen and D. Cappelen. Improvements in the manufacture of carbon anodes for electrolytical processes. July 22.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

- 13,353. R. T. Cardell. Laurel cream soap or any combination of laurel in toilet requisites or soaps, cold creams, &c., &c. June 17.
13,726. J. Mendess. Liquid soap. June 22.
14,056. B. J. Hicks and E. F. Bach. An improved lubricating composition. June 25.
14,198. J. Lightfoot. Improvements in the manufacture of dry soap. June 26.
14,308. A. Schuehardt and T. Otto. New washing substance and process for making it. Complete Specification. June 27.
14,806. T. McKinnon. Improvements in or relating to soaps or other like preparations. July 4.
15,050. G. C. Dymond.—From G. F. Metzger. Improvements in or appertaining to separating oil from its volatile solvent. Complete Specification. July 7.
15,336. T. Coad. Improved treatment of fat or fatty waste. July 10.
15,548. J. H. Tearle. Waste soap utiliser. July 14.
15,597. G. C. Dymond.—From G. F. Metzger. A new or improved process of and apparatus for separating naphtha or other volatile solvent from oil. Complete Specification. July 14.
15,938. W. Downs. A new or improved manufacture of soap. July 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 13,623. A. G. C. Dymond. From The Kobero Eisenwerke. Improvements in or appertaining to oil presses. July 8.

1896.

- 10,681. J. Ascough. Manufacture of soaps and saponaceous compounds. July 15.
10,837. J. Glatz and O. Lugo. Production of glycerine and caustic soda from soap lyes. July 22.
12,953. H. W. Wilson. An improved soap or cleansing agent. July 22.

XIII.—PAINTS, PIGMENTS, VARNISHES,
RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

- 13,238. K. A. Frosell. Improvements in the manufacture of waterproofing solutions. June 16.
13,886. W. P. Tatham and W. Tatham. Improvements in the manufacture of white lead. Complete Specification. June 23.
14,267. D. Mareus. Improvements in paints and varnishes. June 27.
14,428. H. C. Webster and R. Crawford. Improvements in the manufacture of white lead. June 30.
14,613. C. Day. An improved liquid varnish gum. July 2.
14,884. W. Mitchell.—From G. L. Ball. A liquid for removing varnish. July 6.

- 14,988. A. B. Browne. Improvements in the manufacture of white lead. Complete Specification. July 7.

15,165. T. Worth, J. Foster, and H. C. P. Graves. A new or improved compound for use as a substitute for india-rubber, leather, or other substances, or for any other purposes to which it may be applicable. July 8.

15,689. J. W. Steiger and P. D. McArthur. Improvements in stick sealing-wax. Complete Specification. July 15.

15,692. F. J. Longton. A new or improved article of manufacture applicable for use as a substitute for india-rubber. July 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 13,973. S. B. Schryver. Manufacture of paints and pigments. July 22.
17,025. H. C. Longsdon. Improved mechanism for pressing and rolling plastic substances, the same being specially applicable for use in the treatment of crude india-rubber. July 22.

1896.

6396. K. Thou. Blacking for leather and the like. June 24.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

- 13,281. W. L. Wise.—From Knoll and Co. Improvements in the manufacture or production of an albumen-tannin compound. June 16.
13,526. G. W. Adler. Improvements in the tawing of hides and skins. June 19.
13,686. H. Schmidt and J. Laudini. Arrangement for performing a continuous work of tanning. June 20.
13,906. F. C. W. Webb. Improvements in machinery or apparatus for use in tanning hides and skins. June 23.
14,293. G. W. Adler. An improved process of and compound for tawing hides and skins. June 27.
14,548. V. Quaedvlieg. Process for rapidly opening the hair cells of raw hides for the purpose of removing the hair therefrom. July 1.
14,617. W. Sagar, senr., A. P. Sagar, and W. Sagar, junr. Improvements in the method of and apparatus for removing grease or fatty matter from skins and other leather and the like. July 2.
15,044. F. E. Burlingame. Improvements in the manufacture of leather. Complete Specification. July 7.
15,165. T. Worth, J. Foster, and H. C. P. Graves. See Class XIII.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

- 10,752. G. E. Wright and W. Monk. Method and apparatus for degreasing leather. June 24.
11,695. K. Moller. Process for hardening chrome-dressed leather. July 8.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATION.

- 15,173. E. Paternotte. Improvements in chemical manure mixers and the like. Complete Specification. July 13.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

- 15,485. A. Rohrbach. A new or improved process for purifying centrifugally separated substances. Complete Specification. July 13.
15,575. C. Wahl. An improved method of purifying starch and like products. July 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

5844. J. Kantorowicz. An improved process for preparing soluble starch. July 1.
 11,976. J. Werner. Machines for mixing syrup. July 22.
 11,977. J. Werner. Machines for cooling syrups. July 8.
 12,447. A. J. Boulé.—From C. M. Higgins. Flour and starch pastes, and processes of making same. July 15.

XVII.—BREWING, WINES, SPIRITS, ETC.

APPLICATIONS.

13,132. S. H. Wright. An improved method of dealing with yeast in the process of fermentation, of first reducing it in bulk, and cleansing it from carbonic acid gas and other foreign matters, gaseous or otherwise, the products of fermentation or otherwise; and second, of promoting the further development of the yeast so treated; and apparatus therefor. June 15.

13,262. B. W. Valentin. Manufacture of material for use in brewing or priming ales and beers. June 15.

13,695. S. H. Wright. An improved method of dealing with yeast in the process of fermentation, of first reducing it in bulk, and of cleansing it from carbonic acid gas and other foreign matters, gaseous or otherwise, the products of fermentation or otherwise; and second, of delivering the gaseous products and other products, if required, in separate receptacles; and apparatus employed in the above process. June 22.

14,501. A. Moller. Improvements relating to the manufacture of sparkling wine and apparatus therefor. Complete Specification. June 30.

15,805. C. C. Doig. Process for evaporating the liquid ingredients of the residual products of distilleries and other manufactories and sewage, but particularly the residual products of distilleries known as burnt ale. July 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

7258. J. C. R. G. Boulet. Manufacture of fermented products. July 15.

14,482. V. Lapp. Method and apparatus for treating mash in brewing for obtaining the wort therefrom. July 8.

1896.

2684. B. Rothenbucher. Apparatus for producing crushed malt and a process of producing wort from the said malt. June 24.

XVIII.—FOODS, SANITATION, ETC., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

13,703. J. J. Hazard. Improvements in the preservation of organic matters and in apparatus for use in connection therewith. June 22.

14,196. G. C. Dymond.—From G. H. Walker, G. E. Gordon, and J. H. Waterhouse. Improvement in or relating to the treatment of milk for the purpose of suiting it to individual digestions. Complete Specification. June 26.

14,209. R. G. Nash. Improvements in the aëration and preservation of milk and apparatus therefor. June 26.

14,581. C. L. Bachelierie. Improved process of preserving organic substances, more particularly applicable for elementary substances. Complete Specification. July 1.

14,644. A. J. Boulé.—From R. Emmerich. A new or improved process for preserving carcasses of animals or parts thereof. July 2.

B.—Sanitation.

14,124. A. Angell and F. Candy. Improved preparations for use as precipitants in the treatment of sewage and other polluted water. June 25.

14,125. A. Angell and F. Candy. Improvements in the manufacture of materials for use in the filtration and purification of impure water and other liquids. June 25.

14,565. R. W. Cass. Improvements in or relating to means or apparatus for removing or taking out suspended matter in sewage and trade refuse. July 1.

14,638. J. Corp. Improvements in the treatment of smoke and fumes from furnaces. July 2.

15,208. H. W. Kearns. Improvements in and apparatus or means for treating the sludge or deposit from foul waters and the like. July 9.

15,456. E. Sergeant. Combined apparatus for burning refuse and disinfecting. July 13.

15,611. W. G. Waterman.—From L. Alers-Hankey. Improvements in apparatus for purifying water. Complete Specification. July 14.

C.—Disinfectants.

14,634. J. B. Koenig. A process for the manufacture of a preservative liquid which possesses at the same time disinfecting and disodorific qualities. July 2.

14,852. M. Crawford. Improvements in the manufacture of disinfecting, deodorising, and bleaching agents, and in apparatus therefor. July 4.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1895.

15,506. A. J. Boulé.—From A. Delcroix. Coffee or coffee substitutes. July 8.

26,219. C. G. Moor. Humanised condensed milk. July 22.

1896.

2081. W. F. Maclaren and A. S. Fleming. Manufacture of condensed milk products. June 24.

8194. J. C. Uhlenbrock. Method and apparatus for the manufacture of margarine or butter substitute. July 8.

12,150. F. O. Jacob. Process for preserving solid organic alimentary substances. July 22.

B.—Sanitation.

1895.

16,308. N. V. Sleen and A. Schneller. Apparatus for the sterilisation and purification of water. July 8.

C.—Disinfectants.

1895.

23,581. J. Reepmaker. A composition for protecting men and animals from the attacks of mosquitoes and other insects. June 24.

1896.

9345. J. Ascough. Manufacture of antiseptic preparations for the preservation of animal and other food-stuffs. June 24.

11,557. S. Pitt.—From The Société Anonyme de l'Institut R. Pietet. Process and apparatus for producing gaseous mixtures, mainly formic aldehyde, for disinfecting purposes. July 15.

XIX.—PAPER, PASTEBOARD, ETC.

APPLICATIONS.

13,242. W. Hunkemoller. Process for manufacturing artificial whalebone. Complete Specification. June 16.

15,519. G. L. T. Hartmann. Improvements in machines for the manufacture of millboard, pasteboard, or the like. Complete Specification. July 13.

15,552. J. Tait. Improvements in bleaching and purifying paper pulp. July 11.

COMPLETE SPECIFICATION ACCEPTED.

1896.

11,961. T. C. Cadogan and The O. S. Kelly Co. Improvements in devices for handling and feeding paper stock. July 22.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

14,552. O. Inray.—From The Fabriques de Produits Chimiques de Thann et de Mulhouse. Improvements in the manufacture of artificial musk. July 1.

14,928. H. Inray.—From Harmann and Reimer. Process for the manufacture of vanilline from isoeugenol and eugenol. July 6.

14,954. C. Goldschmidt. The preparation of a condensation product from vanilline and para-phenetidine. July 6.

15,295. W. E. Heys.—From The Chemische Fabrik vormals Sandoz. The manufacture or production of bismuthoxy-iodide-methyl-gallate. July 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,631. A. M. Parker. Manufacture of germ extract. July 8.

17,351. W. Schmidt. A process for the preparation of cauphor in the condition of powder. July 8.

17,417. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of pharmaceutical compounds. July 22.

1896.

3192. G. H. R. Dabbs. Apparatus for the production of extracts of tea or other matters. July 15.

11,166. J. C. Mewburn.—From the Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. A new perfume or odiferous principle and process for the manufacture of same. July 1.

XXI.—PHOTOGRAPHY.

APPLICATIONS.

14,977. H. Fowler. A process for producing photographs in gold, silver, or other metals on polished surfaces. June 25.

15,852. E. P. Schoenfelder and E. Kehl. Improvements in chemical compositions for preparing the surface of suitable material for photographic prints. July 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,548. F. W. Lauchester. Photography in colours. July 8.

1896.

11,306. J. Hauff. Photographic developing solutions. July 15.

12,645. J. W. McDonough. Colour photography. July 15.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

13,152. M. I. E. Morris. Improvements in explosives. June 15.

13,269. L. Kelbetz. Improvements in the manufacture and production of explosives. Complete Specification. June 16.

13,270. L. Kelbetz. Improvements in the manufacture and production of explosives. Complete Specification. June 16.

13,755. A. V. Newton.—From A. Nobel. Improvements in rockets. June 22.

13,922. G. Bencke. Improved manufacture of explosives. June 24.

14,007. F. M. Hale and J. B. Reavil. Improvements in percussion fuses for explosive projectiles or shells. June 24.

14,320. C. Lann.—From A. Yernander. An improved safety fuse or quick-match. June 29.

14,595. A. Scott. Improvements in matches. July 1.

14,950. S. V. Dardier. Improvements in the manufacture of explosives. July 6.

15,022. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier. Improvements in the manufacture of explosive compounds. July 7.

15,351. A. F. Hargreaves. Improvements in explosives. July 10.

15,977. L. L. Billaudot. An improved process of manufacturing phosphorus. July 18.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,443. G. G. Andre and C. H. Curtis. Manufacture of explosives. June 24.

1896.

6,555. R. Pierre and W. Pottgiesser. Manufacture of safety explosives. July 8.

13,269. L. Kelbetz. Improvements in the manufacture and production of explosives. July 22.

13,270. L. Kelbetz. Improvements in the manufacture and production of explosives. July 22.

PATENT UNCLASSIFIABLE.

COMPLETE SPECIFICATION ACCEPTED.

1895.

25,013. W. L. Woods. An improved plastic composition and process of combining the same. July 1.

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THE JOURNAL OF THE Society of Chemical Industry:

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

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NOTICES.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready about the end of the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal. The prices will be as follows:—

To Members (see Rules 25 and 27) who make application with remittance not later than September 30, 1896	Each Copy	5s.
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a spiral plate I, P, the outer edge of which has a flange *i*, and accumulates on the surface at F, until it passes through the filter K into the perforated cylinder J, and finally out through *f*.—R. B. P.

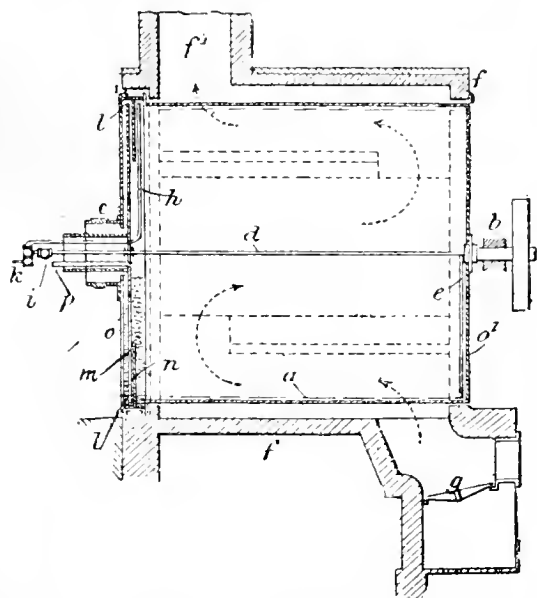
[*Smoke, &c. Purification*], *Impts. in Machinery applicable for Filtering, Condensing, and Absorbing Air, Smoke, Fumes, and other Gases, or for Cooling or Heating Water or other Liquids.* H. R. Chubb, Greenwich, Kent. Eng. Pat. 14,456, July 30, 1895.

In addition to the objects mentioned in the title, the apparatus may be used for impregnating alkaline, acid, or neutral solutions with waste or other gases.

It consists mainly of two chambers, into the first of which the gas or smoke to be treated is forced by means of a fan. Inside this chamber a whirling device causes the gas to impinge against a series of baffle plates which intercept and retain particles of impurities. In the second chamber there is a slowly rotating hollow drum, filled with a suitable filtering material, into which the gas from the first chamber is fed. The gas then passes through the filtering medium and the perforated walls of the drum into the second chamber. In the lower part of this is a layer of liquid, the nature of which depends upon the gas under treatment. Resting on the drum is an endless band with buckets attached to it, the lower end of which hangs in the layer of liquid. As the drum rotates it carries with it the band and its buckets. The latter carry up the liquid and discharge it on to the upper part of the drum, thus keeping the filtering material drenched. The liquid as it runs off is caught in a trough and carried away to suitable appliances—filters, crystallising pans, &c.—for treating it. The purified gas is removed from the top of the second chamber by means of a fan.—R. B. P.

Evaporating and Distilling Liquids, Impts. in Apparatus for. E. Theisen, Baden-Baden, Germany. Eng. Pat. 14,852, Aug. 6, 1895.

THE apparatus consists of a hollow drum *a*, closed by end-plates, *o o'*. It is supported at one end by an axle *b* and at the other by a hollow axle *c*, through which passes the pipe *d e*. This pipe serves for feeding the liquid to be evaporated on to the inner surface of *a*. The centrifugal action set up by rotating the drum causes the liquid to distribute itself in a thin uniform layer on the inner surface of the drum, and also to flow along it and into the annular



lute *l* at the other end, from which it is removed by a stationary scoop at the end of the pipe *h*. At the other

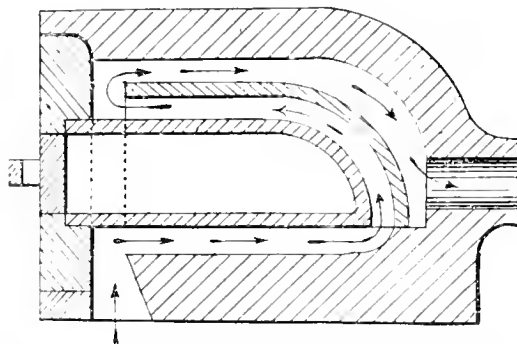
end of *h* is a cock *k*, by means of which the liquid can be run off, or again passed into the drum through *d* and the cock *i*. Fresh liquid also can be introduced through the latter. Heat is applied to the exterior of the drum by the furnace *g, f, f'*, to effect the evaporation of the liquid on the interior surface. The lute *l* is divided by a flat ring *n*, and being filled with a suitable fluid, forms, with the fixed plate *m*, a seal which prevents the products of distillation from escaping from the drum except by the outlet *p*. Two or more concentric drums may be used. Various modifications of the apparatus are described.—R. B. P.

Pulverulent, Granular, or Fibrous Material's, Apparatus for Drying. E. Theisen, Baden-Baden, Germany. Eng. Pat. 14,853, Aug. 6, 1895.

ON to the interior surface of a revolving drum the outer surface of which is subjected to heat, the material to be dried is fed in such a manner that it is spread into a uniform thin layer by centrifugal force. A series of scrapers set at certain points, stir up the material and deliver it on to a fresh portion of the drum's inner surface, and at the same time cause it to travel along the drum towards the discharge orifice.—R. B. P.

[*Muffle*] *Gas Furnaces for Enamelling, Assaying, Hardening, Tempering, Melting, and the like, An Impt. in the Construction of.* F. Willis, London. Eng. Pat. 14,971, Aug. 8, 1895.

THE improvement consists in surrounding the muffle with an additional muffle in order that the products of combustion



may be caused to circulate in the manner indicated by the arrows in the figure, which represents a vertical section through the muffle furnace.—A. G. B.

II.—FUEL, GAS, AND LIGHT.

Sulphite Liquor from Wood Pulp, Utilisation of [Fuel]. Papier Zeit. 1896, 21, [37], 1183.

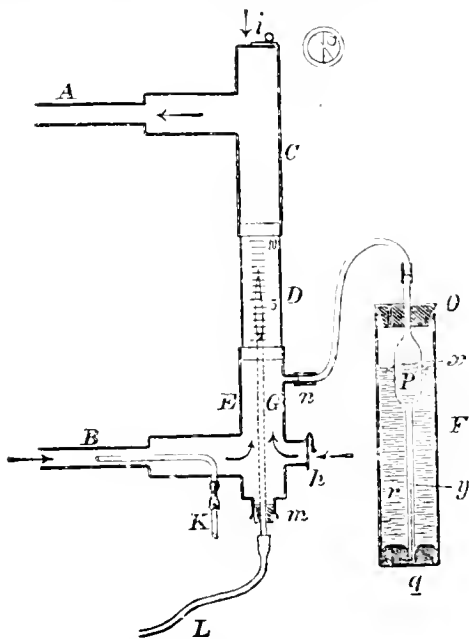
THE author describes a method that was adopted in 1890 for the manufacture of briquettes from small coal and concentrated waste sulphite liquors. The experiments were conducted at the iron-smelting furnaces at Komitat Gömör, in Hungary. The waste sulphite liquors were obtained from a pulp mill in the vicinity, and then concentrated to a suitable consistency in a series of open tanks. Leated by the waste gases from the furnaces. The thick syrup-like residue was mixed with the coal dust in the briquette-making machine. The briquettes when dried, were hard, and formed an excellent fuel, giving off practically no sulphurous odour when burnt. It was also found that by using sufficient lime flux, practically the whole of the sulphur went into the slag when employed in the smelting furnace. After overcoming a number of difficulties, the manager of the works writes, under date of April 30th of the present year, to the effect that the manufacture of these briquettes is carried on satisfactorily, and they not only form good fuel upon ordinary grates, but also in the smelting furnace.

—S. P. E.

Gas Processes, and particularly the Management of Furnaces, Apparatus for Controlling. W. Hempel. Chem. Ind. 1896, **19**, 98—101.

THE author proposes to utilise the known fact that the form of a flame is altered by a change in the composition of the atmosphere surrounding it, to obtain a test apparatus showing at a glance any change in the composition of the chimney gases in furnaces and other analogous cases.

In the accompanying illustration, B is a tube leading from the furnace flue, preferably close behind the bridge, or before the furnace gases have passed through any considerable length of brick flue. A is a tube leading into the



chimney beyond the damper. D is a graduated glass cylinder, open top and bottom, and connected to A and B by the elbow-pieces E and C. G is a narrow tube connected by the flexible tube L to the gas supply, held in position by the air-tight stopper m, and having its nozzle flush with the lowest graduation mark of D. i and h are rosette ventilators. The tube G is removed, the gas lighted, and the tube replaced, and with i and h fully open the gas flame is regulated to a definite height. The firing of the furnace is then arranged so as to give the maximum of carbonic anhydride—by nearly closing the air supply—and ventilator i being quite closed, h is gradually closed till the flame is just extinguished, when the position of h is marked. At the same time a sample of the furnace gas is drawn by means of k and analysed. The furnace is then brought to its most advantageous condition, the ventilators h and i are again opened, the gas re-lighted, i closed, and h closed nearly to the mark previously made, and re-marked; the height of the flame is then noticed, and a sample of the furnace gas taken at K and analysed. By a few trials an empirical scale can be drawn up, showing from the height of the flame the percentage of carbonic anhydride in the furnace gases. F is a Kretz pressure gauge in connection with the apparatus by the lead tube n. This consists of the pipette P full of water in a cylinder of the same and dipping into a layer of a liquid just heavy enough to sink in water—such as a heavy petroleum to which a little carbon bisulphide has been added. This forms a delicate pressure gauge, as a very slight change of level in the bulb of the pipette is represented by a very considerable change in level of the lower layer of liquid in the pipette tube. The pressure in the apparatus is adjusted to that of the atmosphere before reading the flame height, by slightly opening ventilator i.

Very good results have been obtained by this apparatus, which can also be applied to testing other than furnace

gases—such as chlorine generators, sulphuric acid chambers, &c. Where coal-gas is not available, hydrogen, water-gas, or candles can be employed. In the case of the candle, however, it must be remembered that restriction of the oxygen means diminished flame, and not, as in the case of gas flame, increased length, and the variation is much less. For a candle, the form of the apparatus must of course be slightly modified.—L. T. T.

Emission of Light. H. Krüss. Journal für Gasbeleuchtung, 1896, **39**, 425—427.

THE results are given of researches made by Lummer, Kurlbaum, and Wien at the Reichsanstalt on a suitable standard or unit of light-emission, and also of experiments by St. John on the emissive powers of substances. Experiments with Violle's platinum unit and Siemens' modification of it have shown that methods depending upon the melting point or solidifying point of platinum are not satisfactory. Lummer and Kurlbaum adopt as their unit the amount of light emitted from 1 sq. cm. of glowing platinum-foil at a fixed temperature. The foil used is of pure platinum, 25 mm. broad, 60 mm. long, and 0.015 mm. thick, and is heated by passing through it a current from a secondary battery. In front of it is placed a suitable diaphragm with an aperture of 1 sq. cm. The temperature is fixed by a peculiar and interesting absorption method. The absorption vessel consists of a cylindrical glass ring closed by two quartz plates, 1 mm. thick, and containing a layer of water 2 cm. thick. The proportion of the total radiation transmitted through such a vessel depends upon the quality of the radiation, and hence depends upon the temperature of the radiating surface. The normal temperature is fixed as being such that the proportion of the total radiation transmitted shall be one-tenth. The radiation is measured and the proportion determined by means of a bolometer. As far as this element is concerned, the unit can be fixed to an accuracy of 0.3 per cent., or, taking all sources of error into account, to an accuracy of 1 per cent.

St. John has compared the brightness of a hot platinum surface with that of a part of the same platinum at the same temperature but coated with a metallic oxide. The platinum-foil was enclosed in a furnace at a temperature of 1,100—1,200° C., and the observations were made through a hole in the wall of the furnace by a spectro-photometer. Taking the brightness of the plain platinum-foil for a given wave-length ($\lambda = 0.540$) as unity, that of the other surfaces was only found to vary from 0.787 in the case of didymium oxide to 1.017 in the case of lanthanum oxide. Within such a closed hot space the brightness does not measure the emissive power, for the radiation is the sum of the energy emitted and reflected from the surface; and the results are in entire accordance with Kirchhoff's law, according to which the sum of these in any given direction should be constant for all surfaces and equal to that from a perfectly black surface. Unfortunately, St. John has not examined the behaviour of thorium oxide, which is used in the Auer burner. But the fact that the rare earths investigated behave in accordance with Kirchhoff's law is fatal to the suggestion which has often been made that they have a specific luminosity or power of emitting, in the form of light, a part of the energy absorbed in their formation. The observed gradual decrease of efficiency of the Auer burner must be ascribed simply to a gradual contraction of the mantle or of its active surface, and not to any supposed diminution of its specific luminosity. The measurement of brightness above described can be converted into a method of measuring emissive power by pushing a hot (but not glowing) porcelain tube through the walls of the furnace close up to the platinum plate and observing through this tube; we thus cut off reflected light and only observe that directly emitted. Taking the emissive power of platinum as unity, that of lanthanum oxide is found to be 2.15, and that of zirconium oxide as high as 3.15.—D. E. J.

Rare Earths. O. N. Witt. Chem. Ind. 1896, **19**, 156.

THE thoria required for incandescent mantles is now obtained from monazite, which contains only 4—8 per cent. of the earth. After separation of thoria, the ceria, didymia, and lanthana, which make up 50 per cent. of North

Carolina monazite, are found in the same residue, without other admixture. In the present paper, the separation of ceria and attempts to utilise it are described; didymia and lanthana will be dealt with in a subsequent communication. To the mixture of the chlorides of the three metals caustic potash is added till alkaline (caustic soda must not be used, since NaCl dissolves CeO_2) and chlorine passed into the mixture warmed on the water-bath. When the gas is no longer absorbed, a portion is filtered and tested for cerium by ammonia and hydrogen peroxide; if the metal be found, the treatment with potash and chlorine is repeated. The yellow dioxide is filtered off, washed with 5 per cent. potassium chloride, and its hydrochloric acid solution examined for the absorption bands of didymium; if this metal be absent, the solution is also assumed to be free from lanthanum, and pure cerium oxalate is precipitated on addition of oxalic acid. If the didymium bands are seen, the chlorine treatment must be repeated.

Cerium oxalate finds a limited application in medicine, but on account of its insolubility is not suitable for general technical purposes. The most convenient salt is the double sodium cerium nitrate obtained by dissolving 36 grms. of cerium oxalate in 250 c.c. of nitric acid (equal parts acid of sp. gr. 1.4 and water), boiling until nitrous fumes are no longer evolved, and adding 21 grms. of anhydrous sodium carbonate. On cooling, almost the whole of the double salt crystallises out; it is unaltered by air.

1 per cent. of cerium dioxide imparts a fine yellow colour, which resists a white heat, to a glass of a composition suitable for an earthenware glaze, but when used as glaze, only a useless pale yellow colour was produced. Porcelain could not be coloured by cerium compounds. The double nitrate has no effect on the production of aniline blacks; earlier statements to the contrary must have been based upon results obtained with cerium salts containing impurities, possibly vanadium. On the other hand, cerium forms a mordant for the alizarin colours. One method is to print the sodium cerium nitrate, thickened in a suitable manner, on the fabric, dry, and pass through boiling soda; this precipitates insoluble sodium cerium carbonate in the pores of the material. The colours produced on material mordanted in this way are tolerably fast to soap; the shades are intermediate between those given by chromium and iron mordants.—A. C. W.

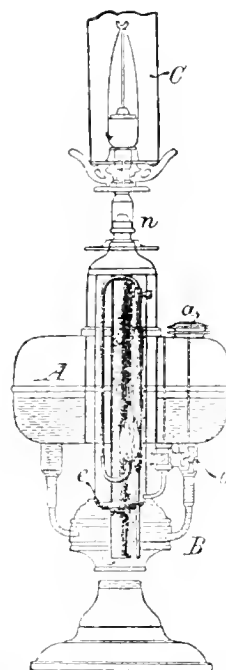
Denaturing Alcohol [Alcohol Incandescent Lamps].

G. Jacquemin. *Comptes rend.* **122**, [25], 1502.

THE author proposes to denature alcohol for use in incandescent lighting by the use of the trihydrate of ethyl hydrosulphide obtained by the distillation of sulphovinate and sulphide of barium, and mixed with 9 per cent. of ethyl hydrosulphide. 5 grms. of this substance will suffice to denature a hectolitre of 90° alcohol at a cost of 15 centimes, and whilst incapable of precipitation or removal by fractional distillation, does not affect the burning of the spirit, the trace of sulphur present being infinitesimal.—C. S.

Incandescent [Alcohol] Spirit-Light, in comparison with other Sources of Light. F. Fischer. *Zeits. angew. Chem.* 1896, 433—434.

THE author describes a wickless spirit-lamp [alcohol-lamp] by means of which an ordinary mantle can be raised to incandescence. In the accompanying figure the spirit is poured into the annular reservoir A (the screw-cap *a* being removed), falls through the side tubes into B, and then rises in the central tube. The cock *b* allows spirit to be poured at will into the little capsule *c* surrounding the central tube; this, when lighted, vaporises the spirit in the central tube, and the vapour is driven out at *n* into a Bunsen burner on which is hung the mantle C. Spirit of not less than 93 per cent. should be used; of this the lamp uses 97 c.c. per hour, and gives a steady pleasant light of 42 candles with a new mantle, sinking to 36 candles after 60 hours' use. Taking as average costs, spirit, 32 pf. per litre (1s. 6d. per gallon); petroleum, 22 pf., "Kaiseröl," 42 pf. (1s., 1s. 11d.); stearin candles, 150 pf. per kilo. (8d. per lb.); coal-gas, 16 pf. per cb. m. (1s. 6d. per 1,000 cb. ft.); and the wear of mantles at 0.5 pf. per 100 candle-hours, the author gives from his own and earlier researches (*Zeits. angew. Chem.* 1891, 623, and 1895, 634 and 665) a comparative table of which the following is a condensation:—



	Actual Light.	Cost per Hour.	Calculated to 100 Candle-Hours.					Radiant Heat per Minute, on Surface of 100 Sq. Cm. at 37.5 Cm. Distance, for every 1 S. Candle-Power.
			Consumption.	Cost.	CO ₂ produced.	H ₂ O produced.	Heat evolved.	
Candles		Pf.	Grms.	Pf.	Kilo.	Kilo.		
Stearin	1	1.3	920	130.0	1.18	1.04	8,100	8.7
Paraffin	1	1.2	770	120.0	1.22	0.99	7,380	8.2
Petroleum (Flat wick)	4	0.6	600	13.2	0.95	0.80	6,240	10.8
Petroleum (Round wick)	25	1.9	330	7.3	0.53	0.44	3,432	10.6
Spirit, incandescent	36	3.3	220	9.1	0.38	0.25	1,247	(1.2)
			cb. m.					
Gas (Flat flame)	12	2.9	1.6	25.6	0.91	1.71	8,480	6.2
Argand	25	4.8	1.2	19.2	0.68	1.38	6,360	6.1
Incandescent	46	2.2	0.25	4.5	0.12	0.21	1,060	7.0
Electric glow-lamp	15	4.1	..	27.3	..	..	400	2.2

—J. T. D.

Hydrocarbons produced by the Action of Water on Metallic Carbides. H. Moissan. *Comptes rend.* **122**, [25], 1462—1467.

IN view of the fact that aluminium carbide gives off pure methane under the action of water, and that uranium carbide furnishes under the same treatment, in addition to

gaseous products, liquid and solid hydrocarbons (4 kilos. of carbide yielded over 100 grms. of liquid hydrocarbons), chiefly of the ethylene series, associated with smaller quantities of the acetylene series and saturated hydrocarbons,—it is considered that the protracted evolution of methane in certain places may be due to the first-named reaction, and that the occurrence of the second reaction at high temperatures might give rise to saturated hydrocarbons analogous to petroleum. To show that petroleum is not always attributable to an animal or vegetable origin the asphalt found in the fissures of the fresh-water limestone of Limagne is cited, the said asphalt being in direct relation with veins of basaltic tuff, and therefore with volcanic phenomena. The petroleum found at a depth of 1,200 metres at Riom may be ascribed to the action of water on carbides, and the escape of carbon dioxide from the granite rocks bordering the tertiary formation near Saint-Nectaire may be an oxidation product of hydrocarbons produced in the same way.

It is also considered possible that sundry volcanic phenomena may be due to the same cause, and that the variety of carbon compounds, from asphalt down to carbon dioxide, produced in the final manifestations occurring in volcanic centres, probably result from the polymerisation of the gases liberated by the contact of water with subterranean stores of metallic carbides.—C. S.

Auer-Welsbach Patents and Monazite in Germany.

U.S. Consular Reps., June 1896, 242.

See under Trade Rep., page 626.

Coal Discovered in Ontario. Eng. and Mining J., July 18, 1896, 53.

See under Trade Rep., page 629.

PATENTS.

Gas [Wood], Impts. relating to the Manufacture of, and to Apparatus therefor. H. Riché, Lisors par Lyons-la-Forêt, France. Eng. Pat. 10,947, June 1, 1895.

The object of this invention is to convert the whole of the non-mineral constituents of wood into gas. The apparatus consists essentially in a vertical retort, which is charged from the top, and from which the gas-outlet pipe is situated near the bottom. After the first charging of the retort the wood is fed in at the top as required, the ashes being removed from the bottom from time to time. In this way the lower part of the retort is constantly filled with an incandescent mass of carbon or charcoal, and the patentee claims that by causing the gases first formed (containing large quantities of steam, &c.) to pass over this incandescent mass a "rich and perfectly pure gas is obtained, ready for immediate use as fuel, as illuminating gas for incandescent gas light, or as a source of motive power."

—L. T. T.

Gas, Heating and Illuminating [Acetylene], Impts. in Apparatus for the Production of. T. Thorp and T. G. Marsh, both of Manchester. Eng. Pat. 12,356, June 26, 1895.

Two forms of apparatus are described. In one the generating chamber is a fixed chamber in a tank, and containing a fixed tray to hold the carbide, and having communication at the bottom with the water in the surrounding tank. When acetylene is generated faster than it is used, the pressure of the gas forces the water down in the generator and so removes it from contact with the carbide.

In the second apparatus the generator forms a bell or holder, rendered buoyant by air-tight chambers or counterpoise weights, and surrounded by a tank of water. In this case when excess of acetylene is produced the generator is lifted, and the carbide thus removed from contact with the water.—L. T. T.

Gas, Illuminating [Poor-Gas with Acetylene], Impts. in the Manufacture of. T. L. Willson, New York, U.S.A. Eng. Pat. 13,750, July 18, 1895. (Date under Internat. Convention, Dec. 19, 1894.)

WHILE a non-illuminating gas, such as water-gas, cannot be economically rendered illuminating by the addition of

acetylene, the patentee claims that a gas of low illuminating power, but already containing hydrocarbons, can be efficiently and economically enriched by the addition of acetylene. He states that, for instance, a poor gas of nine candle-power can be raised to an illuminating power of 25 candles by the addition of 10 per cent. of acetylene.—L. T. T.

Gas, Illuminating [Acetylene modified], Impts. in the Production of. T. L. Willson, New York. Eng. Pat. 13,766, July 18, 1895. (Date under Internat. Convention, Dec. 19, 1894.)

If acetylene be added to a non-luminous combustible gas in its ordinary condition, the illuminating power of the acetylene is, after a short time, practically lost. The patentee claims, however, that by employing the gaseous products obtained from heating acetylene, the illuminating power remains. The acetylene is either passed through red-hot retorts, and the products then introduced into the non-illuminating gas, or the acetylene is first added to the latter gas, and the mixed gases are then passed through fixing retorts or tubes, raised to a bright red heat.—L. T. T.

Calcium Carbide, Impts. in the Production of. T. L. Willson, New York, U.S.A. Eng. Pat. 15,360, Aug. 15, 1895.

LIME and coke, which have been finely powdered and then thoroughly mingled in a grinder or mixer, in the proportion of 35 per cent. of coke and 65 per cent. of lime, are fed into a vertical furnace enclosed in brickwork, and preferably lined with carbon, and provided with a tap-hole at the bottom for the removal of the fused product. The lower electrode is formed of broken carbon, and the upper, which is removable, is of compacted carbon, and is connected with an adjusting mechanism by which it may be raised or lowered. The electrodes are connected to the poles of an alternating-current dynamo having a mean potential of 55 volts, and the reversals of the current may be satisfactorily run at about 50 a second. The amperage, which depends on the size of the furnace, may be 1,500 amperes for a pole of 8 ins. on the side. It is claimed that by this process the difficulty of feeding in between the poles is overcome, and that the output of calcium carbide per electric horse-power is nearly double that which is obtained with a direct current.—G. H. R.

Carbide of Calcium, Impts. in the Process and Apparatus for the Production of. R. P. Pictet, Geneva, Switzerland. Eng. Pat. 9358, May 2, 1896.

A CUPOLA is provided with a ring of tuyères at about two-thirds of its height from the bottom, and with a ring of blow-pipes at about one-third of its height; the electric arc is formed at the bottom of the furnace. Air is injected through the tuyères, and hydrogen and oxygen (water-gas and enriched air) respectively through the separate pipes which form each blow-pipe. The charge of lime and excess of coke is heated by the combustion of a part of the coke to 2,000° C. at the tuyères, to 2,400° C. at the blow-pipes, and to above 3,000° C. at the electric arc. Here the calcium carbide is formed, and flows from the bottom of the furnace in a fused condition, making room for a fresh charge at the top. To protect the furnace lining from the heat of the arc, the exit pipe is made to protrude into the furnace, so that a residuum of calcium carbide remains in the bottom of the cupola, where it partially solidifies on the lining.—A. G. B.

Carbonic Acid, Obtaining, from Gas Mixtures in the Dry Way, An Impd. Process for, and Apparatus therefor. P. W. Raydt, Stuttgart, Germany. Eng. Pat. 13,456, July 12, 1895.

See under VII., page 594.

Coking Processes, Impts. in. J. Bowing, Tilbury, Essex. Eng. Pat. 14,682, Aug. 2, 1895. Compare this Journal, 1891, 628.

STREAM coal may be coked by powdering it until it can pass through $\frac{1}{4}$ -in. mesh, thoroughly wetting it, mixing it with some $\frac{2}{3}$ per cent. of its weight of tar, and ramming it into a gas-tight vessel, so that it shall be as solid as possible

and the vessel shall be quite filled. The vessel is then raised to the coking temperature, and the products allowed to escape through a suitable orifice. In the case of coals which swell when heated, the tar and water may be dispensed with, provided the other conditions be fulfilled. The slack of coals which do not swell much may be merely weighted during the coking process. When dealing with coals which coke with difficulty, the volatile products from one coking chamber should be passed into the next chamber either just prior to or during the beginning of the coking operation; the particles of the newly coking mass become thus cemented together.—A. G. B.

Liquid Hydrocarbons for use as Fuel. An Impd. Process for Treating. P. Baumbert, Berlin, Germany. Eng. Pat. 21,709, Nov. 15, 1895.

THE admission of steam into the combustion chamber is but little aid to perfect combustion of liquid hydrocarbons, but if water be mixed with the hydrocarbon and the emulsion be injected, a better result is obtained. Such an emulsion may be prepared by adding to the hydrocarbon, up to 3 per cent. of its weight of the powdered stems and woody parts of such plants as *Salix viminalis*, *Spiraea filipendula*, *Prunus spinosa*, and the like; the resulting mixture can be emulsified with from 10 to 95 per cent. of water.—A. G. B.

Oil or other Liquid, Evaporating, and Mixing the Vapours Produced with Coal-Gas. Impts. in Apparatus for. F. S. Cripps, London. Eng. Pat. 6008, March 18, 1896.

THE apparatus consists of an iron or steel vessel divided into three chambers, the bottom one being termed the heating chamber, the middle one the mixing chamber, and the top one the oil-arresting chamber. The oil flows through a pipe in the form of an ascending volute contained in the heating chamber, and is delivered on to the floor of the mixing chamber, which serves as an evaporating disc; this disc and the volute are heated by low-pressure steam admitted into the heating chamber. The coal-gas main enters the mixing chamber at the centre of the evaporating disc. The gas thus becomes mixed with the oil vapour and then passes through the perforations in the floor of the arresting chamber, where any liquid oil particles are removed by a column of coke. By a suitable bye-pass arrangement either the whole or a portion of the gas to be enriched may be sent through the apparatus. An advantage claimed is the absence of injectors.—A. G. B.

Gas, Illuminating [Petroleum Spirit, &c.]. Impts. in Apparatus for Producing. C. Gautsch, Münster, Germany. Eng. Pat. 8239, April 18, 1896.

SPECIFICATION describing the production of an illuminating gas by carburetting air. Air is compressed into a chamber and then forced through numerous very fine openings in a tube arranged near the bottom of another chamber filled with a hydrocarbon, such as "ligroine" (petroleum spirit), naphtha, &c.—L. T. T.

III.—DESTRUCTIVE DISTILLATION. TAR PRODUCTS, Etc.

Petroleum in the Island of Tschelken. K. Charitschkoff. Chem. Rev. Fett u. Harz Ind. 1896, [39], 86—88.

ATTENTION has recently been directed to Tschelken as an oil-producing region, in consequence of the success attending the prospecting carried on by the Transcaucasian authorities in seeking new sources of liquid fuel, and the firm of Nobel has resumed boring operations.

Tschelken petroleum is very thick, being, at 9° C., of the consistence of ointment, and setting at a little below 0° C. Some difficulty is occasioned in distillation by the disinclination of the contained water to separate out. The specific gravity of the oil is 0.868, and the flashing point 51.5° C., Abel-Pensky. Fractional distillation yields the following results:—

Up to 200° C.	2.8 per cent. of sp. gr. 0.7712 at 16.5° C.
200°—250° C.	11.9 " " 0.795 "
250°—270° C.	7.6 " " 0.8005 "
270°—310° C.	6.6 " " 0.8128 "

The residuum has a specific gravity of 0.900 at 22.5° C., is salve-like at the ordinary temperature, and may be worked

up direct into vaselin. The percentage of paraffin in the oil is high (5.5, yielding about 3 per cent. of refined paraffin), so that a sediment forms at moderately low temperatures. Two kinds of burning oil can be obtained: the first of sp. gr. 0.7945 at 15° C., flashing point 20° Abel-Pensky, and greatly resembling American petroleum, burning very brightly at first, but falling off a good deal towards the end. The second oil is of sp. gr. 0.8216, flashing point 75°, and does not burn so well, but when the two are mixed together a very satisfactory burning oil of sp. gr. 0.800, and flashing point 35°, is obtained, indicating the possibility of preparing from Tschelken petroleum a very good safety oil for special purposes, as well as the establishment of the vaselin and paraffin industries, not hitherto developed to any extent in the Caucasus.—C. S.

Petroleum of Salt Creek, Wyoming. W. C. Knight and E. E. Slosson. School of Mines (University of Wyoming) Bulletins, Petroleum Series No. 1, June 1896.

THE Salt Creek oil-field lies around the river of that name, but its limits have not yet been ascertained, only a small area having hitherto been tested. Wells have been sunk by three companies about 50 miles north of Casper, and a small refinery has lately been erected, containing one 50-barrel cheese-box still.

The oil is believed to occur in two horizons of oil sands, one of which crops out at about two miles from the existing wells, and dips some 555 feet per mile, the other being indicated by oil springs about two miles further away. The existing wells vary in depth from 809 to 1,200 feet, and are lined by three strings of casing; the average daily production is 10 barrels. In 1895, 7,019 barrels were obtained, and the yield for the present year is estimated at 20,000. Only small quantities of gas are given off from the wells. The water associated with the oil contains a large percentage of sodium sulphate. Drilling is rather expensive, the cost of plant and labour for a first well amounting to 6,000 dol.; and both coal and wood are very dear, but it is expected that workable coal will be found within 8 or 10 miles. In geological age the oil-field is younger than those of the Eastern States, and more nearly approximates to the Hungarian, Galician, and Bukovina oil-fields.

The crude oil is bright red by transmitted, and dark green by reflected light. Its specific gravity at 15° C. is 0.9095; at 70° C., 0.8755; flashing point (open cup), 210° C.; burning point, 260° C.; viscosity (Engler) at 20° C. (water = 1), 15.74; at 100° C., 1.49. No paraffin is deposited on cooling, and the oil remains liquid at -17° C. The chemical composition has not yet been studied, but judging from the violent action of concentrated acids, a large proportion of unsaturated hydrocarbons seems probable. The heating power is 10,813 calories per gm.

Details are given of experimental distillations, with and without superheated steam, air condensers being used for fractionating; and the authors consider that the best results, seeing that the oil is naturally suited for the production of lubricating oil, will be obtained by a process of continuous distillation on the lines of the Russian method, "cracking" being prevented by the use of superheated steam, which has been found to increase the yield of distillate with a sp. gr. of 0.900—0.925 from 22.94 to 29.98 per cent., a gain of 7 per cent., and of that of higher specific gravity than 0.925 from 4.96 to 12.53 per cent., a gain of about 7½ per cent. At present two chief grades of lubricating oil are manufactured, viz.:—

	Specific Gravity.	Viscosity at 20° C.	Flashing Point.
Car oil	0.9065	15.05	Above 215° F.
Engine oil	0.9125	25.17	" 273° F.
	Burning Point.		Cold Test.
Car oil	Above 265° F.		Below -17° C.
Engine oil	" 325° F.		" -15° C.

—C. S.

Tar and Petroleum Oils, Action of Aluminium Chloride on; Theory of Formation of Petroleum. F. Reusler. *Zeits. f. angew. Chem.* 1896, **11**, 318—321.

It may be stated generally that the action of aluminium chloride upon a mixture of saturated, unsaturated and sulphur-containing hydrocarbons may be so directed that the removal of the last two classes may be achieved. Apart from the practical value of this observation, it is of interest to know of the existence of a reaction, which apparently is capable of affording means for determining the percentage of saturated hydrocarbons even in mixtures of very various composition. Armed with this knowledge, one may determine the proportion of unsaturated substances in crude petroleum distillates or in petroleum badly refined or adulterated with oils from brown coal and shale distillation.

With regard to the theory of the origin of petroleum, the author endeavours to elaborate Engler's hypothesis. On treating some of Engler's distillate, boiling from 100° to 120° C., with aluminium chloride, about 60 per cent. of saturated hydrocarbons were left unattacked, the remainder of the material being converted into a resinous mass. A highly viscous oil boiling at 190° to 280° C. under 15 mm. pressure and resembling an ordinary mineral lubricating oil, was also isolated. The following percentages of saturated hydrocarbons were found in various mixed raw materials:—Brown coal-tar, 61.5 per cent.; shale oil, 62 per cent.; fish-oil distillate (according to Engler), 61 per cent.; petroleum from Alsace, 95 per cent.; Ohio petroleum, 97 per cent. From these results the author deduces that the fish-oil distillate of Engler approaches a shale oil rather than a true petroleum, but that from it can be prepared oil precisely similar to that characteristic of true petroleum. Accepting Engler's main hypothesis, the natural formation of petroleum may be considered as taking place in two stages, viz., (1) the resolution of fats by distillation under pressure; (2) the removal of the unsaturated bodies by a process corresponding with that formulated by the author. Whether aluminium chloride or some other agent was concerned in this change cannot be definitely stated.

With regard to the presence of naphthenes in certain petroleum, it may be noted that these hydrocarbons have been found in the distillation products of brown coal and in those of Scotch shale. Bituminous substances therefore exist which are capable of yielding this particular class of petroleum hydrocarbons on being subjected to destructive distillation.—B. B.

Wood, Yield of Charcoal, Methyl Alcohol, and Acetic Acid from Different Kinds of. E. Barillot. *Rev. de Chim. Ind.* 1896, **7**, [76], 100—102.

Two series of experiments were carried out—one in the laboratory and the other on a manufacturing scale, as mentioned this Journal, 1896, 346 and 347.

For the laboratory experiments, retorts of a capacity of $\frac{1}{2}$ cb. m. were used, which were connected with a condenser, and the liquid portions, pyroligneous acid and tar, were collected in a tared receiver. The gaseous products, by means of an exhauster, were conducted through a scrubber charged with coke, where the ascending gases met a fine spray of descending cold water. The greater part of the acid, alcohol and acetone, which escaped condensation was here absorbed. The liquid from the scrubber was then collected for analysis, so as to determine the proportion of useful products lost in actual manufacture.

The method of analysis was as follows:—After saturating the acid with milk of lime, the alcohol was distilled off according to the directions of Gay-Lussac, that is, until 50 per cent. of the original volume had passed over. But, in order to recover all the alcohol present in the crude liquor, the residue, after having been slightly acidified with sulphuric acid, was submitted to a further distillation until another 50 per cent. passed over. The distillate was purified by fractional distillation over an excess of lime until a clear spirit of 96°—98° (alcoholometric degrees) was obtained. This crude alcohol still contained the ethers and acetones produced from the wood, but are included in and returned as methyl alcohol in the first table, page 347.

The acid was titrated with normal soda, using phenolphthalein; and though there are also other acids present in the crude liquor, they are here, for purposes of comparison, all included as acetic acid, and in the table following as calcium acetate. All the quantities given, represent the yield from 100 kilos. of wood, and must be regarded as maxima, as they were obtained by slow and very regular distillation. The results demonstrate that for the production of alcohol, mixtures of barked beech and elm are to be preferred to either round or split cord-wood, and the latter to split beech. For the production of charcoal, white woods should be rejected.

In the experiments on the large scale the same methods were employed as those used in the laboratory experiments. See second and third tables, page 347.—I. S.

IV.—COLOURING MATTERS AND DYES.

Solvents, Some New [for Induline Dyestuffs]. Ch. Gassmann. *Mém. Scient.* 1896, **10**, 348—350.

The author refers to the use of levulinic acid (Ger. Pat. 34,515) and of the acetyl derivatives of glycerin (Ger. Pat. 37,064) as solvents for the indulines. The high price of the former tells against its employment in practice. Whilst the acetyl derivatives of glycerin give excellent results, it is curious that the formic derivatives are not satisfactory. The latter are readily obtained by heating glycerin with either oxalic or formic acid, and the product readily dissolves the indulines; after some time, however, the solution becomes of a greenish colour. This change may be due either to a reduction of the induline at the expense of the COH group or to a condensation resulting in the formation of a di- or triphenylmethane derivative. Glyceryl-acetal, obtained on heating a mixture of glycerin and acetic aldehyde, is also a good solvent for the indulines, but this solution also becomes greenish, and the results obtained on printing are very unsatisfactory. On the other hand, good results are obtained with the glyceride of levulinic acid and its acetyl derivative. These compounds dissolve 25—30 per cent. of induline, and on printing with these solutions, good and regular shades are obtained. The glyceryl derivative of tartaric acid dissolves 40—45 per cent. of induline at 130°—140°. The pastes obtained, do not precipitate on dilution with water or acetic acid, and are satisfactory for printing. The product of its acetylation dissolves 25—30 per cent. of induline.

The above solvents are not satisfactory in the case of the rosindulines or of naphthaeridine.—A. K. M.

Thiorescinol. O. Hesse. *Ann.* 1895, **289**, 61—70.

Thiorescinol [$110.C_6H_4.O.C_6H_4.O.C_6H_4.OH$] is formed by heating (at 85° for 72 hours) resorcinol (4 grms.) with glacial acetic acid (4—6 c.c.) and fuming hydrochloric acid (4 c.c.). It is thus obtained (yield, about 60 per cent. of the theoretical) in combination with hydrochloric acid, from which it is freed by boiling with water.

It is also produced in small quantity, instead of the corresponding diamido compound, when resorcinol (one part) and *m*-amidophenol (two parts) are heated together under the above conditions.

It forms (+ $2\frac{1}{2}$ H₂O) small prisms, which appear yellow by transmitted, and dark purple by reflected light, with a metallic lustre. It is sparingly soluble in cold water, alcohol, &c., its solutions displaying an intense green fluorescence, and it dyes from an alkaline bath, cotton and silk, mordanted with tannic acid, and unmordanted wool, a fast yellow colour. It decomposes at above 130° without melting.—E. B.

Dimethyl-m-amidophenol, Reactions of. L. Lefèvre. *Bull. Soc. Chim.* 1896, **15**, 900—904.

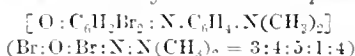
The author does not confirm v. Rothenburg's conclusions (*J. prakt. Chem.* **51**, 578; this Journal, 1895, 992), and points out that resorcinol when heated on the water-bath does not give a fluorescent substance and that this is only formed in presence of a condensing agent and at temperatures above 100° C. Hence v. Rothenburg's test for the position of a carboxyl group requires further investiga-

tion. Several reactions of dimethyl-*m*-amidophenol are described, the substance itself being obtained by fusing dimethylaniline-*m*-sulphonic acid with an alkali. It melts at 83°–85° C. and boils at 265°–268° C. (Ger. Pat. 44,702). When heated for 3–4 hours at 145°–150° C. the residue dissolves easily in very dilute hydrochloric acid, and after filtering, a red fluorescent solution is obtained somewhat similar to that of rhodamine, but the shade on silk has neither the brilliancy nor the strength of that colouring matter. A somewhat stronger colouring matter can be obtained by employing zinc chloride. Neither pyrocatechol, hydroquinone, salicylic acid, nor β -resorcylic acid give colouring matters with dimethyl-*m*-amidophenol, and the two latter substances give off carbonic acid during condensation. The condensation product obtained with benzoic acid is not a phthalein but is similar in its tinctorial properties to the rosanilines which are obtained by the action of phenylchloroform on dimethyl-*m*-amidophenol. Certain fatty acids, such as citric or tartaric acid, give colouring matters on heating with dimethyl-*m*-amidophenol, but these will require further investigation to determine whether they can be classed as phthaleins.—T. A. L.

Quinazine and Oxazine Dyestuffs, Researches on. R. Möhlau and K. Uhlmann. Ann. 1895, 289, 90–130.

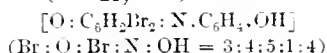
THE authors adopt the nomenclature for the indamine, indophenol, and allied compounds, proposed by Nietzki (Ber. 25, 2994; this Journal, 1893, 137), that is, the names azine and azone to designate colouring matters, the chromophors of which are nitrogen atoms in the *p*-positions to nitrogen and oxygen atoms respectively, their derivatives being termed oxazines, thiazines, oxazones, &c.

Basic Azones.—*Dimethylamidodibromodiphenazone*—



is obtained by the action of dibromoquinonechlorimide (m.pt. 78°) on dimethylaniline. It decomposes, when heated, without melting; is insoluble in water, with difficulty soluble in cold alcohol and ether, more readily in hot alcohol, acetic acid, &c.; it crystallises from pyridine in needles; dissolves in dilute acids (in alcohol, &c.) and in concentrated sulphuric acid with a blue colour, the solutions changing colour on the addition of water, owing to the azone decomposing: it is completely decomposed by prolonged boiling with dilute hydrochloric acid into ammonia, dimethylamine, dibromo-*p*-amidophenol, dibromoquinone and quinone.

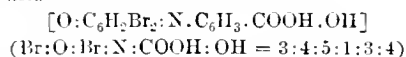
Phenolic Azones.—The sole representative of this group hitherto known has been the *p*-hydroxydiphenazone prepared by Hirsch (Ber. 13, 1907). Its dibromo-derivative—



is produced by the interaction of dibromoquinonechlorimide and phenol, and resembles it closely. Both compounds are very sensitive to acids.

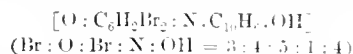
To ascertain whether the stability towards acids of the members of the group could be increased by introducing into the molecule acidic groups, such as COOH, or by increasing the molecular weight, compounds were prepared from dibromoquinonechlorimide and salicylic acid and α -naphthol respectively (β -naphthol was found not to react with the formation of a colouring matter).

The first of these—*o*-hydroxydibromodiphenazonecarboxylic acid—



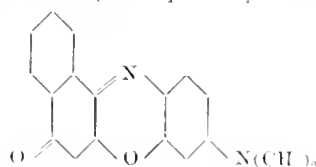
—forms a brown-red powder, which dissolves with difficulty in water and chloroform, but easily in alcohol and ether. It is decomposed when heated with acids. Its sodium salt is insoluble in ether, but very soluble in water and alcohol, the colour of the solutions being bluer than those of hydroxydibromodiphenazone. Like the latter, it gives a pale brown-red solution when heated with dilute alkalis, which, on cooling and exposing to air, becomes blue.

The second compound—*hydroxy-naphthodibromodiphenazone*—



—crystallises in brown-red needles; decomposes, without melting, at about 201°, and is soluble in alcohol and ether with an orange colour, but insoluble in water; acids decompose it on heating. Its sodium compound is readily soluble in water and alcohol with a purple-blue colour (redder than that of the solutions of the sodium salt of the compound last described), and is insoluble in ether. The aqueous solution does not change colour on adding alkalis and heating.

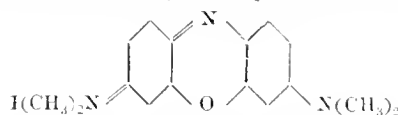
Oxazines.—*Dimethylamidophenonaphthoxazine*—



is formed when nitroso-dimethyl-*m*-amidophenol hydrochloride and α -naphthol are boiled together in acetic acid solution. The base crystallises from pyridine in long prisms which display a beautiful green surface-lustre, and appear by transmitted light reddish-brown. It melts at 244°, is insoluble in water, soluble in hot alcohol, chloroform, &c., with a cherry-red colour and scarlet fluorescence. It forms two series of salts, both of which are dissociated by water; of these, the monacid salts may be isolated (from chloroform) and are stable in dry air.

The diethyl compound is very similar to the foregoing.

Oxazines.—*Tetramethylamidophenonaphthoxazine iodide*—



is of interest, on account of its relationship to Methylene blue. It is obtained (in very small quantity) by the interaction of dimethyl-*m*-amidophenol and nitroso-dimethyl-*m*-amidophenol hydrochloride in acetic acid solution, and conversion of the resulting easily soluble chloride into the less soluble iodide, by the addition to its solution of potassium iodide. It is soluble in water, acetone, and chloroform, with a blue colour and powerful brown-red fluorescence; it is not affected by dilute acids, ammonia or caustic soda in the cold; the latter on heating give a blue precipitate, doubtless of the free base. It is dissolved by concentrated sulphuric acid with a brown-red colour, which changes to blue on the addition of water.—E. B.

Violet and Blue [Triphenylmethane] Colouring Matters. A Method for Preparing. Weinmann (J. R. Geigy and Co.). Bull. Soc. Ind. Mulhouse, 1896, 201.

A SEALED note, deposited February 16, 1885.

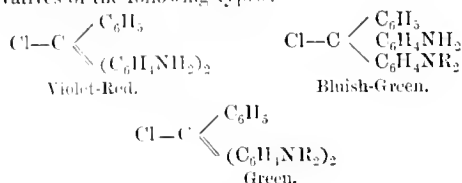
It describes the production of colouring matters by the conjoint oxidation of tetramethyldiamidodiphenylmethane and certain aromatic amido bases, namely:—diphenylamine, from which a blue-violet dyestuff was obtained, which, it was found, could be readily sulphonated; dimethylaniline, the product from which was a crystallisable violet dyestuff; and phenyl- α -naphthylamine, which yielded a soluble blue dyestuff, from which a sulphonic acid derivative was prepared. Colouring matters were also prepared from primary aromatic amines, which were employed in the form of their acetyl derivatives.

The intermediate formation of tetramethyldiamidodiphenylcarbinol or of tetramethyldiamidobenzophenone was not observed.—E. B.

Hydrols [Diphenyl Carbinols] and Aromatic Amines, Condensation of, in presence of Concentrated Sulphuric Acid. M. Prud'homme. Bull. Soc. Chim. 1896, 717–720.

By condensing *p*-nitro-amido diphenyl carbinol (benzhydrol) with benzylaniline, dibenzylaniline, or ethyl-benzylaniline

in presence of concentrated sulphuric acid, violet-red colouring matters are obtained, very different from the more or less bluish fuchsines produced when the condensing agent is hydrochloric acid and alcohol. Nitrodiethylamidodiphenyl carbinol gives bluish-greens, whilst tetramethyldiamidodiphenyl carbinol, on condensation with the above bases, gives leuco compounds which on oxidation yield pure greens. These three series of colouring matters are derivatives of the following types:—



where R is an alcoholic radical $\text{CH}_2\text{C}_2\text{H}_5$, &c. A compound of the second type has been prepared by dissolving *p*-nitro-diethylamidodiphenylcarbinol in a mixture of equal weights of benzene and sulphuric acid, and allowing the whole to stand for 48 hours at the ordinary temperature. The triphenylmethane derivative, after separation from the benzene, is converted into a bluish-green colouring matter by the author's method for the synthesis of *p*-fuchsine. The influence of the condensing agent in determining the position at which condensation takes place was first pointed out by Noetting, who showed that with tetramethyldiamidodiphenyl carbinol and *p*-toluidine, the condensation occurs in the *meta* or *ortho* position relative to the amidogen, according as to whether hydrochloric or sulphuric acid is employed. In the latter case the colouring matter obtained is a bluish-green, which on benzylation gives a greenish-blue. The direct condensation of the carbinol with dibenzyl-*p*-toluidine in sulphuric acid gives a pure green. It is assumed that in this case the condensation takes place in the benzyl and not in the benzene nucleus; and as a matter of fact, on condensing benzylamine with the carbinol in presence of sulphuric acid, a base is obtained which gives a green on oxidation. Benzylamine can also be condensed with *p*-nitrodiethylamidodiphenyl carbinol by means of sulphuric acid, and subsequent reduction and oxidation gives a corresponding colouring matter, *viz.*, a bluish-green, but no condensation of benzylamine, and any of the three carbinols mentioned above could be effected by means of hydrochloric acid and alcohol. Hence benzylamine in its condensations behaves like an aromatic hydrocarbon, and is, in fact, a toluene substituted in the side chain. Benzylaniline, dibenzylaniline, and ethylbenzylaniline in presence of concentrated sulphuric acid act like dibenzyl-*p*-toluidine and benzylamine. The corresponding colouring matters may be considered as diamidotriphenylmethane derivatives, giving violet-red, bluish-green, or green shades, according as to whether the amidogens are unsubstituted or are partially or wholly so. With regard to the manner in which the condensation takes place, some light is thrown on this by a condensation, carried out by the author, of tetramethyldiamidodiphenyl carbinol and diethylaniline. Equal parts by weight of these two substances are heated with 15 parts of concentrated sulphuric acid for 24 hours to 95–100° C. The melt is then poured into water and steamed, to expel the excess of diethylaniline. The leuco base so obtained, after oxidation with acetic acid and peroxide of lead, gives a colouring matter which dyes wool and silk blue. It is, however, a mixture of a violet and a green, which can be separated by salt, the former being precipitated. The violet corresponds to a normal condensation para to the amido group, whilst the green corresponds most probably to a condensation in the ortho position. It would thus appear that condensations between a hydroxyl (carbinol) and an amine take place in presence of concentrated sulphuric acid, and preferably in the para position when this is unoccupied.—T. A. L.

Benzylated Parafuchsines. M. Prud'homme. Bull. Soc. Chim. 1896, 720–723.

By condensing *p*-nitro-amidodiphenylcarbinol, *p*-nitrodiethylamidodiphenylcarbinol, and *p*-nitrobenzaldehyde with mono-

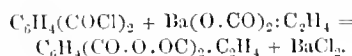
and dibenzylaniline and with ethylbenzylaniline in alcoholic solution by means of hydrochloric acid, nine new fuchsines have been obtained. The colouring matters produced are either bluish fuchsines or reddish-violets, but the effect of the benzylation as regards blueness, although analogous, is inferior to that of a methylation. The increase in molecular weight does not appear to have a preponderating effect; thus dibenzylaniline has less effect than ethylbenzylaniline. With a view of testing the applicability of this rule to parafuchsines benzylation in three nuclei, the author has condensed ethylbenzylaniline with *o*-formic ether in presence of zinc chloride. The leuco base is oxidised with chloranil and the colouring matter obtained is a violet intermediate between hexamethyl and hexa-ethyl violet. Hence benzylation is equivalent to methylation, that is to say, the C_6H_5 group in $\text{C}_6\text{H}_5\text{CH}_2$ is without action on the colour, and it would appear that this difference between the phenyl and benzyl derivatives is due to the fact that, in the former case, C_6H_5 is directly united to nitrogen, whilst, in the latter, CH_2 is interposed.—T. A. L.

PATENTS.

Phthaleins, Manufacture of, by the Action of Mixed Anhydrides [Rhodamines]. A. Fischesser and Co., Lutterbach, Germany. Eng. Pat. 13,949, July 22, 1895.

THE manufacture of phthalein colouring matters by the action of mixed acid anhydrides on resorcinol, *m*-amidophenol, cresol, and their alkyl and phenyl derivatives is claimed, also the colouring matters so produced.

The mixed anhydrides are obtained by the action of the chloride of one acid on a salt of the other in molecular proportions; thus, phthalyl succinyl anhydride by the following reaction:—



The anhydride condenses with the phenol on heating the two together without dehydrating agents. The new rhodamines obtained by this process produce on wool and silk fine bluish-red shades, extremely fast to acids, soda, soap, air, and light. They are well suited for cotton dyeing.

—A. C. W.

Dyestuffs [Basic] and Chemical Compounds derived from Phenolic Bodies, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 14,488, July 30, 1895.

ACCORDING to Eng. Pat. 8988 of 1895 (this Journal, 1896, 349), new products were obtained by the action of phenols or naphthols on primary or secondary fatty amines in presence of formaldehyde. These products had the general formula $\text{O.C}_6\text{H}_5:\text{N.R}:\text{C}_2\text{H}_5$, R being an alkyl group. Thus, for instance, the action of dimethylamine on phenol in presence of formaldehyde yields dimethyl-*exo*-amidomethylphenol ether, $\text{C}_6\text{H}_5\text{O.CH}_2\text{N}(\text{CH}_3)_2$. It has now been found that such products can be converted into isomeric compounds, that last mentioned yielding hydroxybenzyl-dimethylamine, $\text{HO.C}_6\text{H}_4\text{CH}_2\text{N}(\text{CH}_3)_2$. In order to carry out this reaction, the products are heated either alone or in presence of a solvent or diluent together with the addition of a small quantity of an alkali, or an acid, or of certain salts. The following is a typical example:—An alcoholic solution of 2.1 kilos. of *p*-acetamidodimethyl-*exo*-amidomethylphenol ether, $\text{CH}_3\text{CONH.C}_6\text{H}_4\text{OCH}_2\text{N}(\text{CH}_3)_2$ (obtained from 1.5 kilos. of *p*-acetamidophenol, 0.8 kilo. of a 40 per cent. formaldehyde solution, and 0.9 kilo. of a 50 per cent. dimethylamine solution), is heated on the water-bath until a sample dissolves in caustic soda-lye. The resulting product has the formula—

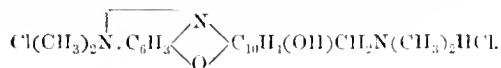


and melts at 110° C. This process can also be applied for the production of colouring matters, and several new basic dyestuffs have thus been obtained. For instance, 1.35 kilos. of a 33 per cent. dimethylamine solution and 0.75 kilo. of a 40 per cent. formaldehyde solution, are run into 20 litres of alcohol containing 1.98 kilos. of benzene-azo-phenol. The mixture is cohobated on a water-bath for

several hours until the action is complete. After distilling off the alcohol, the residue is dissolved in hydrochloric acid, and the hydrochloride of the colouring matter is salted out and filtered off. It has the formula—



and dyes cotton mordanted with tannin, yellow shades fast to alkalis. In a similar manner, muscarine (obtained from nitrosodimethylaniline and 2,2'-dihydroxynaphthalene) can be converted into a new colouring matter. For this purpose, 3.26 kilos. of it mixed with 30 litres of alcohol are cohabited as above with the same quantity of dimethylamine and formaldehyde. The new dyestuff is separated in the same manner. It is more soluble than muscarine, and tanned cotton dyed with it gives blue shades fast to alkalis. The new product has the formula—



—T. A. L.

Azo Colouring Matters [Yellow to Brown], and of New Bases for Use therein, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Bräuning," Höchst a/M., Germany. Eng. Pat. 11,494, July 30, 1895.

THE new bases referred to are amido-ammonium bases of the general formula $\text{H}_2\text{N}\cdot\text{A}\cdot\text{N}(\text{X})_2$, where A is an aromatic radicle, R is an alkyl group, and X is a halogen. These products are obtained by reducing the corresponding nitro-ammonium bases or the azo-ammonium bases, or even by alkylating diamines in which one amido group is protected by an acetyl group, which is subsequently split off. The nitro-ammonium bases are obtained by alkylating the nitro bases, or nitrating the corresponding ammonium bases. About 2 kilos. of *m*-nitrophenyltrimethyl ammonium chloride are mixed with 5 litres of water and 5 kilos. of hydrochloric acid and reduced with 2 kilos. of zinc turnings. On concentrating, the zinc chloride double salt of *m*-amido-phenyltrimethylammonium chloride separates out. It may be freed from zinc by adding the calculated amount of sodium carbonate, filtering, evaporating, and extracting with alcohol, when the product forms colourless tablets readily soluble in hot alcohol and water. The following is an example of another method employed:—*p*-Acetyl-amido-dimethylaniline, melting at 130°C ., is heated on the water-bath with one molecular proportion of methyl iodide. The resulting *p*-acetamidophenyltrimethylammonium iodide is tolerably soluble in water and melts at 325°C . The corresponding chloride melts at 215°C ., and crystallises in small scales from alcohol. On boiling with 6–10 per cent. hydrochloric acid it yields *p*-amidophenyltrimethylammonium, and the double zinc salt may be precipitated from the solution by means of zinc chloride, or the solution may be employed directly for the production of azo colouring matters. By nitrating β -naphthyltrimethylammonium in concentrated sulphuric acid, the resulting nitro- β -naphthyltrimethylammonium sulphate yields, when reduced with zinc and hydrochloric acid, amido- β -naphthyltrimethylammonium chloride, which gives a sparingly soluble zinc chloride double salt. All these amido-ammonium bases can be diazotised and combined with phenols and amines in the usual manner; for instance: 1 kilo. of the zinc chloride double salt of *m*-amidophenyltrimethylammonium dissolved in 10 litres of water is diazotised with 0.7 kilo. of concentrated hydrochloric acid and 0.195 kilo. of nitrite. When combined with β -naphthol in presence of acetic acid, a yellowish-red powder is produced. By substituting resorcinol for the β -naphthol either a mono- or disazo colouring matter can be obtained. The process can be further modified by forming first of all amido-azo colouring matters, which subsequently are converted into ammonium azo colouring matters. For instance: diazotised dimethyl-*p*-phenylenediamine is combined with β -naphthol, and the resulting *p*-dimethylamidobenzene-azo- β -naphthol is heated with methyl iodide at 90° – 100°C . The original dark blue mass is converted into an orange-yellow product soluble in water. All the colouring matters produced according to the

preceding methods dye tanned cotton yellow and reddish-yellow to brown shades. The specification contains a table showing various dyestuffs obtained and some of their reactions.—T. A. L.

Anthraquinone Derivatives, The Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 14,686, Aug. 2, 1895.

THE introduction of hydroxyl groups into anthraquinone is covered by the following patents:—Eng. Pats. 8725, 12,715, 17,712, and 18,729 of 1890 (this Journal, 1891, 567, 759, and 917); 4871, 13,677, and 21,717 of 1891 (this Journal, 1892, 513, 749, and 1000); 1657, 12,579, and 12,580 of 1892 (this Journal, 1893, 142 and 596); 14,345 of 1893 (this Journal, 1894, 723); and 973, 974, 975, 2325, and 3113 of 1894 (this Journal, 1895, 30,144, and 146). According to the present specification the process can also be carried out by the use of perchloric acid or its salts, the following being typical examples:—10 kilos. of potassium perchlorate are carefully stirred into a hot solution of 10 kilos. of anthraquinone in 200 kilos. of fuming sulphuric acid containing 20 per cent. of SO_3 , the temperature being kept below 150°C . The first products are quinizarin and the like, but these are further oxidised, yielding hexahydroxyanthraquinone sulphonic acid, and the product can be separated from the melt in a suitable manner. 6 kilos. of potassium perchlorate are stirred into a solution of 10 kilos. of alizarin in 200 kilos. of the above fuming acid, the temperature being kept below 30°C . After stirring for some hours, the melt is poured into 2,000 litres of ice-water containing 10 kilos. of sodium bisulphite. The whole is then boiled and filtered, the residue consisting of hexahydroxyanthraquinone, which may be purified in a suitable manner.—T. A. L.

Black Colouring Matters of the Anthraquinone Series suitable for Directly Dyeing Cotton in the Cold Bath, The Manufacture and Production of. J. Y. Johnson, London. From the "Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 15,242, Aug. 13, 1895.

IN Eng. Pat. 10,996 of 1893 (this Journal, 1894, 630), the action of alkaline reducing agents on the dinitronaphthalenes is described, giving rise to black cotton dyestuffs. By applying this process to the dinitro-anthraquinones, diamido-anthraquinones, or to the intermediate products obtained by the action of alkaline sulphides on nitro derivatives of anthraquinone, black colouring matters are produced, which dye cotton directly from a cold alkaline bath in shades fast to light, acids, soap, or chlorine. The products are soluble in water, giving bluish-green or violet-blue solutions which are precipitated by acids. About 250 kilos. of crystallised sodium sulphide are heated with 75 kilos. of sulphur until saturated, when about 50 kilos. of 1,4-di-*o*-nitro-anthraquinone are added, and the whole is heated until a sample is completely soluble in water. The resulting solid mass may be used directly for dyeing, or suitably purified. It dissolves in water with a blue colour, in concentrated sulphuric acid with a greyish-black, and in alcohol with a green colour, but it is insoluble in acetone. Mineral acids or acetic acid precipitate the aqueous solutions, and the precipitate is readily soluble in alkalis and alkaline sulphides, the solutions dyeing cotton black.

—T. A. L.

Colouring Matters of the Rosinduline Series, Manufacture of. C. D. Abel, London. From "The Aetien-Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 16,217, Aug. 29, 1895.

THESE colouring matters can be obtained by the oxidation of equimolecular proportions of α -naphthylamine and *o*-amidodiphenylamine sulphonic acid or derivatives of these substances. Corresponding rosinduline derivatives may also be obtained by heating together α -naphthylamine and *o*-nitrodiphenylamine sulphonic acid. The two following examples illustrate these methods:—A mixture of 17.1 kilos. of ethyl- α -naphthylamine and 26.5 kilos. of *o*-amidodiphenylamine sulphonic acid dissolved in dilute hydro-

chloric or acetic acid is treated with ferric chloride solution or with a solution of 20 kilos. of sodium bichromate. The ethylsulphadine sulphonic acid, which is sparingly soluble in water, separates out. 25 kilos. of α -naphthylamine, 10 kilos. of α -naphthylamine hydrochloride, 16 kilos. of nitrodiphenylamine sulphonic acid, and 5 kilos. of zinc chloride are well stirred together and heated for 4–5 hours at 140°–150° C. After cooling, the melt is powdered and extracted with dilute hydrochloric acid, when the rosinduline sulphonic acid remains undissolved as a greenish powder. It is sparingly soluble in soda-lye and dilute acids. The rosinduline derivatives thus obtained may be converted into readily soluble sulphonic acids by subsequent sulphonation.—T. A. L.

Dis- and Polyazo Dyes [Cotton Dyes] by Oxidation, Impts. in the Manufacture of. B. Willeox, London. From the "Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 17,260, Sept. 16, 1895.

This is an improved method of obtaining the colouring matters produced according to Eng. Pat. 12,303 of 1895 (this Journal, 1896, 351). For instance, in the manufacture of Congo red, benzene azo-naphthionic acid was oxidised in sulphuric acid solution by manganese peroxide. The patentees, according to the present specification, carry out the oxidation by means of an electric current, the following details being given:—A solution of about 50 kilos. of α -toluidine-azo-naphthionic acid (sodium salt) in 750 kilos. of 91 per cent. sulphuric acid is placed in a porous cell containing the positive electrode of platinum or other suitable material. The porous cell stands in another vessel containing concentrated sulphuric acid and the negative electrode. A current of about 4 amperes per sq. dec. at 5–6 volts is then passed through the cell until no further change of mono- to disazo-dyestuff takes place. The solution is then poured on to ice, filtered, washed, and converted into the sodium salt.—T. A. L.

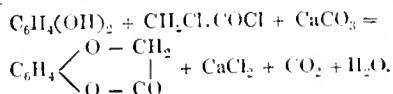
Mangrove Bark, Impts. relating to the Treatment of, for the Obtainment therefrom of Pure Solid Tannin, Dye, and Cutch. W. Clarke, Singapore. Eng. Pat. 17,402, Sept. 18, 1895.

MANGROVE bark, either dry or fresh, and in small pieces, or pulverised, is boiled in water for 12 hours, more or less. The strained-off liquor is evaporated to half its bulk, and to it is added a suitable quantity of "either ammonia, potash, soda, or any other alkali or alkaline carbonate, mercurial chloride, gum ammoniacum, alum, or borax." The boiling is now continued until a semi-solid mass is obtained, which is then cut into suitable pieces and dried by sun heat, or otherwise.

To obtain 1 picul = 133½ lb. of "solid tannin, dye, or cutch," 533½ lb. of bark are treated with 150 gallons of water, and 30 oz. of alum, or 20 oz. of borax or fixed alkali, or 5 oz. of "mercurial chloride," gum ammoniacum, or ammonia, are added.—E. R. B.

Pyrocatechin-anhydro-monoacetic Acid, Processes for the Manufacture of. Chemische Fabrik von Heyden, Radebeul, Germany. Eng. Pat. 8154, April 17, 1896.

THE above substance is claimed as a new product, with the following processes for its manufacture. Pyrocatechin is heated with monochloroacetylchloride and precipitated chalk:—



Also pyrocatechinmonoacetic acid, its esters, or amide, on heating, yield the anhydro acid.—A. C. W.

Black Azo Dyestuffs on the Fibre, Process for Producing. E. Ritter von Portheim, Prague, Bohemia. Eng. Pat. 9912, May 9, 1896.

THE process consists in impregnating the cotton fibre with sodium- β -naphtholate and applying the diazo compound of an amidochrysoidine. The proportions employed for producing the diazo compound are given in the following

example:—A mixture of 5.3 kilos. of amidochrysoidine (triamido-azobenzene), 7 kilos. of hydrochloric acid (sp. gr. 1.2), 75 litres of water, and 45 kilos. of ice, is diazotised by adding a concentrated solution of 1.78 kilos. of sodium nitrite. The diazo solution is mixed with 110 kilos. of acetic starch paste, 5.3 kilos. of oxalic acid, and 2.4 kilos. of sodium acetate. It is claimed that deep shades can be obtained which are fast to light.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Vegetable Textile Fibres, Lignification of. A. Herzog. Chem. Zeit. 1896, 20, 461.

THE amount of lignin in the various fibres named below was determined by Zeisel's method, as amended by Benedikt, Hamberger, and Grüssner, the methyl number of pure lignin being taken as 52.9:—

Nature of Fibre.	Water.	Lignin in Fibre Dried at 100°
SEED-HAIRS:—		
Cotton, <i>Gossypium barbadense</i> (Sea Island).....	Per Cent. 7.40	Per Cent. ..
Cotton-silk, <i>Bombax speciosa</i>	6.77	12.90
" <i>Calotropis gigantea</i>	6.68	15.46
Typia angustifolia.....	7.07	18.08
(MONOCOTYLEDONOUS.) FIBRE BUNDLES:—		
Manilla hemp, <i>Musa textilis</i> (hackled).....	7.81	30.11
Agave americana (hackled).....	7.10	16.02
Aloe, <i>Aloe perfoliata</i> (hackled).....	7.90	17.22
Cocoa-nut, <i>Cocos nucifera</i>	7.36	41.59
Tillandsia, <i>Tillandsia usneoides</i>	8.19	21.13
(DICOTYLEDONOUS.) BAST FIBRES:—		
Common nettle, <i>Urtica dioica</i> (bleached).....	8.15	..
China grass, <i>Boehmeria nivea</i>	7.84	1.46
Jute, <i>Corchorus capsularis</i>	8.06	40.26
Paper mulberry, <i>Morus papyrifera</i>	6.03	4.74
Linen, <i>Linum usitatissimum</i> (Russian) (imperfectly retted) (broken).....	8.40	0.92
Linen (Belgian; Courtrai) (hackled).....	8.71	..
Hemp, <i>Cannabis sativa</i> (Italian) (hackled).....	7.93	5.33
Hemp, <i>Cannabis sativa</i> (Polish) (hackled).....	8.20	5.41

The fibres examined, with the exception of those of the common nettle, were in the unbleached state. As is well known, a portion of the lignin is removed in the process of bleaching.

The lignin imparts harshness to the fibres, and unfavourably affects their elasticity and suppleness.

It is pointed out that, as unbleached hemp and linen are widely differentiated by their methyl values, the determination of the latter will afford a sure means of distinguishing these fibres from each other.—E. B.

Carbon Tetrachloride [Solvent] as a Substitute for Petroleum Spirit. Neueste Erfind. u. Erfahrungen, 1896, 3.

CARBON tetrachloride, by reason of its solvent action on tar, grease, paraffin, stearin, &c., and the unflammable nature of its vapour, is well calculated to replace petroleum spirit for cleansing purposes. It may also be used in conjunction with the latter substance, since the inflammability of the petroleum spirit is considerably reduced, combustion being gradual and the flame greenish, with copious evolution of smoke. The tetrachloride also combines with absolute alcohol, ether, oils, and soaps, and is useful in the caoutchouc industry, for brocade printing, and bronzing. It combines with benzine soaps, and may, by suitable treatment, be invested with considerable washing power; this effect may be increased by the addition of ammonium chloride, and acetic acid may be added for preserving certain colours, both these ingredients being first mixed with alcohol.

Being heavier than water the latter may be used as a seal to prevent the evaporation of the tetrachloride.

In removing grease spots, carbon tetrachloride is preferable to petroleum spirit, since it does not leave marks round the edges of the greasy places.

Experiments on the behaviour of the tetrachloride towards woollen and silk stuffs dyed with aniline colours failed to reveal any action on the latter, and it is therefore assumed there would be no influence exerted on colour-shades. Satisfactory results were also obtained in testing the resistance of the various "finishing" materials for textiles.—C. S.

Cotton Warps. Sizing and Dressing, Alsation Methods of.
E. Ackermann and V. Ackermann. Rev. d. Chim. Ind. 1896, 7, [76], 102—104.

THERE are two methods of preparing cotton warps for weaving, technically known as "dressing" and "sizing." The former is used for the finer and the latter for coarser yarns. For "dressing," the composition is used tepid, and is applied by brushes moving in the same direction as the yarn, to give smoothness to the latter without the sizing completely effecting penetration. For "sizing," on the contrary, the yarn is passed through the composition, which is hot and less concentrated than in the former case, so that the yarn is saturated and retains a more or less woolly surface. The chief ingredient used for sizing in Alsace is farina, starch being seldom used on account of its high price. To this are added fatty or other substances, such as oil, tallow, soap, glycerin, &c., to give the cloth a soft handle, and glutinous substances (gum, dextrin, size) to give adhesiveness, but which must not be used in large quantities or the yarn becomes stiff and brittle. To prevent mildew, sulphate of copper or zinc is added to the size, and often also pipe-clay, kaolin, &c. In the following table are given some of the compositions used for dressing:—

No.	Water.	Farina.	British Gum.	Sulphate of Copper or Zinc.	Yellow Wax.	Glycerin.	Fermented Farina.
	Litres.	Kilos.	Kilos.	Kilos.	Kilos.	Litres.	Kilos.
1	100	8.30	0.250	0.084	..	..	..
2	"	20.00	1.900	0.250	0.530	0.250	..
3	"	16.00	0.600	0.250	0.500	0.250	..
4	"	10.00	0.150	0.150	..	..	..
5	"	12.00	0.100	0.200	..	..	1.200
6	"	7.00	..	0.200	0.200	..	..

No. 2 is used for yarns of Nos. 12—18, intended for cretonnes; No. 3 for those of 24—30 for twills; and 28—40 for figured cloth and crêpes. In general, larger quantities of farina are used for coarser threads. By experience it has been found that in "sizing," the yarn absorbs 15—30 per cent. of its weight of size and 6—12 per cent. in "dressing," or about 10—15 grms. per skein of 100 m. in the former and one-third of this quantity in the latter.

The following table gives a few formulæ of compositions used for sizing:—

Litres.	Kilos.	Kilos.			
700	100	Tallow.....	4.50	Soft soap	3 kilos.
"	"	".....	5.00	"	4 "
"	"	Gommeline ..	5.00	Glycerin	7 litres.
"	"	Glyxiogomme	2.00	"	8 "
"	"	Soda crystals	1.35	Tallow...	8 kilos.
"	"	Cornflower...	1.00	" ...	8 "

—L. S.

Tussah Silk, The Examination of, in Textile Fabrics.

F. Filsinger. Chem. Zeit. 20, 324.

See under XXIII., page 619.

PATENTS.

Peat Fibre, to be used for making Sheets or Laps of Fibre, Threads, or Surgical Dressings, An Impd. Process and Apparatus for the Preparation of. G. A. Cannot, London. Eng. Pat. 12,331, June 25, 1895.

THE peat fibres are washed in running water, in which they are agitated; then they are dried more or less completely, and, finally, are worked in carding engines.

The apparatus claimed for the first of these operations consists of a movable frame carrying rods or bars, arranged in a vessel provided with pipes for the supply and discharge of water, the bars on the movable frame passing, as the frame is raised and lowered, between similar bars on a frame affixed to the vessel.—E. B.

Flax and Hemp, Impts. in and connected with Retting.
G. Loppens and H. Deswarte, Nieuport, Belgium. Eng. Pat. 14,781, Aug. 3, 1895.

THE retting is performed in a tank with vertical sides and a perforated false bottom. Inlet and outlet water-pipes are placed between the bottom and false bottom, the first at a higher level than the second, their size being sufficient to allow the water to pass in and out without producing eddies or whirls.

The flax or hemp is made up into bundles, which are arranged vertically on the false bottom of the tank, and are prevented by suitable means from rising in the water.

In virtue of "the superior density of the juice given out by the stems," this sinks to the bottom of the tanks and is replaced by fresh water, uniform action being thus secured with the use of "a minimum supply of water."—E. B.

Wool, Cotton-Waste, and like Materials, Impts. in Degreasing and Cleansing, and in Apparatus therefor. F. N. Turney, Nottingham. Eng. Pat. 14,978, Aug. 8, 1895.

THE materials (loose wool, &c.) to be operated upon are laid upon a canvas band and wound with it upon a roller. The roll thus formed is placed inside an "air-lock," A, at the entrance end of a system of vapour tight tanks, a, in which the operations of cleansing or "degreasing" are performed, the object being to keep the apparatus, when closed, supplied for a considerable length of time with the materials to be treated.

(See next page for illustration.)

The materials, which, as the roll is unwound, fall away from the supporting band, are carried along progressively by endless travelling bands through the tanks, and are subjected to heating and squeezing while immersed in or saturated with the volatile solvent (carbon disulphide, "petroleum spirit," &c.) employed. They pass next into a drying chamber, B, being again deposited upon a series of endless travelling bands, and are dried in a current of hot air, the vapours escaping from the chamber passing through a condenser, for the recovery of the solvent. The dried materials are received in an "air-lock" at the exit end of the apparatus, whence they are removed after a sufficient quantity has accumulated therein.—E. B.

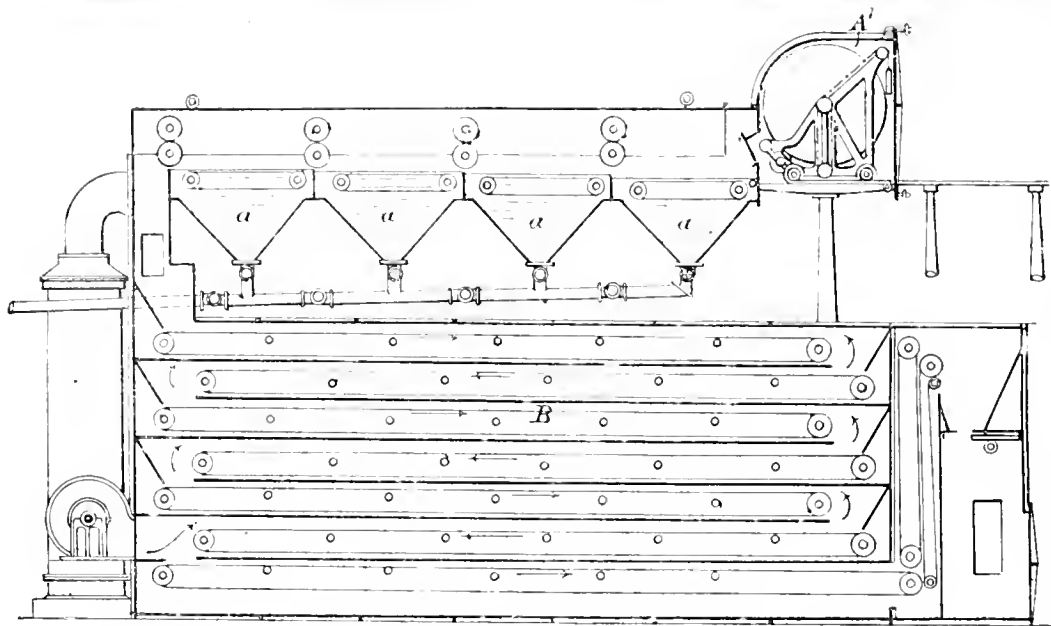
VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Textiles, Chemical Technology of; Report on the Progress made during 1895 in the. O. N. Witt and A. Buntrock. Dingl. Polyt. J. 300, 185—191.

Bleaching.—A continuation of report of 1895 (Dingler's Polyt. J. 295, 233). The reference there made to the combined ozone-hypochlorite process of bleaching (this Journal, 1895, 33) is now supplemented, the process having since been successfully tried in a Silesian linen bleach works (Oesterreichs. Wollen u. Leinen Ind. 1895, 746). Seven hours' ozonising is said to be equal to four days' "grassing" for a $\frac{1}{2}$ -bleach; for a full bleach the process is repeated three or four times. The tints obtained by the two processes vary slightly, the former giving a yellowish, and the latter a bluish-grey white.

To bleach satins composed of raw silk and unbleached cotton, L. Tabourin (Bull. Soc. Ind. Mulhouse, 1895, 351) recommends 10 per cent. barium peroxide suspended in water at 40°—60°. Hydrogen peroxide in alkaline solution is also said to give good results.

"Scrooping" Woollen Yarn.—A silky lustre and "handle" may be conferred on wool (Oest. Wollen u. Leinen Ind. 1895, 634) by the following process:—The cleansed and still wet material is treated for 10—30 minutes in a cold bath (for heavier yarns warm up to 70° C.)



[See page 589.] APPARATUS FOR DEGREASING AND CLEANSING WOOL, COTTON-WASTE, &c.

containing 5–10 grms. of sulphuric acid per litre. Hydro-extract, work 20–30 minutes in a cold solution of bleaching powder (5–15 grms. per litre), rinse well, soap 20–30 minutes at 30°–70°, with 5–10 grms. of soap to the litre, pass again through acid bath, rinse, and dye with acid colours to required shade. This process is said to intensify considerably the affinity of the wool fibre for colouring matters. Its felting properties, however, are diminished, whereby the use of the process is limited to knitting and hosiery yarns. It is stated that hard, lustrous mohair fibre is the most suitable for this treatment.

Silk.—E. Herzog (Färber Zeit. 6, 201) gives the following characteristics whereby to distinguish artificial (*Chardonnet's*) from natural silk. Artificial silk does not possess the crisp feel and crunching sound ("seroop") peculiar to boiled-off natural silk. In potassium hydrate solution artificial silk dissolves with a yellow colour, while the solution of natural silk is colourless. The behaviour of most other solvents is the same towards both fibres, with the exception of the alkaline copper glyceride solution (10 grms. of copper sulphate dissolved in 100 grms. of water and 5 grms. of glycerin, and just sufficient potassium hydrate to re-dissolve the precipitate formed), in which Chardonnet's silk is insoluble, whereas natural silk is completely dissolved by this reagent. (See also J. Soc. Dyers and Col. 1896, 115.)

Dyeing of Unions.—To dye mixed goods of wool and cotton with substantive colours exactly to shade, G. Mecklenburg (Färber Zeit. 6, 197) concludes that the safest method is to use mixtures of such colouring matters as will dye in a neutral boiling bath one or other of the two fibres only.

Mixed Colours on Piece-Goods.—The process for dyeing silk, woollen, or cotton cloths in different colours by mordanting one part only of the threads of silk, wool, or cotton, patented by Zillesen (Eng. Pat. 4984, 1892; this Journal, 1893, 261), is stated on the authority of L. Schreiner (Färber Zeit. 6, 229) to be specially adapted for the production of two-coloured cotton goods. The dyeing to shade in a single bath is alleged to be very easy, and calculations as to cost are given in the original paper.

Removing Stains.—The stains on the white parts of cloth, caused by the bleeding of the dyed portions during the process of milling, may be completely removed in the case of certain alizarins and many of the azo colouring matters, according to F. Geissler (Färber Zeit. 6, 145), by passing the cloth through a solution of sodium thiosulphate.

Artificial Dyes for Army Cloth.—As a result of careful investigation and comparative trials, the Prussian War

Office has sanctioned the use of certain artificial colouring matters for the dyeing of army cloth, and instructions have been given that in future cloths thus dyed shall be accepted, provided they answer to the following tests.

p-Nitraniline Red on the Fibre.—V. Werner, who made investigations as to the best method of preparing the diazo solution of *p*-nitraniline, arrived at the following results (Färber Zeit. 6, 294):—The nitraniline should be dissolved in boiling water before the requisite quantity of hydrochloric acid is added, and then cooled quickly so as to ensure a fine division of the nitraniline hydrochloride. The solution should be complete, as any undissolved portions are not acted on by the nitrite. If too little of the acid be taken, the diazo solution soon decomposes, and too large an excess of acid produces yellowish shades, and requires larger quantities of sodium acetate. With less than the theoretical quantity of nitrite, the diazotising will be incomplete, causing the formation of an insoluble, brownish-yellow, flocculent precipitate, while an excess favours decomposition; but in practice it has, nevertheless, been found best to use a small excess of nitrite. A properly prepared diazo-hydrochloride solution does not commence to decompose, even at 23°, until after 1½ hours' standing; and at lower temperatures will keep, it is alleged, for months. The addition of sodium acetate greatly favours the decomposition, and in proportion as the acetate solution is more concentrated. On these observations Werner bases the following method for the diazotising of *p*-nitraniline as the most suitable:—5 kilos. 520 grms. of *p*-nitraniline are dissolved in 16 litres of boiling hot water, and 11 litres of pure hydrochloric acid of 22° B., to which are then added 40 litres of cold water and 40 kilos. of ice. When cooled down to 0°, 2 kilos. 888 grms. of sodium nitrite dissolved in 20 litres of cold water are quickly added, and the whole is stirred. After 15 minutes' standing, the clear solution is made up to 160 litres. For use, 20 litres of this stock solution are diluted with 60 litres of cold water, and then 2 kilos. 500 grms. of sodium acetate dissolved in 20 litres of water added thereto. Soda may be substituted for part of the acetate, taking care, however, that the solution remains distinctly acid after such addition; the remaining free hydrochloric acid being then neutralised with sodium acetate.

A bluish shade of Nitraniline red may be obtained, according to a patent specification of the *Farbwerke Hoechst* (German application refused), by adding to the sodium naphtholate solution small quantities of the sodium salt of $\beta_1\beta_2$ -naphthol-sulphonic acid (F acid of Cassella). An addition of 5 per cent. is said to be sufficient to produce a

TABLE FOR TESTING ARMY CLOTH (GERMAN ARMY) DYED WITH FAST ARTIFICIAL COLOURING MATTERS.

Kind of Cloth.	(a.) Immerse for two minutes in cold dilute HCl (1 part strong acid to 3 of water) and rinse at once in cold water.	(b.) Boil for one minute in dilute HCl as under (a).	(c.) Put a drop of strong HCl on cloth, and after five minutes press between filter paper.	(d.) Boil for two minutes in 15 per cent. acetic acid, let solution cool, shake up with ether, and add 2-3 drops of a solution of equal parts stannous chloride, strong HCl, and water.
Dark blue cloth for coats, I. and II. Russian blue cloth. Dark blue molton. Grey cloak cloth.	The colour to turn only slightly redder. Solution should not turn a distinct red. (Absence of log-wood.)	The solutions should be according to the different colouring matters used, reddish to bluish-violet, giving with soda-lye of 20° B. after a short time, a reddish-blue to bluish-green precipitate. The colour of the fibre with this test is immaterial.	.. ..	.. ..
Black cloth.....	The colour of the fibre should not alter much, and the solution should be nearly colourless. (Logwood turns the acid red.)	Solution should be only slightly reddish, and should turn to greenish-blue or become decolorised with soda-lye of 20° B. The boiled and well-rinsed cloth, on being heated with soda-lye, to yield a blue to greenish-blue solution.	Colour may change, but not to red; filter paper must not show a red stain. (Logwood.)	.. ..
Dark blue cloth (black mixed with white).	As above.....	Solution red to violet, turning, when supersaturated with soda-lye, blue to greenish-blue, and, after some time, a reddish-blue to bluish-green precipitate. The fibre, washed free from acid and heated with soda-lye, should yield a blue or greenish-blue solution.	As above.....	.. ..
Green cloth.....	Colour of cloth must not change materially. (Logwood would give a red solution.)	Solution brown-red to bluish-red, turning green with excess of soda-lye, and, after standing, green to blue precipitate. (Fustic with indigo does not give this precipitate.)	.. ..	The upper layer of ether is coloured yellowish-red to bluish-red, but must not show a yellow fluorescence (fustic). Lower layer of water nearly colourless.
Brown cloth.....	Colour lighter.....	Yellowish-brown solution, giving, with sodium hydrate of 20° B., a greenish-black precipitate. Acidifying this with acetic acid and filtering, a brown residue is left, which turns yellowish-brown with HCl, and dark violet with NaHO.	.. ..	As above.

distinct bluish shade equal, in fastness to soaping, to ordinary red.

To prevent the cotton cloth impregnated with naphthol solution from turning brown, Lauber and Caberti have patented the use of the addition to the alkaline naphthol solution of an alkaline solution of antimony oxide in glycerin. (See also this Journal, 1896, 111 and 112.)—I.S.

Indigo, Loss of, through Chroming. K. Ernst. *Färber Zeit.* 7, [18], 282-283, and [19], 298-300.

In chroming indigo-dyed wool, more or less of the indigo on the fibre is destroyed. To determine how far this destruc-

tion is favoured by the different auxiliaries in common use for chroming wool, the author has made a series of experiments, the results of which are given in the following table.

The horizontal columns give the percentage quantities used of the substances specified for each column, and the vertical lines represent the comparative degrees to which the indigo on the fibre has suffered destruction. No. 1 of the scale has been scarcely affected; in No. 20 the indigo has been completely destroyed, whilst the other numbers represent intermediate results:—

DEGREES OF DESTRUCTION OF INDIGO.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Potassium bichromate	1'0	..	2'0	..	3'0	..	4'0	..	5'0	..	..	..	..	..	..	..	..	..
Potassium bichromate	1'0	..	..	2'0	..	..	3'0	..	..	4'0	..	..	5'0	..	..	..	..
Sulphuric acid.....	1'0	..	..	2'0	..	..	3'0	..	..	4'0	..	..	5'0	..	..	..	..
Potassium bichromate	1'0	..	..	..	2'0	..	..	..	3'0	..	..	..	4'0	..	..	..	5'0	..
Oxalic acid.....	1'0	..	..	..	2'0	..	..	..	3'0	..	..	..	1'0	..	..	..	5'0	..
Potassium bichromate	1'0	..	2'0	..	3'0	..	4'0	..	5'0	..	..	..	..	..	..	..	..	..	..
Lactic acid.....	..	1'0	..	2'0	..	3'0	..	1'0	..	5'0	..	..	..	..	..	..	..	..	..	..
Potassium bichromate ..	1'0	..	2'0	..	3'0	..	4'0	..	5'0	..	..	..	..	..	..	..	..	..	..	..
Tartar (crystallised) ...	1'0	..	2'0	..	3'0	..	4'0	..	5'0	..	..	..	..	..	..	..	..	..	..	..
Potassium bichromate	0'6	..	1'2	..	1'8	..	2'4	..	3'0	..	..	..	..	..	..	..
Copper sulphate	0'4	..	0'8	..	1'2	..	1'6	..	2'0	..	..	..	..	..	..	..
Potassium bichromate	0'6	..	1'2	..	1'8	..	2'4	..	..	..	3'0	..
Copper sulphate	0'4	..	0'8	..	1'2	..	1'6	..	..	..	2'0	..
Sulphuric acid.....	1'0	..	2'0	..	3'0	..	4'0	..	..	..	5'0	..
Potassium bichromate	0'6	..	1'2	..	..	1'8	..	..	2'4	..	..	..	3'0
Copper sulphate	0'4	..	0'8	..	..	1'2	..	..	1'6	..	..	..	2'0
Oxalic acid.....	1'0	..	2'0	..	..	3'0	..	..	4'0	..	..	..	5'0
Potassium bichromate	0'6	..	1'2	..	..	1'8	..	..	2'4	..	..	3'0	..
Copper sulphate	0'4	..	0'8	..	..	1'2	..	..	1'6	..	..	2'0	..
Lactic acid.....	1'0	..	2'0	..	..	3'0	..	..	4'0	..	..	5'0	..
Potassium bichromate	0'6	..	1'2	..	1'8	..	..	2'4	..	..	3'0	..	..	..	..
Copper sulphate	0'4	..	0'8	..	1'2	..	..	1'6	..	..	2'0	..	..	..	..
Tartar.....	1'0	..	2'0	..	3'0	..	..	4'0	..	..	5'0	..	..	..	..

Percentages used in Chroming.

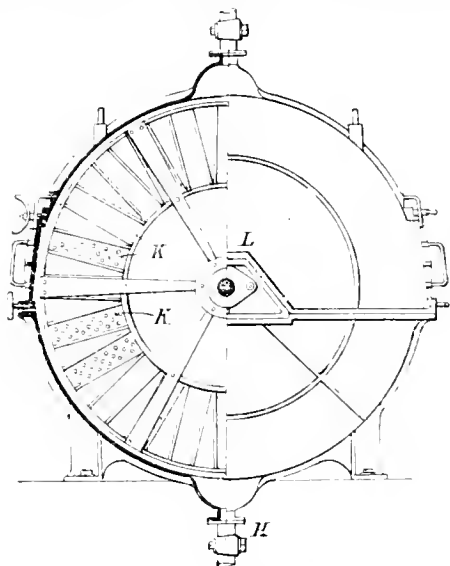
Rare Earths [Cerium as Mordant]. O. N. Witt. Chem. Ind. 1896, 19, 156.

See under 11., page 580.

PATENTS.

Textile and other Materials, An Impd. Process for the Treatment of [Bleaching, &c.], and Apparatus therefor. G. C. Dymond, London. From La Société Lebleis Piceni and Co., Elbeuf St. Aubin, France. Eng. Pat. 11,453, July 30, 1895.

PERFORATED BOXES, K, containing the materials to be treated, are affixed to a shaft L inside a vessel which, when closed, will withstand considerable external pressure. The air is exhausted from the vessel, and the bleaching, &c.



liquors drawn in, their action being assisted by revolving the shaft and by drawing the liquors from the lower part of the apparatus and discharging them at its centre. Steam is supplied, and the bleaching, &c. liquors and air are introduced and withdrawn, as required, by the pipe H.—E. B.

Cotton, Wool, Silk, Jute, Rhea, China Grass, and other Fibrous Materials in a Raw, Manufactured, or Partly Manufactured State: Impd. Apparatus and Plant for Scouring, Bleaching, Dyeing, Impregnating, Digesting, Drying, Carbonising, and otherwise Treating. W. Hepworth-Collins, Bolton. Eng. Pat. 21,032, Nov. 7, 1895.

THE apparatus is a movable, cylindrical cage with a perforated bottom, serving as receptacle for the fibrous material to be operated upon, which is placed inside a chamber.

The lower portion of this chamber is formed into a cylinder, from, and to which, the treating liquors or gases are alternately forced and drawn through the mass of the materials lying above, by the motion of a piston in the cylinder.

The liquors, &c., may be heated by a steam-coil. Various combinations and modifications of the apparatus are described.—E. B.

Fabrics, Impts. in the Art of Fixing Dyes in [by Electricity]. C. M. White, London. From The Electro-Waterproofing and Dye-fixing Co., New York, U.S.A. Eng. Pat. 8318, April 21, 1896.

A process for "fixing natural dyes" on fabrics, accomplished by applying them in suitable solvents to the fabrics, either entirely over their surface or in parts (patterns) only, placing the impregnated fabrics in contact with an anode of an oxidisable metal, the oxide of which is

capable of acting as a mordant, and a suitable (carbon) cathode, and passing a current of electricity through to oxidise the surface of the anode and so produce a mordant which, as it is formed, shall combine with the colouring matter upon the fabrics and produce a colour-lake. The fabrics are next dried, and, if necessary, washed, to remove any colouring matter from the untreated portions.

It is stated that with plates of tin, lead, and aluminium 2—3 ins. in diameter, and a current of 20—30 volts, a treatment of the fabrics 10 seconds in duration is required.

—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Sulphuric Acid, Arrangement of Plant in Manufacture of. R. H. Niedenführ. Chem. Zeit. 1896, 20, 583—584.

NEW principles for the arrangement of a sulphuric acid plant have been brought to light by work done during the past decade.

On the one hand, Lunge and Sorel have shown that the conversion of sulphurous to sulphuric acid going on in the chambers is due to the continuous formation and decomposition of nitrosylsulphuric acid, and that this reaction is improved with lesser concentration and higher temperature. On the other hand, the researches of Schertel and Retter have demonstrated that, working with a single chamber, the entering concentrated gases become, at the beginning of the system, excessively dilute, their power of reaction being thereby weakened and the duration of the process lengthened. All these investigators come to the conclusion that the acid formation is assisted by mixing the gases and by the impact of these on solid surfaces.

The value of a one-chamber system was thus decided; no results have, however, been given to show the value of single small chambers, nor the variation of this value according to the relative position of these in the system. The tendency of the inactive constituents of the gaseous mixture to lag in the passage through the system, prevents the answer to this question being arrived at by an estimation of the sulphurous acid at different points.

The only method is by direct measurement of the acid formed in each chamber, and the author gives some figures so obtained. The plant, worked without Glover or Gay-Lussac towers, was specially arranged for this investigation; the results show that too much must not be expected from making the chambers smaller.

The system consisted of five chambers and two after-towers of the following dimensions:—Chambers 1 and 2 had a ground area 4.25 × 4.25 m. and a height 6.55 m.; chamber 3 was 8.5 m. broad, 32 m. long, and 7.1 m. high; chambers 4 and 5 were each 4.3 × 8.3 m. in area and 6.75 m. in height. The two towers (6 and 7) were respectively 1.95 × 1.95 m. and 1.95 × 1 m. in ground area, and each was 6.35 m. high.

Sicilian sulphur (97—98 per cent.) was the raw material employed.

The table on next page shows the relation of the production in the single chambers.

On calculating the chamber space used for 1 kilo. of sulphur (from the acid produced), the following values are obtained:—

For Chamber 1:			
For 1,800 kilos. daily consumption,	1.068 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	0.948 " 1 "		
For Chamber 2:			
For 1,800 kilos. daily consumption,	1.068 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	0.948 " 1 "		
For Chamber 3:			
For 1,800 kilos. daily consumption,	1.567 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	1.531 " 1 "		
For Chamber 4:			
For 1,800 kilos. daily consumption,	2.028 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	2.128 " 1 "		
For Chamber 5:			
For 1,800 kilos. daily consumption,	2.375 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	2.235 " 1 "		
For Chambers 6 and 7:			
For 1,800 kilos. daily consumption,	3.984 cb. m.	per 1 kilo. sulphur.	
" 1,895 " " "	3.731 " 1 "		

Number of Chamber.	Chamber Space in Cu. m.	Kilos. H ₂ SO ₄ produced from		Kilos. H ₂ SO ₄ produced per 1 Cu. m. Chamber Space from		Percentage of Total Production from	
		1,800 Kilos. Sulphur.	1,895 Kilos. Sulphur.	1,800 Kilos. Sulphur.	1,895 Kilos. Sulphur.	1,800 Kilos. Sulphur.	1,895 Kilos. Sulphur.
1	118'3	336	385	2'84	3'23	6'65	7'2
2	118'3	337	382	2'85	3'22	6'65	7'2
3	1931'2	3,694	3,862	1'93	2'00	72'80	72'4
4	240'9	364	348	1'51	1'44	7'20	6'5
5	240'9	312	329	1'29	1'37	6'20	6'2
6 and 7	36'5	28	30	0'77	0'82	0'50	0'5
Totals and Averages.	2686'1	5,971	5,336	2'24	2'42	100'00	100'0

These results show that Schertel's proposal to estimate the acid formed from the percentage of sulphurous acid in the ingoing and exit gases would lead to error. Thus, while chambers 1 and 2 produce the same quantity of acid per cu. m., the working capacity of the large middle chamber is lessened only to the extent of 50 per cent., and chambers 4 and 5, which are fed with very dilute gases, show a result only slightly less than half that of the first and second. Schertel's figures may be explained by the fact that the active gases travel more quickly through the system, leaving the inactive gas in the so-called dead space of the chambers; this phenomenon goes on until a definite limit has been attained. This tendency to lag is less with smaller chambers, but the above figures show that the division of the chamber space into a large number of smaller chambers leads to a constantly decreasing advantage. The author concludes that the best way to obtain the necessary surface for good working in a small compass is by using the Lunge-Rohrman plate-towers. (See this Journal, 1896, 541—543.)

—J. T. C.

Sulphuric Acid, Concentration of. E. Loew. Zeits. f. angew. Chem. 1896, [9], 259—262.

THE methods at present in use for concentrating sulphuric acid may be grouped as follows:—

- (1.) Concentration by means of distillation.
- (2.) Concentration by means of air at a temperature when the acid possesses considerable vapour tension.
- (3.) Concentration by crySTALLISING the monohydrate from high-strength acids.

For the concentration of sulphuric acid by distillation, a great variety of apparatus has been tried, constructed of different materials, such as platinum, gilded platinum, glass, porcelain, or iron, but at the present time those made of platinum find most favour.

It is well known that sulphuric acid may be concentrated by means of hot air, the chief aim being to saturate the air with aqueous vapour and allow the concentrated acid to flow off.

It is by no means essential that the sulphuric acid should be maintained at its boiling point, as concentration will take place at lower temperatures with absolutely dry air; nevertheless, the higher the temperature the better, as the vapour tension increases, the nearer the boiling point is approached. The intensity of the work of concentration is determined by the difference between the absolute and maximum vapour tension of air and the vapour tension of the acid. The work of concentration is determined by—

- (1.) The heating surface.
- (2.) The volume, temperature, and dryness of the air.
- (3.) Loss by radiation and conductivity.

To make a calculation of the work of concentration, the following conditions are presupposed:—

- (1.) The acid to be concentrated has a temperature of 20° C., and contains 64·5 per cent. of monohydrate.
- (2.) The air leaves the apparatus saturated with aqueous vapour at 80° and 760 mm. tension; the acid formed is at its boiling point, and contains 95·6 per cent. of monohydrate.
- (3.) The air has a temperature of 20° at 760 mm. tension. From these figures the amount of heat required to produce 95·6 per cent. acid from 64·5 per cent. may be calculated,

and it will thus be found that 100 kilos. of acid require 49,500 cal. If, under the same conditions, the air should leave the apparatus saturated at 50·6°, 51,800 cal. would be required; on the other hand, saturated at 90° C., only 48,900 cal. are necessary.

The presence of carbonic acid in the gases, when obtained from a direct fire, has scarcely any influence on the figures quoted, whereas the presence of water, formed by the combustion of any material used for firing, would naturally be disadvantageous.

Theoretically, it is immaterial whether the heat be supplied by means of air or sulphuric acid. When concentrating in lead vessels, the acid is heated to 139°—150° C., and the air is allowed to heat itself and absorb aqueous vapour. By this means, however, it is impossible to saturate the air with aqueous vapour; even under the most favourable conditions the air will only be so far saturated that its tension for steam is equal to the vapour tension of the hot dilute sulphuric acid. The temperature of 140° C. is rarely exceeded in lead vessels, at which temperature the tension of an acid of 60 B. is inconsiderable, wherefore it is advantageous to cover such vessels in, thus making it possible to allow the air to escape at a temperature of 80°—90° C. In Kessler's apparatus the escaping air is caused to meet the acid to be concentrated, when it is possible for the air to have a higher tension than that of the acid to be concentrated, with which the air was last in touch. However, practically, it is impossible to utilise the air in such a manner that it shall escape, saturated with moisture, and it is therefore always necessary to employ an excess over the theoretical amount. This, however, still permits of a good utilisation of the heat supplied, and a production of an acid of any strength up to 98 per cent.—J. R.

Phosphorus, Spectrum of, in Fused Salts and Metallurgical Products. A. de Gramont. Comptes rend. 1896, 122, 1534.

See under XXIII., page 616.

Hydrofluoric Acid, Volumetric Analysis of; Some Applications of the Acid. H. F. Stahl. J. Amer. Chem. Soc. 1896, 18, [5], 415.

See under XXIII., page 617.

Pyrites, Determination of Sulphur in. T. S. Gladding. J. Amer. Chem. Soc. 1896, 18, [5], 446.

See under XXIII., page 617.

PATENTS.

Sodium Cyanide, Manufacture of. W. McD. Mackey, Leeds, and J. F. Hutcheson, Glasgow. Eng. Pat. 6009, March 22, 1895.

IN Eng. Pat. 6925, 1894 (this Journal, 1895, 482), the inventors describe a process for obtaining potassium cyanide, consisting in heating together carbonaceous matter and some potassium compound, such as the carbonate, in a cupola subjected to blasts from specially arranged tuyères. To obtain sodium cyanide, the same process is now to be used, substituting a sodium compound for one of potassium.

—E. S.

Hydrocyanic Acid, Manufacture of. A. K. Huntington, London. Eng. Pat. 14,855, Aug. 6, 1895.

ACETYLENE and nitric oxide are drawn in about equal volumes into a cylinder provided with a piston as in a gas engine: the mixture is fired, preferably by an electric spark, and the products of the ignition, consisting mainly of carbonic oxide, hydrogen, and hydrocyanic acid, are expelled by the in-stroke of the piston, into, for instance, solution of soda or potash, to form a cyanide. The unabsorbed gases may be used for combustion.—E. S.

Cyanides. A Process for the Manufacture of. J. Pflieger, Kaiserslautern, Germany. Eng. Pat. 15,116, Aug. 10, 1895.

A MIXTURE of five parts of potash (carbonate of potash) and one of charcoal is placed in a crucible having a cap and escape tube. The crucible is heated to 900° C., and ammonia gas, at a certain pressure above that of the atmosphere, is forced in through a tube reaching to the bottom. More charcoal is then added. The operation is complete in about two hours, when the fixed product consists of pure cyanide. The reaction takes place according to the equation $K_2CO_3 + 4C + 2NH_3 = 2KCN + 3CO + 6H$. If an excess of carbon be added, it remains with the product, and may be separated by solution and filtration. Instead of ammonia, nitrogen or air may be used in the process; but if air be used, the proportion of charcoal must be increased. When nitrogen is used, a considerably higher temperature must be attained, but with air this increase of heat is given by combustion of the charcoal. The inventor points out the distinctions between his process and those of Siepermann and Beilby, which are stated to involve the preliminary production of cyanate.—E. S.

Chlorine, Impts. in the Manufacture of, from Hydrochloric Acid Gas. T. T. Best, A. Kay, and J. Brock, Liverpool. Eng. Pat. 13,451, July 12, 1895.

WHEN a mixture of dry hydrochloric acid gas and air is passed through a "Deacon's decomposer" or equivalent apparatus, part of the acid gas is decomposed into chlorine and aqueous vapour, and part remains unacted upon. According to the present invention, the residual gases are withdrawn, cooled, and freed from moisture by sulphuric acid or other hygroscopic substance, when the dried gases are passed through a second decomposer, and the process may be repeated until practically all the hydrochloric acid has been converted.—E. S.

Carbonic Acid, obtaining from Gas Mixtures in the Dry Way. An Impt. Process for, and Apparatus therefor. P. W. Raydt, Stuttgart, Germany. Eng. Pat. 13,456, July 12, 1895.

SODIUM or potassium carbonate is moistened, and exposed to the action of cooled gases of combustion, or of other carbonic acid gas mixture, when it becomes bicarbonated, according to the equation $Na_2CO_3 + CO_2 + H_2O = 2NaHCO_3$. The bicarbonate is then heated to obtain pure carbonic acid gas, which is collected and may be liquefied, and the recovered carbonate is again moistened for renewal of the process.

The carbonate is spread out on horizontal trays or wicker-work within a closed vessel, having an aperture at the bottom for admission of dilute carbonic acid gas, and an exit opening at the top. Perforated tubes, connected to small cisterns filled with the necessary quantity of water, and simultaneously discharged by gas-pressure, are suitably placed for moistening each layer of carbonate, several such layers being arranged, one above the other, within the apparatus. A pipe also circulates under and over each carbonate layer, carrying heating or cooling gases or water. For continuous working, several such apparatus are connected in series, so that in some vessels carbonic acid gas is being absorbed, and in others expelled by heat from the already formed bicarbonate. Gases of combustion, after passage through a lime-stone purifier, are led through the heating tubes of two apparatus in which the carbonate has already been bicarbonated, when pure carbonic acid is thus expelled; the fire gases are then taken through a cooler

and a washing vessel successively, and then pass through two apparatus containing moistened carbonate, to which they give up their carbonic acid, and the residual gases are allowed to escape. Provision is made for collecting and storing the carbonic acid gas evolved on heating the bicarbonate. The process is thus alternated in the different vessels of the series.—E. S.

Nitric Acid, Impts. in the Manufacture or Production of, and Apparatus therefor. C. Dreyfus, Manchester. Eng. Pat. 13,826, July 19, 1895.

SODIUM or potassium nitrate is heated with sulphuric acid in a still in which a vacuum is maintained to a regulated temperature, reaching from 170° to 190° C. The vapours pass into a receiver, then through a cooling coil, thence through a set of receivers and another cooling coil, and are then taken through a series of small receivers, alternately empty and partly charged with a liquid, which in the second vessel is sulphuric acid (to absorb nitrous fumes), in the fourth vessel, water, and in the sixth vessel, an alkaline solution. The vapours then pass up and through a tower containing coke, down which an alkaline solution trickles, an outlet pipe to the tower being connected to the air-pump or exhauster, which, by the described means, is preserved from injury by corrosive gases.—E. S.

Hydrochloric Acid, Impts. in and Apparatus for the Manufacture or Production of. C. Dreyfus, Manchester. Eng. Pat. 13,827, July 19, 1895.

THE distillation of sodium chloride with sulphuric acid to obtain hydrochloric acid, is conducted as is described in the preceding abstract in reference to sodium nitrate, except that the most suitable temperature is found in the present case to be about 260° C.; that the small receivers are all charged with water; and that two washing towers are used, the first for water and the second for an alkaline solution, the air-pump being connected to this tower as in the before-described process.—E. S.

Carbon Bisulphide, Impts. in Manufacture of, and Apparatus therefor. A. J. Holt, Manchester, and G. Millard, Droylsden. Eng. Pat. 14,912, Aug. 7, 1895.

THE improvement claimed in the process consists in passing sulphur vapour up through the carbon in the retort, and then returning the gases through the carbon to the bottom of the retort. The improved apparatus claimed, suitable for this process, has, in addition to the lid and exhaust-pipe at the top of the retort, an additional exhaust-pipe and a feed-pipe by which melted sulphur may be added, both at the bottom of the retort. The improvement may be applied to existing retorts.—A. C. W.

Certain Waste Materials, Impts. in Treating, to Produce Valuable Products, such as Plaster or Stiffening, Weighting, and Whitening Materials therefrom. J. H. Lester, Manchester, and T. E. Thomlinson, Bury, Lancaster. Eng. Pat. 15,283, Aug. 14, 1895.

THE residues of the process of treating ammonium sulphate with slaked lime, and other like residues, were directed, in Eng. Pat. 13,198, 1894 (this Journal, 1895, 483), to be treated with sulphuric acid; but the inventors have found it preferable to use hydrochloric acid, and, after separation of the solution from undissolved calcium sulphate, to precipitate the liquor with sulphuric acid. The calcium sulphate obtained is prepared for the applications named in the title by processes described in the cited patent, *loc. cit.* The dilute and impure hydrochloric acid remaining after the precipitation by sulphuric acid, is utilised in treating other portions of the calcareous residues.—E. S.

Galvanisers' Flux Skimmings, Impts. in the Treatment of. A. Wolf and W. S. Blythe, Church, near Accrington. Eng. Pat. 15,326, Aug. 15, 1895.

THE portion of the flux skimmings soluble in hot water is treated in solution with an alkaline carbonate in excess, and the precipitated zinc oxy-carbonate is separated. Lime is added to the residual solution to obtain ammonia. The zinc oxy-carbonate, or normal carbonate, is agitated with a hot solution of potassium chloride or sodium chloride, and

chlorine is passed in until the precipitate is dissolved; the solution is then filtered and concentrated, to obtain a chlorate of the alkali metal, which is crystallised out, zinc chloride remaining in solution.—E. S.

Kelp Liquor, Impts. in or relating to the Treatment or Utilisation of. J. W. Stevens, Horley, Surrey. Eng. Pat. 15,807, Aug. 22, 1895.

The first liquor obtained on lixiviating kelp is concentrated, and the alkali chlorides and sulphates are separated by crystallisation, the process being repeated until a mother-liquor is obtained rich in iodides. Sulphuric acid is then added, and, after addition of manganic oxide, the iodine and bromine are distilled off. The second and subsequent liquors are neutralised by hydrochloric acid, and after filtering off any separated sulphur, and concentrating to obtain a crop of potassium sulphate, "the liquor is electrolysed to convert chlorides, iodides, and bromides respectively into chlorates, iodates, and bromates." The chlorates are in part crystallised out, and the liquor again concentrated, or it is saturated with the alkali chlorides previously obtained and is "again electrolysed," the process being repeated until, it is stated, the liquor is sufficiently charged with iodates and bromates, which are then reconverted into iodides and bromides by sulphurous acid, from which the iodine and bromine may be obtained in the usual manner.—E. S.

Chlorine and Zinc, Impts. in and connected with the Production of. F. M. Lyte, London. Eng. Pat. 15,813, Aug. 22, 1895.

BLEND, or mixed ores of blende and galena, may be roasted, and the product lixiviated with dilute sulphuric acid, and the solution of zinc sulphate, after purification, treated with calcium or sodium chloride. After separation of the calcium or sodium sulphate formed, the solution of zinc chloride is evaporated to dryness, and may then be subjected to distillation to separate from non-volatile impurities. The zinc chloride is now heated to a temperature slightly above the melting point of zinc, and is then electrolysed, an anode of carbon and a cathode of fused zinc being used. As the zinc accumulates in the cell, it may be automatically siphoned off. The chlorine set free may be liquefied and stored. Residual galena from the treated ore may be worked by known processes to obtain lead and any precious metals that it may contain.—E. S.

Chlorine Gas, Process for Purifying. P. Jensen, London. From D. Cappelen and H. Cappelen, Gjemso Kloster, Norway. Eng. Pat. 9544, May 5, 1896.

THE chlorine gas produced in the electrolysis of alkaline chlorides is apt to contain impurities, and especially carbonic acid, which is objectionable in the use of the chlorine for making bleaching powder. It is found that when such impure chlorine is passed through milk of lime, that most of the carbon dioxide and but little of the chlorine is absorbed. The absorption vessels have pipe devices and are worked under pressure, the purified chlorine being led away through pipes provided with regulating valves. The chlorine water obtained as a by-product may be utilised in paper factories.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

PATENT.

Glass, Impts. in the Manufacture of Articles of. F. Kopp, Janstein, Moravia. Eng. Pat. 46, Jan. 1, 1896.

ARTICLES, such as bottle stoppers, which are commonly moulded by pressing a divided mould on a mass of plastic glass, are made, according to the present process, by the patented apparatus consisting of two half-moulds, initially closed, and arranged radially round a central reservoir provided with a piston serving to force plastic glass through radial channels into the moulds. By providing these moulds with cores, hollow goods may be produced. The depression of the piston and the insertion of the cores may be performed at one operation by connecting the piston with the cores by suitable links and levers.—B. B.

Glass Industry of Germany. U.S. Consular Reps., June 1896, 222.

See under Trade Rep., page 626.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement, Action of Water on. A. Stutzer. Zeits. f. angew. Chem. 1896, 11, 317—318.

THE author has had the opportunity of observing the action of water on the cement mortar used to line a reservoir for the supply of a small town on the Rhine. The reservoir had been built for nine years, and at the end of that time it was noticed that the cement mortar forming its lining had been converted into a brownish mud, which became softer in consistency as the bottom of the reservoir was approached. The bottom of the reservoir was partly stripped of its cement rendering. An examination of the water showed that it contained only 0.205 grm. per litre of total solids, largely consisting of calcium carbonate. Analysis of the unaltered mortar above the water line, and of the sludge below the water line, went to show that the greater part of the lime of the cement had been abstracted from the mortar below the water level. A similar result was observed in the case of another reservoir. In this case the water, regarded from a dietetic point of view, was of good quality, and the bulk of the mineral matter contained therein consisted of calcium carbonate. The author attributes the failure of the mortar of these two reservoirs to the solvent action of the carbon dioxide contained in the waters, and explains the greater effect observed at the bottom of the reservoir by the increased solubility of carbon dioxide at increased pressures. He further cites Michaelis concerning the behaviour of Portland cement towards solvents, in particular towards sea-water. That chemist, starting with the fact that during the setting of Portland cement a good deal of calcium hydroxide is set free, argues that the lime thus liberated is a source of weakness in that it is acted on by many substances with which the cement may be brought in contact, e.g., sea-water with its sulphates, magnesium salts and so forth. Further, loose compounds, such as calcium ferrite, may be attacked if the solvent be sufficiently active; the calcium aluminates are the next to go, the cementitious calcium silicate resisting longest. It is on account of these considerations that Michaelis recommends the addition to Portland cement of some active form of silica, such as trass, capable of combining with the lime, which would otherwise be set free as calcium hydroxide ready for attack by many solvents to the injury of the cement. The proportion of 125 parts of trass to 100 parts of Portland cement is stated to be suitable for this purpose. The author correlates these views (based chiefly on the observation of the action of sea-water on cement) with his own experience of the influence of fresh water containing carbon dioxide, the latter serving as a solvent for a portion of the lime essential for the strength and permanency of mortar made with Portland cement.—B. B.

PATENTS.

Peat, Impts. in the Process of and Apparatus for the Manufacture of different Articles from, and the Residue resulting from the Manufacture of Fibrous Peat, or from Peat Litter or its Residues. G. A. Cannot, London. Eng. Pat. 12,332, June 25, 1895.

PEAT, or peat litter or waste, is broken up, mixed with water, and incorporated with 20 per cent. of slaked lime or cement. The product, of clay-like consistency, may be incorporated with a variety of materials and moulded into bricks, or otherwise brought into a merchantable form. The articles that it is proposed to manufacture from material thus prepared are of a most varied kind, such as chimney pieces, paving tiles, roofing slates, waterproof cardboard, stocks for guns, &c., resembling carved ebony, artificial stone, &c.—B. B.

Composition, Impd. Plastic [for Sewer Pipes, Ducts, &c.], and Process of Combining the same. W. L. Woods, Washington, U.S.A. Eng. Pat. 25,013, Dec. 31, 1895.

A MIXTURE of 30 parts of magnesia, 60 of silica, 60 of sulphur, and 3—10 of "mineral wax" (e.g. ozokerite), is prepared by grinding and drying the silica and magnesia, melting the sulphur and wax, and pouring them into water repeatedly, following this by incorporating the whole of the materials at 300—500° F.

The product is used as a cement for any suitable aggregate, the resulting concrete mass serving for the manufacture of water ducts, sinks, battery jars, burial caskets, &c. In all underground work the material is said to be "imperishable."—B. B.

Wood, Method and Apparatus for Treating, for Fire-proofing or Preserving the same. A. M. Clark, London. Eng. Pat. 7032, March 31, 1896.

THE apparatus consists of a horizontal cylinder into which the wood to be treated can be run on cars, the wheels of which are supported by rails, while their axles project so as to pass beneath supplementary rails designed to prevent the rising of the car with its load from the main rails. The method of preservation consists in exhausting the cylindrical vessel, heating its contents, ejecting the gases and vapours arising from the wood, and treating the wood with a saturating liquid.—B. B.

Hot-Blast Blocks and Bricks, and Similar Apparatus. C. A. Brackelsberg, Steele, Germany. Eng. Pat. 8106, April 17, 1896.

THE bricks commonly used in hot-blast stoves are hexagonal in section, whereas in the present patented pattern they are triangular, the corners of the triangle being, however, hollowed out, so that where six such corners meet, a hole similar to that existing in the centre of the triangular brick is formed. In the next course the continuity is broken by placing a single block with its central hole over that formed in the way described. It is claimed that by this means a better bond is secured than by the usual practice.—B. B.

Fresco Painting, Impts. in or connected with. O. Matthiesen, Charlottenlund, Denmark. Eng. Pat. 10,000, May 11, 1896.

IN order to harden the surface of fresco and to neutralise the free lime which it contains, the patentee prescribes the distribution of pure carbonic acid under pressure over the plastic surface, while the latter is still wet and after the paints have been applied thereto.—B. B.

Firebricks, Impts. relating to the Manufacture of. J. G. Henry, T. E. W. Henry, and R. O. Henry, Jarrow. Eng. Pat. 10,293, May 14, 1896.

A MIXTURE of about equal volumes of lime water and "red liquor" (from the manufacture of soda-ash) is mixed with one of equal parts of sawdust and coke-dust in the proportion of about 3½ galls. of the liquid mixture to 1 cwt. of the coke- and sawdust mixture. Finely ground fireclay and ganister in the proportion of about 2 : 1, are mixed with the product described above, in the proportion of 4 cwt. of the former to 1 cwt. of the latter. Water is added until a consistency suitable for brick-making is reached, when the mass may be used for the production of firebricks, said "to be light and refractory."—B. B.

X.—METALLURGY.

Lead and Zinc Deposits of Iowa. A. G. Leonard. Eng. and Mining J. 1896, 61, 614.

THE lead and zinc ores are found in crevices, which widen out into several openings, in beds of galena limestone. The lead occurs as galena and the zinc as zinc carbonate. The zinc ore generally occurs a short distance beyond the lead, and if the ores are mixed, the amount is small.

The mine of the Dubuque Lead Mining Company has three shafts, 210 ft. deep, with a steam hoist on one, and "gins" (large wooden drums revolving in a horizontal

plane) on the other two. The ore-bearing dolomite forms a zone from 2 to 4 ft. wide, and contains an abundance of iron pyrites and galena. Up to the present, 100,000 lb. of lead ore have been raised.

The mine of the Lansing Mining and Smelting Company, in Allamakee County, extends 1,000 ft. horizontally; the vein is 3 to 4 ins. wide and 25 to 30 ft. deep in the main body of the mine. Since 1891, over 500,000 lb. of lead, and in the last two years over 250,000 lb., have been raised from the mine, although the output during the past year was small on account of the low price of lead.

The mine of the Dubuque Zinc and Lead Mining Company is worked by an open cut. The larger masses of the deposits are blasted, and the smaller ones loosened with the pick; the ore, when broken from the rock, is mixed with sand and small fragments of rock, and, after washing to free it from sand and dirt, is hand-picked. The output for the past few years averages about 2,500 tons per six months.

Several mines have been closed for nearly two years on account of the low price of zinc carbonate—5 to 6 dols. per ton, as against the former price of 12 to 18 dols. per ton. The price of lead is also low at present—17 dols. per 1,000 lb., as against 20 to 22 dols. formerly.

The output of the Iowa mines for the year 1895 was about 700,000 lb. of lead ore and 3,000 to 3,500 tons of zinc ore; but the zinc mines, which are capable of turning out 8,000 to 10,000 tons of ore per year, were closed during the greater part of the year.—A. S.

Diffusion of Metals. W. C. Roberts-Austen. Proc. Roy. Soc. 59, 281—285.

THE author states that owing to the want of sufficiently accurate methods, very little attention has been devoted to the measurement, or even to the consideration, of the molecular movements which enable two or more metals to form a truly homogeneous fluid mass. His own recording pyrometer for high temperatures used in conjunction with thermo-junctions renders it possible to measure and record the temperatures of diffusion of metals. Values have been thereby obtained for the diffusibility in square centimetres per day of various metals as follows:—

Gold in lead.....	3.19 at 500°
" bismuth.....	4.52 "
" tin.....	4.65 "
Silver in tin.....	4.74 "
Lead ".....	3.18 "
Rhodium in lead.....	3.04 "
Platinum ".....	1.69 at 190°
Gold in lead.....	3.03 "
Gold in mercury.....	0.72 at 11°

The diffusibility of sodium chloride in water at 18° is 1.04. No conclusions are at present drawn from these figures, but it is observed that the relatively slow rate of diffusion of platinum as compared with gold, points to its having the more complex molecule.

The diffusion of solid metals is then dealt with, first of all historically and then in consideration of the author's experiments. Cylinders of lead, with either gold or a rich alloy of gold and lead at their base, were maintained at temperatures below the melting point of lead for 31 days. After cutting the cylinders into sections and assaying, the following results were obtained:—

Diffusibility of gold in fluid lead at 550°	Per Sq. Cm. per Day.
" " solid " 251°	3.19
" " " " 200°	0.03
" " " " 165°	0.007
" " " " 100°	0.004
" " " " 100°	0.00002

Clean surfaces of lead and gold held together *in vacuo* at a temperature of only 40° for four days, united so firmly as to withstand a load equal to one-third of the breaking strain of lead itself before parting. Experiments are still in progress, and from them it would appear that the diffusibility of solid gold in solid silver, or copper, at 800°, is of the same order as that of gold in lead at 100°.

—A. W.

Zinc-Iron Ores, Magnetic Concentration; Wetherill System of. Eng. and Mining J. 1896, 61, 564-565.

Two electro-magnets are arranged with adjustable pole-pieces (fixed at any point by means of suitable nuts) at a convenient distance apart. The ore is fed in a $\frac{1}{2}$ to $\frac{3}{4}$ in. layer on to a belt from a hopper with adjustable feed. The belt travels towards and over a roller, bringing the fine ore particles within the sphere of attraction of the pole-pieces; the magnetic portion is attracted and is caught and carried on by another and a horizontal belt travelling away from the poles. The ore particles are thus carried off until they fall by gravity into a suitable receptacle. The non-magnetic particles fall into a second receptacle beneath. A proper adjustment of the current, of the space between the poles, and of the distance of the belt carrying the ore from the poles, causes the ore to be removed by the horizontal belt as fast as it is attracted by them. With a current of 6 amperes and 16 volts, such a machine with four pole-pieces separates Franklinite from Willemite, but requires to be passed three times through the apparatus to insure perfect separation, each passage being made at the rate of $3\frac{1}{2}$ tons per hour. For hematite, a yoke with two pole-pieces is used, with a current of 8 amperes and 22 volts. The machine for treating coarse particles is slightly modified. The process as in use in the Lehigh Zinc and Iron Co., removes garnet, Franklinite, tephroite, and Fowlerite from Willemite, zincite, and limonite, treating 1,000 tons of the mixture per mensem. The magnetic intensity of the machine being readily adjusted, several products may be obtained showing slight differences in magnetic permeability. The only substances in which iron is largely present that have not been attracted by the magnets constructed up to the present time, are the higher sulphides and "the cyanides of that metal." Magnets of greater power are being constructed, and it is expected that these substances will also be capable of magnetic separation.—W. G. M.

Aluminium, The Presence of Sodium in. Rev. de Chim. Ind. 1896, 7, [76], 107-108.

Besides carbon and nitrogen, the presence of which has been proved by Moissan, commercial aluminium nearly always contains sodium. 250 grams of aluminium filings were digested for 15 days in 300 c.c. of absolutely pure distilled water, and to avoid other possible sources of error, the filings were digested in an aluminium vessel. Every day the mixture was heated to boiling, and finally filtered and washed with boiling water. The liquid was slightly alkaline. It was evaporated in a platinum dish and ignited at a dull red heat. On the addition of HCl, carbonic acid was disengaged. After again evaporating and drying at 300°, the residue presented all the characteristics of sodium chloride. The quantity of Na thus extracted by water was determined by titration with silver nitrate. It was found to amount in different samples to from 0.1-0.3 per cent. In one sample prepared a considerable time, the sodium amounted to 0.42 per cent.

The presence of sodium in aluminium is very detrimental, since, in the presence of water, sodium hydrate is formed, in which the film of aluminium oxide (which always forms and serves as a protection to the metal against further oxidation) is dissolved. The quantity of soda present being very small, it may not be able to dissolve all the oxide formed; but the aluminate decomposes, liberating the sodium hydrate, which dissolves fresh portions, thereby increasing the alkalinity of the liquid, and, in proportion, its corroding action.

The properties of the alloys of aluminium depend on the purity of the metal employed, and also on the homogeneity of the alloy. An alloy of aluminium absolutely free from sodium, with 6 per cent. of tin, was not attacked by water with disengagement of gas, as stated by Riche. After two months, the metal was punctured in parts, with an efflorescence of alumina. But in presence of a considerable amount of tin, the decomposition is much stronger; hence tin solder for aluminium should be absolutely rejected.

The frequent want of homogeneity in the aluminium alloys, notably those also containing copper, is another great defect; for in such a case, in presence of moisture,

currents are set up, and the metal becomes oxidised. A sheet of aluminium which was kept in contact with water for several days became covered at certain points with an incrustation of alumina. On examining such parts under the microscope, a particle of carbon or some other foreign body was in most cases detected, which must have formed with the rest of the metal, a galvanic couple. In a solution of salt the action is much stronger, and takes place also in dilute alcohol. This accounts for the corrosion of the cans used by the military. With pure metal, free from nitrogen, carbon, and sodium, corrosion does not take place.—I. S.

Aluminium Alloys prepared by Chemical Reaction. C. Combes. Comptes rend. 122, [25], 1482-1484.

In place of the method recently proposed by Moissan (Comptes rend. 122, 1302) of combining powdered aluminium with metallic oxides in a bath of the molten metal, it is proposed to apply the metal from which the alloy is to be prepared, in the state of sulphide or chloride, to the fused aluminium, the result being a reduction to the metallic state and incorporation with the aluminium, whilst the sulphide or chloride of the latter metal simultaneously formed, can be collected and the metal recovered. In most cases the possibility of the reaction can be ascertained by reference to thermo-chemical data, the essential particular being a positive difference between the heat required for the formation of the metallic sulphide or chloride in question and that of the aluminium salt. For example, an alloy of nickel and aluminium can be so prepared, whereas zinc and manganese are not suitable. This rule hardly holds good, however, in the case of chlorides, since manganese can be alloyed with aluminium from the chloride of the former. One result of this reaction is the removal of a portion of the sodium frequently present in aluminium.

For nickel alloys, refined Bessemer nickel matte (NiS) is used. The alloy, containing 20 per cent. of nickel, is hard, and crystallises on cooling.

For manganese alloys, pieces of the chloride are dropped into the aluminium bath, and the chloride of the latter metal volatilises directly. The 4 per cent. (Mn) alloy exhibits a crystalline fracture.

In the case of chromium, the sesquichloride is employed, and the reaction is very violent. The 7 per cent. (Cr) alloy is very hard, and exhibits a fine crystalline structure, and the 13 per cent. alloy is perfectly crystalline, and can be powdered in a mortar.—C. S.

Gold Extraction by Potassium Cyanide. J. Loewy. Chem. Zeit. 1896, 20, [49], 479-480.

Working with a refractory cupriferous gold ore from the Lydenburg District (Transvaal), containing about 9 dwt. of gold per ton and 2.59 per cent. of copper, the author found that under similar conditions different cyanide solutions gave extractions as follows:—

Strength of Cyanide Solution.	Ag extracted.	Cu extracted.
Per Cent.	Per Cent.	Per Cent.
0.5	15.2	4.5
1.0	13.7	8.4
2.0	48.0	19.6
5.0	53.0	} over 25.0
10.0	76.5	

The results of all experiments tried may be summed up as follows:—

- (1.) The McArthur-Forrest recommendation to use only weak (0.2 to 1 per cent.) cyanide solutions for refractory ores, is not sound according to the author's opinion.
- (2.) Such weak solutions give an inferior extraction.
- (3.) The stronger the cyanide liquors, the greater is the amount both of base metals and of gold dissolved.
- (4.) The cyanide process is not suitable for most refractory ores, as the strength of cyanide required is too high, and the time needed for extraction too great.—W. G. M.

Gold Extraction: the Rignaud Process. Eng. and Mining J., 1896, 61, 561.

The ore or tailings are treated with the chloride of sulphur, S_2Cl_2 (see page 599), whereby chlorine is to be evolved and

the whole of the gold extracted. Taking the cost of tailings at 3 fr. per ton, and allowing 2 fr. for sinking fund, the total cost of the process is to be 9 fr. per ton.—W. G. M.

Gold Extraction, The Cassel-Hinman Bromine Process of. P. C. McIlhenny. J. Amer. Chem. Soc. 1896, **18**, [5], 451—456.

THIS process is intended for the extraction of low-grade ores, not suitable for amalgamation, as, for example, the telluride ores of Colorado. The *modus operandi* is practically the same as in the chlorination process. The ore is crushed, dried, sifted, roasted if necessary, and treated, either by percolation in vats, or, preferably, is agitated in revolving barrels, with an aqueous solution of bromine (strength, apparently about $1\frac{1}{2}$ per cent.). The liquid is then drawn off, the ore washed, &c. The chief and essential feature of the process is the subsequent recovery of the bromine, which is effected by adding bleaching powder, or potassium permanganate and sulphuric acid, to the liquor. The latter is then heated in a covered stone tank by direct steam. The bromine vapour is condensed in an earthenware worm, and there brought into contact with weak wash liquor from previous operations, for the purpose of regenerating bromine solution for future use. From a bath containing 15 lb. of bromine per 100 galls., the whole of the halogen is expelled, when 5 per cent. of the liquid has been distilled.

Important advantages are claimed for the process. As a solvent for gold, bromine is not only more rapid and thorough in its action than chlorine, but, on account of its superior solubility in water, may be used in stronger solutions, (up to 3 per cent.). Unlike chlorine, however, bromine attacks only to a slight extent the useless constituents (pyrites, &c.) of the ore, and the proportion converted into bromide little exceeds that corresponding to the gold dissolved. On this account the preliminary roasting of the ore (to destroy sulphides, &c.) need not be carried so far as is essential in the chlorination process; and this is a point of great importance, since certain ores—particularly tellurides of gold—lose a large proportion of the precious metal, either mechanically or by volatilisation, during the final stages of the roasting.—H. T. P.

Silver and Gold, Removal of, from Sea-Water by Mants-Metal Sheathing. A. Liversidge. Roy. Soc. of N. S. Wales, 1895.

COMPARING old Mants-metal plates which had been long exposed to the influence of sea-water with new specimens, the metallic portion showed an apparent loss of about half the silver and nearly one-third of the gold supposed to have been present originally; the scale upon the surface, whilst indicating about the same loss of silver, showed a gain of over 7 dwts. (or 700 per cent.) of gold. There is therefore a distinct loss of silver. The increase in the amount of gold may be accounted for, either by precipitation of the metal from the sea-water, or by the concentration, due to the solution of the other constituents of the sheathing, leaving the gold unattacked. Samples of new sheathing exposed for about 20 months to the influence of salt water showed a slight decrease in the amount of silver and an increase in that of gold; but the latter result is not satisfactory, as the gold contained platinum from the sulphuric acid used to dissolve the metal for analysis.—W. G. M.

Metallic Alloys, Fusibility of. H. Gautier. Comptes rend. 1896, **123**, 109.

THE melting point of alloys of tin and nickel, tin and aluminium, aluminium and silver, antimony and aluminium, were determined by means of Le Chatelier's thermo-electric couple. In each case the curves expressing the connection between melting point and percentage composition consist of three branches, thus pointing to the existence of definite compounds. The composition of these compounds is expressed by the formulae Ni_3Sn_2 , SnAl or Sn_2Al_3 , Ag_2Al , and SbAl .

The alloys of antimony and aluminium containing more than 2 per cent. of the latter metal are less fusible than aluminium. Antimony was found to melt at 632°, and not at 420°, which is the temperature usually given.—A. C. W.

Alloys, Metallic. H. Gautier. Comptes rend. 1896, **123**, 172—174.

IN continuation of his former paper (see preceding abstract), the author quotes a fourth case which may present itself in the solidification of alloys, *viz.*, where two non-isomorphous metals give a combination isomorphous with one of them, just as ammonium chloride and ferric chloride give a double compound isomorphous with the former. The study of the fusibility of the alloys should in this case throw light upon their constitution. Taking five pairs of metals, the effects upon the fusing point, of adding successive quantities of the less fusible metal to the other are as follows:—

Zinc-Silver.—The curve in this case runs in almost a straight line from 433° C. at 100 per cent. Zn up to 715° at 42 per cent. Zn; it then falls to 690° at 38 per cent. Zn, and finally rises almost in a straight line to 954° at 100 per cent. Ag.

Cadmium-Silver.—This curve rises evenly from 322° C. at 100 per cent. Cd to 710° at 58 per cent. Cd (which is higher than the mean of the constituents); thence it is less steep, but runs in a straight line up to 880° at 22·4 per cent. Cd; and thence assumes the form of a gradually flattening curve to 954°.

Tin-Silver.—The curve shows a fall from 232° at 100 per cent. Sn to 221° at 4·86 per cent. Ag; thence a nearly steady rise to 535° at 58·8 per cent. Ag, where the curve becomes gradually steeper up to 900° at 90·9 per cent. Ag; and, lastly, somewhat flatter up to 954°.

Copper-Nickel.—This would be a steadily flattening curve from 1,950° (pure Cu) up to 1,450° (pure Ni) but for a slight depression which finds its maximum at 1,340° for the 50 per cent. Ni alloy. The eutectic alloy, however, contains 0·5 per cent. Ni and melts at 1,945°; with this exception all the alloys of these metals have fusing points above the means of the constituent metals.

Antimony-Silver.—The fusing point is gradually lowered from 632° (pure Sb) to 482°, which is the eutectic alloy, and contains 55 per cent. Ag; thence it rises by a slightly S-shaped curve to the melting point of silver.

In these alloys, silver added to zinc or cadmium raises the fusing point above the mean; similarly, the melting point of tin or bismuth is raised by small quantities of antimony; and bismuth and antimony are isomorphous. This abnormal rise in the fusing point appears to be connected with isomorphism in alloys.—W. G. M.

Tungsten, Researches on. H. Moissan. Comptes rend. 1896, **123**, 14.

TUNGSTEN is readily obtained pure by reducing excess of tungstic acid with carbon in the electric furnace. If excess of carbon be used, or the metal fused so that it attacks the crucible, the carbide CW_6 is formed. Porous tungsten can be easily powdered, and at a temperature well below its melting point can be welded. It is more infusible than chromium and molybdenum, does not oxidise in moist air, but is slowly attacked by water containing carbon dioxide, reduces that gas at 1,200°, and is only attacked by acids (except a mixture of hydrofluoric and nitric) with difficulty. The carbide has very similar properties.—A. C. W.

Gold Solvents, Estimating the Efficiency of. W. J. Sharwood. Eng. and Mining J. 1896, **61**, 613.

See under XXIII., page 617.

Silver from Gold, Separation of, by Volatilisation. J. W. Richards. J. Franklin Inst. **14**, [896], 447.

See under XXIII., page 617.

Mineral and Metal Trade of Spain. U.S. Consular Reps., July 1896, 599.

See under Trade Rep., page 627.

PATENTS.

Refractory Ores [of Precious Metals], Impts. in Treating. A. J. Boulton, London. From P. A. Gasse, Paris. Eng. Pat. 12,692, July 1, 1895.

The refractory ore is suspended in water and agitated, air or oxygen containing about 5 to 7 per cent. of ozone being introduced through a pipe composed of unoxidisable material. The ozone is generated by passing dry and cooled oxygen or air through a chamber containing insulated metallic sheets, placed parallel with one another, and communicating alternately with the opposite poles of an intermittent or alternating current generator of high potential (7,000 volts). The ozone-laden gas is passed through water to absorb nitrogen acids, and then passes direct to the ore chamber, the intention being to oxidise the baser metals to oxides and sulphates, whilst leaving the "precious metals" in a refractory state, and thus better suited for separation from the former.—W. G. M.

Cyanide Process, Impts. in Treating Ores by, and in Appliances for. E. G. Appleby, London. From L. F. Gowans, Johannesburg. Eng. Pat. 14,162, July 25, 1895.

Two long, rectangular vats are built side by side, with a launder at one end placed at a level 12 in. below that of the discharge of the concentrator, and with accurately fitting discharge doors communicating with a second launder at the opposite end. The actual bottoms of the vats slope downwards toward the inlet end, but there is a perforated false bottom, covered with a filtering medium, which is placed horizontally. Running longitudinally over the vats, are a 6-in. water-pipe and a 9-in. air-main, each communicating with several series of perforated pipes suspended at any desired level in the vats. Within the air-main is a steam-coil, to heat the air supply when necessary. In use, water is admitted to the height of 1 ft. above the false bottom; air is next passed through one set of perforated pipes to agitate the liquid; the ore is then allowed to enter, more and more air being passed during the process in order to distribute it evenly. The water is pumped out from below, the cyanide solution being introduced, and in turn pumped away for further treatment, whilst the tailings are finally discharged through the end doors, with the aid of the agitation produced by the admission of water and air through the perforated pipes.—W. G. M.

Gold-extracting Processes [Chloride of Sulphur] and Apparatus therefor, Impts. in. W. P. Thompson, London. From La Soc. pour l'Extraction Intégrale et Economique de l'Or, Procédé de Rigaud, Paris. Eng. Pat. 15,954, Aug. 24, 1895.

The powdered ore is treated in a closed vessel with chloride of sulphur; the mixture is warmed and agitated. It is stated that only one clearly defined chloride of sulphur exists and that of the formula S_2Cl_2 , and this it is which is here referred to. The gold dissolves as chloride, and is recovered by precipitation; the other metals form insoluble compounds, which may be readily separated. The precipitant proposed is ferrous sulphate.—W. G. M.

Antimony Gold-bearing Ores, Improved Method of Treating. A. Jones, Melbourne. Eng. Pat. 10,097, May 12, 1896.

The powdered ore is treated with hydrochloric acid in a closed vat provided internally with a steam-coil for heating purposes, and with a rotary stirrer actuated from without; the hydrogen sulphide generated, is collected in a tank of water placed above the vat. When the acid is saturated with antimony, the solution is run off through an asbestos filtering box to an electrolysing vat, in which the antimony is deposited on suitable cathodes opposed to insoluble anodes; the chlorine produced by electrolysis is conveyed to the hydrogen sulphide tank, where it reacts with the latter substance, forming precipitated sulphur and hydrochloric acid, which may be used to treat a second batch of ore. The electrolysed solution is also returned by means of a pump to the dissolving vat. The ore, freed in this

manner from antimony, still retains the whole of the gold, and for further treatment is removed from the vat through a man-hole provided at the bottom.—W. G. M.

Reed Wire; Impt. in Means of Cleaning, Galvanising, and Hardening or Tempering, to prevent Rust and Wear. S. Stankie, Walsden, Lancashire. Eng. Pat. 12,908, July 4, 1895.

The wire is unwound from the reed-maker's flanged pulley and passed consecutively through an acid bath for cleansing, a metal bath for galvanising, an asbestos-lined clip to remove superfluous liquid metal, and finally over a revolving pulley through water to "temper" it, and thence it is wound on to a tin wheel.—W. G. M.

Puddling and Reheating Furnaces of the Siemens Type, Impts. in. E. Bonchill, Marchienne-au-Pont, Belgium. Eng. Pat. 15,701, Aug. 20, 1895.

These are (1) the provision of a valve adapted to serve specially in connection with each gas producer, and provided with its own independent operating lever, in order that any one producer may be thrown out of work without interfering with the others; (2) cooling the basin of the furnace by causing the required amount of external air to pass under them, such air being drawn in by the natural draught of the furnace; (3) causing the burnt gases to pass through comparatively long flues before they enter the regenerators, so that they may deposit suspended matters, and at the same time be partially cooled, whereby they are prevented from too quickly destroying the brickwork of the regenerators.—A. G. B.

Chlorine and Zinc, Impts. in and connected with the Production of. F. M. Lyte, London. Eng. Pat. 15,813, Aug. 22, 1895.

See under VII., page 595.

Double Aluminium Sulphides or Sulphurets with Alkaline Metals, or Metals of the Nature of Alkaline Earths; A Process for the Production of [Aluminium Manufacture]. D. Péniaikoff, Pierre Huy, Belgium. Eng. Pat. 6290, March 21, 1895. (Under Internat. Convention.)

When alumina is highly heated in vapour of carbon bisulphide, the reaction whereby aluminium sulphide is formed takes place with difficulty, owing to the absorption of heat. But the conditions are in this respect reversed by introduction of a body, such as potassium oxide, which in reacting with carbon bisulphide evolves much heat. Thus, by using a "triple base aluminate," the reaction is shown to become exothermic or heat-generating. In practice, an aluminate is obtained "by treating red bauxite and alkaline sulphate, mixed with iron pyrites or alkaline sulphide," and the aluminate is mixed with tar, carbonised, and then subjected in small fragments to the action of the vapours of sulphur, carbon oxy-sulphide or bisulphide, to obtain (according to the proportion of carbon present) either a baked or a melted product. From the baked product, aluminium or aluminium alloys may be obtained by the action of reducing gases, and from the fused product, by electrolysis.—E. S.

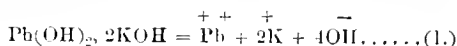
XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

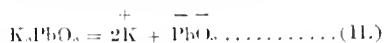
Lead Accumulators, Theory of. C. Liebenow. Zeits. für Elektrochem. 1896, 2, 30, 653, 655.

In a previous paper the author has shown that the reactions in a lead accumulator can be more simply described if we assume that negative PbO_2 -ions are present; but hitherto the existence of such ions has not been proved.

Consider an aqueous solution of the compound $Pb(KO)_2$. If it is to be regarded as a solution of the double oxide PbO, K_2O , it ought to split up into ions in accordance with the equation—



but, if it is to be regarded as a solution of lead plumbate, it ought to split up into ions according to the equation—



Which view is correct may be tested as follows:—A dilute solution of caustic potash is electrolysed between platinum electrodes (wires) in a glass cylinder divided by suitable membranes into three parts. The solution in the middle part is saturated with lead oxide; the parts on either side contain only potash. When a current is passed, oxygen is evolved at the anode and hydrogen at the cathode. At the same time all positive ions in the electrolyte move towards the negative electrode and all negative ions towards the positive electrode. If the lead only gives rise to positive metallic ions (equation 1.), it will move with the sodium ions in the direction of the current; but if it gives rise to negative PbO_2 -ions (equation 11.), these will move in a direction opposite to that of the current. The author finds that the latter is what actually takes place, and regards this as conclusive proof of the existence of negative PbO_2 -ions.

—D. E. J.

Zinc Analysis by Electrolysis. E. Jordis. *Zeits. für Elektrochem.* 1896, 2, [30], 653.

See under XXIII., page 618.

PATENTS.

Calcium Carbide, Improvements in the Production of. T. L. Willson, New York, U.S.A. Eng. Pat. 15,360, Jan. 16, 1895.

See under II., page 582.

Electrolysing Apparatus, An Impd. [Bi-polar Electrodes.] J. Kolb and A. D. A. Lambert, Lille, France. Eng. Pat. 14,342, July 27, 1895.

THE electrolyser consists of two series of plates of insulating material—say ebonite; one series is provided with conducting blades which form bi-polar electrodes, and the other, which is interposed between the above, has porous extensions. All these plates are recessed on both sides, so that when placed together, they form compartments for the circulation of the electrolyte. Ribs are arranged on the inner surface of the recesses on each plate so that they come against each other without making contact. Each plate is provided with four openings which, in the case of the electrode plates, are closed with thin metal blades of about $\frac{1}{20}$ th mm. in thickness, the two faces of which are of opposite polarity; while in the intermediate plates the conducting blades are replaced by porous plates. The blades and plates are held in front of the apertures in the insulating plates by frames and ebonite pegs, and there are channels in the thickness of the plates carrying electrodes, the lower of which admit, while the upper discharge the electrolyte. These channels, which are connected with a main conduit, are so arranged that the liquid entering at one side of the apparatus, leaves it at the other, whilst two apertures at the top of each plate form continuous channels for the collection and removal of the gases when the plates are in juxtaposition, and similarly formed channels at the bottom of the plates serve to admit air under pressure, when necessary. By means of these two systems of channels, both the liquid and gaseous products of electrolysis are separated. The plates are clamped together in suitable frames, from which they are insulated, and electrical connection is made with the four metal blades on each of the terminal electrodes.—G. H. R.

Electric Accumulators [“Dry” Alkaline], Impts. in. E. W. Jungner, Skara, Sweden. Eng. Pat. 15,880, Aug. 23, 1895.

THESE improvements relate to the construction of an alkaline secondary battery of the “dry” kind. Cotton or asbestos saturated with zincate of potash for electrolyte, with an oxygen-absorbing metallic powder next the anode in charging—finely-divided silver, mercury, or an amalgam of silver and mercury being claimed, copper also being mentioned in the specification. The inventor claims a method of sup-

porting the oxides in a bag (asbestos), mixing the metallic powder with graphite, and sealing the cell with a layer of sand and pitch to exclude carbon dioxide.—J. C. R.

Electric Accumulators [Celluloid Plates], Impts. in. P. F. Ribbe, Berlin. Eng. Pat. 5506, March 11, 1896.

THIS invention is based on the use of carrying-plates of celluloid, which plates, after a thin lead plate has been placed between, are connected by means of a celluloid solution. The celluloid plates are so pressed or stamped that they are directly connected at suitable places by the celluloid solution. The celluloid plates thus enclose the lead plates, and are provided with a number of openings, the edges of which form the supports for the active material or paste. The invention is illustrated by drawings.

—J. C. R.

Electric Batteries, Impts. in [Primary]. J. Entwistle, Manchester. From S. N. Smith and E. S. Baring-Gould, Minnesota, U.S.A. Eng. Pat. 6981, March 31, 1896.

THE battery consists of an outer vessel within which is fixed a porous pot. Between this and the outer vessel the zinc, in the form of an incomplete cylinder, is suspended from the lid, and through an opening in it is passed a cup of porous carbon which constitutes the other element. The outer vessel contains a solution of common salt, whilst in the porous pot is placed a depolarising solution made by diluting one to three parts of sulphuric acid with three parts of water, to which, when cold, is added nitrate of soda in the proportion of 8 to 10 oz. of the nitrate to 1 lb. of the acid. The carbon pot is closed by a lid provided with a washer, and connection is made with the lower part of the zinc to prevent unequal action.—G. H. R.

(B.)—ELECTRO-METALLURGY.

Electrolytic Separation and Refining of Metals, Process for. D. Tommasi, Monteur Scient., July 1896, 10, 507—508.

THE anodes are either cast plates or granulated material resting in direct contact with the positive leads. The cathode is a vertical disc capable of rotation about its horizontal axis. Only the lower portion is immersed in the electrolyte, and the upper part is passed during rotation between scrapers that effect the removal of any spongy deposit, transferring it to channels by which it is conveyed to a convenient receptacle. The disc is constructed in replaceable sectors, when a reguline deposit is to be obtained, and the sectors are one by one removed mechanically as they attain sufficient thickness, and are plunged beneath a fluid bath of the metal under treatment until the deposit has been melted away and the sector is ready for use again. A solid disc is preferred for spongy deposits. The advantages of this arrangement are that polarisation is prevented by the rotation of the cathode and by the action of the scrapers, and the liquid is sufficiently agitated to prevent separation into layers of different density, whilst spongy deposits are removed as fast as they are produced, thus preventing oxidation by the liquid and the occurrence of local action. At the same time the electrodes may be allowed to approach more closely owing to the impossibility of short-circuiting through irregularity of deposit, and the resistance of the bath is therefore sensibly diminished.

—W. G. M.

PATENTS.

Electrolytic Deposition of Metals, Impts. in the, and in means applicable therefor [Compound Cathode]. C. Kalkigh, Johannesburg, Africa. Eng. Pat. 11,944, June 1, 1895.

THE electrodes are constructed of two or more layers of the same or of different metals, or of a substance having a metallic surface temporarily attached, the object being to facilitate the separation of the deposited metal. In the case of the deposition of gold, lead cathodes, the surface of which has been gilded electrolytically, may be employed, and this surface is covered with lead-foil, which receives the deposit of gold. The lead-foil is removed from its backing and placed on an inclined sheet of screening, or metal

plate, and heated above the melting point of the lead, which runs off, leaving the film of gold. Any suitable metal having a melting point sufficiently different from that of the deposited metal, may be used. With cyanide solutions the electrodes are plates of copper, silver, or other metal, or may take the form described in Eng. Pat. 23,431, 1893 (this Journal, 1894, 402), but their surfaces must be plated with silver or gold, and be kept saturated with mercury sprayed on them in a finely divided state. To secure better deposition, a salt of a base metal, preferably mercury, is added to the solution in excess of the gold; or silver-foil, which will form a salt in solution, may be employed. The excess of mercury drips off the cathode, carrying with it the gold before it has time to get attached to the copper. The used electrolyte is run through copper turnings to free it from the mercury salt. It is preferable to frequently reverse the current so that deposition takes place on both electrodes, but an alternating-current dynamo may be used. The deposition of other metals is also improved by the addition to the electrolyte of the salt of a second metal the electro-chemical energy of which is lower than that of the metal to be deposited, but with lead cathodes the salt of mercury is inadmissible.—G. H. R.

Gold and Silver Extracting [Ramic Diaphragm], from Cyanide Solutions by Electricity; Impts. in or connected with Apparatus for. J. Pflger, Kaiserslautern, Germany. Eng. Pat. 16,736, Sept. 6, 1895.

THE inventor claims a porous diaphragm, made of ramie fibre, in apparatus for extracting gold and silver from cyanide solutions by electricity, with or without soaking the said diaphragm in a solution of caustic alkali.—J. C. R.

Gold and Silver Extracting, from Cyanide Solutions, Electrical Apparatus for; Impts. in or connected with. J. Pflger, Kaiserslautern, Germany. Eng. Pat. 16,737, Sept. 6, 1895.

THE essential feature is in employing a cathode of large surface in precipitating gold electrolytically, or by zinc, short-circuited, battery-fashion. The cathode is made of shavings, wire-work, or gauze (iron). The electrolyte circulates through the cathode. The gold may be separated from the cathode by mercury, or cyanide of potassium solution (8 to 10 per cent.), a carbon plate being joined up to the cathode to form a couple.—J. C. R.

Nickel Plating, Impts. in Process of [Corrugated Anodes]. H. L. Haas, New York, U.S.A. Eng. Pat. 7358, April 7, 1896.

CORRUGATED nickel anodes are employed, whereby it is claimed that the strength of the bath is maintained, as the solution of the anode by the sulphuric acid formed on the passage of the current through the neutral solution, takes place uniformly with deposition of the metal at the cathode. The large anode surface also admits of the use of a power as low as 2 volts; and the formation of basic salts of nickel and the stripping of the deposit due to the action of an excess of hydrogen at the cathode, which are the results of a high voltage, are prevented.

—G. H. R.

XII.—FATS, OILS, AND SOAP.

Fatty Acids, Salts of, and Soaps; Behaviour of, in Presence of Water. F. Kraft and A. Strutz. Ber. 29, [8], 1896, 1328—1334. (Compare this Journal, 1894, 1207; and 1896, 206.)

IN the last communication on the above subject, Kraft and Wiglow showed that it was impossible to determine the molecular weights of the real soaps in aqueous solution by the ebullioscopic method, and that such solutions behaved in all respects like *colloids*. It is well known that alcoholic solutions of soaps exhibit a neutral reaction towards indicators, showing that they are not decomposed, as is the case with aqueous solutions; hence the authors have applied the ebullioscopic method to the determination of the molecular weight of sodium oleate (chosen on account of its greater solubility) in alcoholic solution, and found that

it corresponds very closely to that required by the formula $2C_{18}H_{35}O_2Na$. The authors have also, for the sake of comparison, extended their experiments to hexadecyl ammonium chloride ($C_{16}H_{33}NH_3Cl$), which is a salt of an organic base with an inorganic acid, whilst the soaps are salts of inorganic bases with organic acids, and found that this substance behaves in precisely the same way as the soaps, *viz.*, in aqueous solution it exhibits the properties of a *colloid*, *i.e.*, it does not raise the boiling point of the solvent, whilst in alcoholic solution it behaves as a *crystalloid*, and gives a molecular weight of 291, corresponding to the theoretical number 277. That sodium oleate possesses a molecular weight twice that of the theoretical is comparable with the fact that, besides the neutral salts of the fatty acids, acid salts are also known, such as potassium diacetate, $C_2H_3O_2K$, $C_2H_3O_2$, &c. On the other hand, acid salts of ammonium chloride have never been discovered. The analogy between the soaps and the homologous series of which hexadecyl ammonium chloride is a member, is complete. In the case of aqueous solutions of the soaps, the lower members, *e.g.*, sodium acetate, are *crystalloids*, whilst the higher members are *colloids*; and the same holds good for the hexadecyl ammonium chloride series, the lowest members, *viz.*, ammonium chloride and methyl ammonium chloride, being *crystalloids*.—J. S.

Colloidal Solutions, A Theory of. F. Krafft. Ber. 29, 1896, [8], 1334—1341.

THE author discusses the work which he, in conjunction with others (see preceding abstract), has carried out on the nature of soap solutions, and arrives at the following conclusions:—

1. Colloidal liquids or solutions contain the liquefied substances in the molecular condition; and
2. Colloidal liquefied molecules rotate in very small closed paths or surfaces.—J. S.

Margarin Manufacture in France. A. M. Villon. Monit. Prod. Chim. 1896, 4.

See under XVIII. A., page 607.

Fats and Oils, Vegetable and Animal; The Determination of the Solid Fat in Artificial Mixtures of. J. H. Wainwright. J. Amer. Chem. Soc. 1896, 259.

See under XXIII., page 620.

Filtering Apparatus for [Waste] Oil and other Liquids, Improvements in. R. Conrader, Erie, Penn., U.S.A. Eng. Pat. 9539, May 5, 1895.

See under I., page 578.

PATENTS.

Oil-Presses, Impts. in or appertaining to. G. C. Dymond. Liverpool. From K. Eisenwerke, Harburg, Hamburg. Eng. Pat. 13,623, July 16, 1895.

THESE consist in an oil-press with revoluble earthenware press-pots, in combination with a seal-heater, charging hopper, and hydraulic preliminary and final pressing apparatus, arranged in such a manner that the axis of one pot coincides with the axes of the heater and the press, whilst the axis of the other pot coincides with the axes of the preliminary pressing apparatus. To increase the production of oil, the preliminary pressing apparatus (by changing the pressure) is used as high-pressure, and the main press as low-pressure apparatus, the first partly pressing out the oil, and the second completing the operation without removing the material from the press-pot in the interval.—J. J. K.

Soap, Impts. in the Manufacture of. R. E. Green, London. Eng. Pat. 18,163, Sept. 28, 1895.

AN insoluble soap is first made by combining, with the aid of steam, fatty matter with any of the hydrates of barium, calcium, magnesium, aluminium, or with lead oxide. The liberated glycerin is separated by pressure. The insoluble soap is then converted into a soluble one by boiling with sodium silicate (if a hard laundry soap be desired) or sodium phosphate (if a neutral soap be required). Sodium

chloride is added to separate the soluble soap from the insoluble silicate or phosphate of the alkaline earth, and, after settling, the soap is drawn off for a final melting before it is run into the frames. The insoluble residue is said to be useful for the manufacture of paint.—J. J. K.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER. Etc.

(A.)—PIGMENTS, PAINTS.

Zinc White, Yellow Tint of. F. Fuchs and F. Schiff.
Oest. Z. Berg. u. Hüttenw. 1896, 29.

THE authors find that the yellow tint sometimes met with in zinc white, and which has hitherto been attributed to the presence of ferric oxide, is due to traces of cadmium sulphide.—J. L. B.

(B.)—RESINS, VARNISHES.

PATENT.

Blackboards, An Improved Liquid Composition for. V. Bourlez, Brussels, Belgium. Eng. Pat. 14,172, July 25, 1895.

THIS liquid for surfacing blackboards used in schools, is composed of ferri-ferrous corundum, 340 parts; linseed oil, 120 parts; resin, 43 parts; manganese oxide, 28 parts; lead protoxide, 28 parts; turpentine, 400 parts; benzene, 6 parts; and lampblack, 35 parts.

The oil, resin, oxide of manganese, and lead oxide, are heated together up to the point of oxidation and until the resin is dissolved; the turpentine and benzene are then poured in, and the mass allowed to cool, after which the lampblack and ferri-ferrous corundum are added.—J. J. K.

(C.)—INDIA-RUBBER, &c.

PATENT.

India-Rubber, Impts. in the Vulcanisation of India-Rubber Articles and Fabrics coated with. C. Dreyfus, Clayton, Manchester. Eng. Pat. 15,347, Aug. 15, 1895.

PURE benzene is used instead of carbon bisulphide or petroleum spirit, as a solvent for the sulphur chloride employed for vulcanising the rubber, being less inflammable than these, and leaving the vulcanised article without any disagreeable smell. Its higher boiling point is said to ensure a "restrained action" of the sulphur chloride upon the goods, consequently effecting a more even vulcanisation.—J. J. K.

XIV.—TANNING, LEATHER, GLUE, SIZE

Glue, Valuation of. C. Stelling. Chem. Zeit. 1896, 20, 161.

See under XXIII., page 620.

Tannin, Estimation of. B. Weiss. Der Gerber, 1896, 22, 62.

See under XXIII., page 620.

Tanning in United States. Ch. of Commerce J., July 1895, 125.

See under Trade Rep., page 628.

PATENT.

Treating Skins [Sulphide of Sodium], Impts. in the Art or Process of. J. W. Pearson and F. A. T. Moor, both of Philadelphia (Penn.), U.S.A. Eng. Pat. 3715, Feb. 18, 1896.

THE inventors claim the preparation of skins or hides, ready for "any preferred method of tanning," by a single, continuous, and uninterrupted operation of a few hours' duration.

The process consists in subjecting skins and hides to the action of a solution of sodium sulphide in a closed vessel. The solution at first, has (or may have) a temperature of about 100° F.; and, during the first two hours, the containing vessel or drum is rotated, whilst, during the next ten hours, it remains at rest. The drum is then opened and the skins taken out and washed. They are then ready for tanning.

25 lb. of sodium sulphide are dissolved in 20 "ordinary buckets full" of water, this solution being sufficient for the treatment of 240 sheep-skins.

The "skins or hides" are placed in the solution "just as they come from the animal, except in the case of sheep-skins, when the wool is previously removed."—E. R. B.

XV.—MANURES, Etc.

Excessive Manuring in Spain. U.S. Consular Reps., July 1896, 591.

UNDER date of June 18, 1896, Consul-General Bowen, of Barcelona, transmits the annual report from Consular Agent Mertens, of Grao, from which the following statement relative to the indiscriminate use of fertilisers in Valencia is extracted:—

While the exports from Grao during the year 1895 were largely in excess of those of the preceding year, as far as tonnage is concerned, the profits did not keep pace with this increase. This was chiefly due to the indiscriminate use of artificial manures, which the farmers of this province have employed during the last few years in their fields to obtain a larger quantity of fruit and other produce. The result has been that the quality of oranges is, in many cases, such that they could not stand exportation, and arrived at their destination in a completely spoiled condition. The complaints from the rice millers are to the same effect, and the low prices of this grain, due to this deterioration in quality, proves a veritable calamity. The desire to secure larger crops was, in many instances, such that some farmers went beyond employing an increased quantity of guano, and used sulphates of ammonia and nitrates of soda alone as manure, without any other preparation or mixture with other chemicals. The effect on the soil must, sooner or later, prove disastrous, and the result will be complete failure of crops, likely to last for several years. American farmers should take warning from this, and use artificial manures carefully and judiciously.

Fertiliser, Ground Mineral Phosphate as a. F. T. Shutt. Chem. News, 1896, 74, 4.

THE author found that by treatment of finely ground mineral phosphate (apatite), containing about 25 per cent. of carbonate of lime, with a 1 per cent. citric acid solution, only 6.2 per cent. of the total phosphoric acid was rendered soluble, or 1.5 per cent. of phosphoric acid passed into solution. Experiments were undertaken with the object of rendering the phosphoric acid soluble. The results of the first series of experiments were published in the Report of the Minister of Agriculture for 1893. It was found in one instance that fusion of the finely ground apatite with bisulphate of soda rendered phosphoric acid equivalent to 38.49 per cent. of the apatite, soluble. In the above-mentioned report the author draws the following conclusions from his first series of experiments:—Any soluble phosphoric acid formed by ignition of the mineral phosphate with sodium or potassium sulphate immediately re-combines in presence of water to form tricalcium phosphate. The ignition of mineral phosphates with sodium or potassium bisulphate produces, according to circumstances, more or less soluble phosphoric acid.

Since the issue of this report the author has undertaken a further series of experiments, but he states that these were made before the publication of Dr. Dyer's paper (this Journal, 1894, 13, 288), wherein it is said that 1 per cent. citric acid solution represents the acidity in root-sap, and he used 2 per cent. citric acid solution to ascertain the soluble phosphoric acid.

The finely ground mineral phosphate was ignited with sulphate of soda, with the result that phosphoric acid

equivalent to from 35 to 37 per cent. of the phosphate was soluble in the citric acid solution.

Ignition of the finely ground apatite with a crude product consisting for the most part of sulphate, but containing a small proportion of bisulphate of soda, rendered 50 per cent. soluble in the citric acid solution.

Ignition of the finely ground phosphate with either wood ashes or a mixture of wood ashes and sand did not appreciably increase the solubility.

The finely ground phosphate was fused with potassium carbonate, and the mass treated with water. This dissolved phosphoric acid equivalent to 6.5 per cent. of the phosphate. Treatment of the residue in the cold with 1 per cent. citric acid solution further dissolved phosphoric acid equivalent to 4.3 per cent. of the phosphate.

The author points out that if the potash salt be used in the fusion, a better fertiliser is obtained on account of the potash introduced.—A. S.

Ammonium Citrate Solution used in the Analysis of Fertilisers, A Simple Method for Determining the Neutrality of. N. W. Lord. J. Amer. Chem. Soc. 1896, 18, [5], 457.

See under XXIII., page 618.

Algerian Phosphate Dispute. Chem. Trade J., Aug. 15, 1896, 28.

See under Trade Rep., page 628.

PATENT.

Animals' Carcasses and Offal, Imps. in Apparatus for Treating. H. C. F. Otte, Altona, Germany. Eng. Pat. 8990, May 6, 1895.

The apparatus consists of a rotating perforated drum with a steam-jacketed pan. The offal, &c., is first heated by the steam jacket and afterwards by the direct injection of "live steam."—E. R. B.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar-House Analyses, Two Sources of Error in. E. C. Shorey. J. Amer. Chem. Soc. 1896, 18, [5], 462—465.

1. *The Determination of Fibre (Insoluble Matter) in Cane and Bagasse* is usually made by extracting with water and weighing the dried residue. It is shown that discordant results are likely to be obtained if the duration of boiling and the number of washings with water be varied. For instance, fibre prepared by exhausting cane with cold water, yielded up to boiling water 7.2 per cent. of its weight in five minutes, 12 per cent. in two hours. A uniform *modus operandi* therefore should be adopted in respect to time of boiling, state of sub-division of the sample, &c. When the sole object of an analysis is merely to compare the percentages of fibre in the cane and bagasse respectively, with a view to calculating the "extraction" by formula, the author prefers to dry and regard as "fibre" the residue from the alcoholic extraction of the cane, since the results are more uniform, and readily obtained.

2. *Determination of Albuminoid Nitrogen.*—In the generally accepted method, the cane juice is heated to boiling, treated with cupric hydrate, allowed to cool, filtered, and nitrogen determined in the precipitate. The results thus obtained are considerably too low, owing to the conversion, at a boiling temperature, of a portion of the albumin into other bodies (probably peptones)—not precipitated by copper hydrate—under the influence of the natural acidity of the juice. In two experiments, the loss of albuminoid nitrogen incurred by boiling the juice for one minute was found to be 9 per cent. and 16 per cent. respectively (total N = 100). It is recommended, therefore, to add copper hydrate to the cold juice, to filter cold and wash with cold water.—H. T. P.

Sugar Industry, Progress in, for the First Quarter of 1896. Dingl. Polyt. J. 1896, 300, 253—264.

The Simultaneous Determination of the Organic and Mineral Acidity of Beetroot Juice.—Sidersky (J. des Fabricants de

Sucre, 1896, 37, No. 3) recommends for this purpose the use of paper soaked in an aqueous solution (1:1000) of Congo Red, 4 R. A drop of dilute mineral acid produces a dark brown stain on the paper, whilst organic acids are without effect. If a known volume of beetroot juice be treated with alkali, the stain becomes less intense in proportion as the mineral acid is neutralised; the absence of colour on the test paper is an indication that organic acids alone are present. The same author has discovered that the colouring matter present in the beetroot is a more sensitive indicator. Beet juice oxidises rapidly in the air, thereby occasioning the black colour of diffusion juice. The addition of sulphuric acid prevents this oxidation and causes the acid distillery liquor to appear clear and bright. If potash of known titre be gradually run into a measured quantity of such juice, a sudden darkening occurs. This vanishes on shaking, so long as the juice contains free sulphuric acid; when this is neutralised, the oxidation and change of colour at once sets in, and some colouring matter is precipitated. More potash is added until the liquor is neutral to litmus paper. The end of the first reaction indicates the free mineral acid, and the second the total acidity; the difference between them is the acidity due to organic acids.

Grundmann, in some experiments on diffusion (Centralblatt f. die Zuckerind. der Welt, 1896, 4, 419), states that in most factories the sugar content of the thin juice was lower than that of the diffusion juice; he suggests that the slicings, before being mashed with battery juice, should be subjected to a previous diffusion with thin juice. The writer of the review suggests the following method of working:—When the diffuser is filled with slicings, these are mashed with thin juice at a temperature of 80° C., introduced from below by a conduit, so that the slicing and mashing take place whilst the juice from the previous diffuser is being discharged for defection. As soon as this operation is over the fresh diffuser is filled and mashed as before with battery juice, and the resulting thin juice passed into a special measuring vessel. When, after mashing, the thin juice has left the diffuser, the diffusion juice which is about to enter is passed by means of valves through another measuring vessel to the first defection, and when purified, serves for mashing in the succeeding diffusers. The thin juice derived from the previous diffusion contained in the first measurer passes to the second defection, and can be there treated with a small quantity of lime and saturated up to 0.03 per cent. of alkalinity in order to be ready for further working.

The electrical purification of juice has made little advance since the opposition offered to it three years ago. It is not generally known to what extent Schollmeyer's method is employed in Germany. According to Jauraux, Gallois, and Dupont (Gazeta Żukrowicza, 1895, 16, through Zeits. für Zuckerind. in Böhmen, 1896, 20, 252), lime or baryta is added to the juice from the beetroot or sugar cane until there is a slight alkaline reaction. It is heated from 85—90° C., filtered, and electrolysed in two series of vessels; the first being on a higher level, so that the juice can flow into the second. The first vessel is divided by two porous porcelain plates into three compartments; the middle one containing the defeccated juice and the two outer, water. The cathode, either of manganese or aluminium oxide, is lowered into the juice, whilst the anodes, prepared of carbon, iron, or other material insoluble in alkali, are placed in the water. Acids are liberated by the electrolysis from the cathode and combine with the same; the alkali diffuses through the porcelain plates into the water. The juice then flows into the second vessel, where complete purification is effected by means of lead electrodes. When the electrolysis is finished, the juice is run off and the precipitated organic compounds and lead salts are removed by filtration. Should the juice still contain traces of lead, they can be removed by rendering slightly acid with phosphoric acid, the excess of the latter being adjusted by lime. Little is known of this process, which, if generally employed, would revolutionise the purification of juice. One refinery, however, which has employed this or a similar method (Neue Zeits. f. Rübenzuckerind. 1895, 36, 19), finds that the lead anodes become covered with an insoluble precipitate, consisting for the most part of lead oxide, with which

apparently the organic acids are too weak to combine, and the working is thereby hindered.

Temporary unsatisfactory working of the defecation-mud presses frequently occurs, and arises from various causes—among others, cholesterin, which is derived from the beet root, and imparts a greasiness to the mud. The question has been discussed by the Brunswick-Hanoverian *Zuckerzeits.*, and Brüning (*Zeits. Ver. Rübenzuckerind.* 1896, **46**, 71) is of opinion that the difficulty in filtration arises from overheating during the diffusion. Herzfeld, who has examined the mud, found that it contained a considerable amount of iron, which combines with the pectins to form gelatinous compounds instead of the granular calcium salt of the pectin. He thereupon conjectured the cause of the difficulty in filtration to be that a considerable amount of pectin enters the juice during overheating; and in consequence of limestone being used, the iron present therein contributed to the formation of an iron compound of the pectin. When, therefore, Brüning only warmed to 75° C., the filter presses worked satisfactorily. Herzfeld also remarks that difficult working with thick juice presses is nearly always to be attributed to the presence of too much fat. A case is cited in which a mud was acid to phenolphthalein, alkaline to litmus, and contained a considerable amount of free alumina arising from the decomposition of aluminates by carbonic acid during saturation. This delayed deposition and made filtration through cloths impossible. On adding a small quantity of lime, the quality of the mud was immediately changed—it settled easily and filtered normally. It is therefore unnecessary, when material is rich in alumina, to carry saturation to the extent at one time considered requisite.—J. L. B.

Sugar Industry, Progress in, for the First Quarter of 1896. Dingl. Polyt. J., 1896, **300**, 282—287, 296—301.

Dry and Wet Defecation.—J. Murke (*Die Deutsche Zuckerind.* 1895, **20**, 1874) concludes from his experiments that in many cases wet defecation is to be preferred to dry. The darkening of the juice treated in the dry way might be somewhat lessened by diluting the juice prior to treatment, but then the chief advantage of dry defecation over wet, namely, the smaller quantity of water to be evaporated, would not be realised. On the other hand, it is generally advantageous to employ the dry process with beetroot material, this showing little or no difference in the final result, when the two methods are tested side by side.

Treatment of Calcium Saccharate in Filter Presses, Washing Out, and Shudging the Saccharate with Water, Lime-Water, or Solutions of Sugar and Saccharate Saturated or Supersaturated with Lime.—P. Bengtson Harje (*ibid.* 1896, **21**, 238) found that if calcium tri-saccharate be treated with water or lime-water, it is decomposed the more readily the higher the temperature of the wash water. Solutions of calcium mono- or disaccharate result, or the sugar is split off, in all cases with separation of calcium hydroxide. In practice this decomposition gives rise to the formation of channels in the press cakes during washing in the filter presses, through which the water flows off without fulfilling its purpose. The solution of the saccharate with attendant phenomena, are wholly prevented by the application of a previously prepared washing liquid, consisting of sugar or saccharate solutions, saturated or supersaturated with lime, which are without action on the saccharate. These washing liquids, the use of which is patented, have generally a composition of 0.1 to 1 per cent. of sugar, and 0.4 to 0.65 per cent. of CaO, and are prepared by adding an excess of powdered lime to a 0.3 to 0.5 per cent. sugar or saccharate solution. The excess of lime is afterwards removed by filtration, or the clear liquid is decanted from the lime. By washing with such a liquid, the formation of channels and clefts in the cake is avoided, little time is required, the filter-cloths remain soft, and the colouring matters and salts are completely removed. A saccharate washed in this manner yields after saturation a good, clear, sweet juice, the massecuite from which can be immediately employed for the production of finished sugar.

Hudec (*Oester. Ungar. Zeits. für Zuckerind. und Landwirts.* 1896, **25**, 38) gives a description of the separa-

tion of ammonia, by the Sixta-Hudec method, from the steam rising from the juice during evaporation—a process employed in a sugar factory during the last campaign. The ammonia is removed from the steam of the juice to prevent its action on the heating area of the succeeding member of the triple effect, by spraying a solution of potash alum into it. Experiments showed that the solution of alum does not exert an unfavourable influence on the evaporation. The alumina formed is pure and white, and the salts from the decomposition contained 12 to 16.25 per cent. of ammonia. Isolated groups of crystals were found in the mass of salt, containing as much as 24 per cent. of ammonia. The author calculates a profit of 4.62 fl. per cwt. of alum employed.

At the beginning of the present campaign, Drenkman *Zeits. Ver. Rübenzuckerind.* 1896, **6**, 81) noticed that the juices were frequently dark in colour after defecation, saturation, and boiling, and that this coloration became more frequent and regular when the beets had been stored for some time. This phenomenon is due, not to the colouring matters contained in the beet, but to the products of decomposition of glucose, apoglucinic acid, and saccharic acid. The author has also observed during evaporation a striking increase of alkalinity, which is mainly attributed to the presence of ammonia in the juices. The additional alkalinity is favorable to the colouring of the juice, for during the warming, the organic acids combine with a small quantity of iron, and under the influence of light become dark violet coloured. It seems that when glucose is boiled with lime or alkali, acids are formed, and it is noticeable that beets yielding dark syrups contain considerable quantities of reducing substances. The dark juices influence only the colour of the first products, and not the yield. The reason of the greater viscosity so often observed in the boiled after-products, is not so much the concentration of the dark organic acids as the excess of arabic acid, the deleterious effect of which on the crystallisation of sugar is considerably intensified by the increased alkalinity of the juice. It is therefore better to keep the alkalinity of after-products low, and the boiled mass in a state of motion.

Cane Sugar.—The propagation of the sugar cane is usually effected in all tropical countries by means of small shoots removed from the stem at the time of harvest. These, when planted, quickly develop "eyes," and at the end of the year have become full-grown plants ready for gathering. J. Waaker (*Botanisches Centralblatt*, 1896, **17**, 37), has succeeded in obtaining seed from the cane and in raising flourishing plants therefrom. He has not, however, met with the same degree of success with all species of the cane, some of the varieties having proved particularly ill-adapted for the production of seed.

Organic Non-Sugar in Cane Juice.—According to Maxwell (*Deutsch. Zuckerind.* 1896, **21**, 425 *et seq.*), the organic non-sugar, free from nitrogen, constitutes the gums, the chief impurity met with in the factory. Three groups of substances have been isolated from the gum, all of which are composed of glucose-forming constituents combined with a more or less insoluble modification of cellulose. Further investigations have shown that this is a mixture of mucilage and gum. The mucilage consists for the most part of hexosans, which are decomposed into glucose and cellulose by boiling with dilute acids (see Maxwell, this *Journal*, 1896, 125). The true gums are composed of pentosans, and on hydrolysis yield pentoses. Lime is the only substance capable of removing these gums from the juice. The electric current has exercised a favourable influence on the juice, for, although unaccompanied by any purifying effect, the boiling is rendered more satisfactory and the grain forms at once.—J. L. B.

Masseculite, Investigations relating to. Claassen.

Pap. Sac. Belge, **23**, 145.

It is desirable to determine the degree of concentration the composition of the syrup surrounding the crystals, and the amount of the crystals contained in the mass at different periods of the process, and for this purpose samples are taken before, during, and after the formation of "grain." The assay samples are polarised, and the amount of water they contain is determined. In order to calculate the

amount of crystals present, Schneider's formula is made use of:—Percentage of crystals = $100 \frac{P-n}{100-p}$, in which P = polarimetric reading of the massecuite, and p = that of the syrup. Finally, the amount of sugar dissolved in one part of water is calculated for each of the syrups, and this number is compared with that given by Herzfeld for

solutions of pure sugar. If a represent the quantity of sugar dissolved in one part of water in the syrup under examination, and b the quantity of sugar contained in a solution of pure sugar, then $\frac{a}{b}$ is the coefficient of supersaturation, which averages about 1.2. The results obtained are given in the following table:—

	Temp. of Massecuite.	Massecuite.			Strained Syrup.			Coefficient of Saccharose.	Crystals.	
		Rotation.	Water.	Quotient.	Rotation.	Water.	Quotient.		Per Cent. of Mass.	Per Cent. of Sugar.
Shortly before formation of "grain"	74	74.4	18.33	90.11	..	..	..	1.21	..	..
During ..	74	74.4	17.71	90.8	..	..	..	1.26	..	..
2 hrs. 25 min. after ..	74	78.3	18.57	90.6	73.0	19.1	90.1	1.14	19.6	25.0
2 hrs. 55 min. ..	71	76.6	16.25	91.5	71.3	20.5	89.7	1.07	18.6	24.3
3 hrs. 10 min. ..	72	79.1	..	..	71.8	..	87.6	1.21	25.5	32.2
4 hrs. 10 min. ..	72	80.7	..	..	70.5	..	85.3	1.23	34.6	42.9
4 hrs. 55 min. ..	68	81.3	..	90.9	70.0	..	84.7	1.29	37.7	46.4
5 hrs. 25 min. ..	71	80.7	..	91.2	68.6	..	84.1	1.14	38.5	47.7
6 hrs. 10 min. ..	73	84.1	..	91.6	69.0	..	80.0	1.28	48.7	57.9
At discharging ..	77	85.6	..	91.6	68.0	..	80.0	1.30	55.0	64.3

—A. K. M.

Pentose, A New [from Wood-Sugar Molasses]: Lyxonic Acid and Lyxitol. G. Bertrand. Bull. Soc. Chim. 1896, 15, [3], 592–594.

This paper confirms the work of Fischer and Bromberg (Ber. 29, 581). In addition to lyxonic acid and lyxose, lyxitol was prepared by the further reduction of lyxose, and obtained in the form of a syrup. Lyxitol does not readily yield an acetal (with benzaldehyde, for example), differing in this respect from xylitol. As regards lyxonic acid, its strychnine, quinine, barium, and strontium salts are crystalline; the lead, zinc, and calcium salts, amorphous. In conclusion, a method is described for preparing lyxonic acid in quantity from the waste molasses of crystallised wood-sugar manufactories.—H. T. P.

Wood Gum, Composition of. S. W. Johnsen. J. Amer. Chem. Soc. 1896, 214–222.

1. From *Maize*.—Ground maize cobs were digested for 24 hours, with frequent agitation, in a mixture of 1 vol. of concentrated ammonia and 7 vols. of water, filtered, washed to remove ammonia, and digested for 48 hours with 7 per cent. caustic soda solution. The filtered extract was mixed with twice its volume of 93 per cent. alcohol. The precipitate was washed until the washings were neutral to test paper, then stirred up with dilute hydrochloric acid, again washed with dilute alcohol until neutral, and finally treated with absolute alcohol and ether, and dried over sulphuric acid. About 25 per cent. of white, easily powdered material was thus obtained, which answered to Thomson's description of wood gum.

It was not turned blue by iodine. Agitated with pure water at ordinary temperatures, a 0.14 per cent. solution was obtained, neutral in reaction. Boiled with water for six hours the solution contained 0.44 per cent. of dissolved substance, which very slightly reduced Fehling's solution. It was neutral, gave no precipitate with normal lead acetate, but a heavy flocculent precipitate with basic lead acetate. The average of three closely agreeing analyses gave: Carbon, 39.09; hydrogen, 6.73; ash, 0.61; moisture, 13.51; from which the composition of the dry and ash-free substance works out as according with the formula $C_5H_8O_4$.

By hydrolysis a syrup was obtained, which, after seeding with a little pure xylose, in a few days nearly solidified to a mass of crystals, which, when washed with alcohol and dried, melted at 153° C. The cobs of Indian corn therefore yield very pure xylan, $C_5H_8O_4$. Earlier analyses of wood gum, leading to the incorrect formula $C_6H_{10}O_5$, were probably made on imperfectly dried material.

2. From *Birch Wood*.—Preparations obtained from the wood of the American white or grey birch, *Betula alba*, differ in composition from the xylan of maize cob. Analysis points to the formula $C_4H_6O_3$. The gum, when hydrolysed, yields a syrup from which a very small proportion of

crystals can be separated, which do not appear to be increased in quantity by seeding with xylose crystals.

3. From *Vegetable Ivory*.—According to Reiss, this substance, the fruit of *Phytelphas*, yields about 7½ per cent. of yellowish-brown gum, soluble in water, levo-rotatory, and readily hydrolysed, yielding mannose. Reiss also obtained another carbohydrate as a white amorphous powder, which was found to swell and partially dissolve in water, reducing Fehling's solution; this, which he termed semini, also yielded mannose on hydrolysis. A quantity of refuse vegetable ivory received by the author with the information that "it had been used as a food for cattle, which ate it with great relish and fattened upon it," was subjected to "fodder analysis," with the following percentage results:—Water (at 100° C.), 18.78; ash, 1.08; crude fat (ether extract), 0.70; albuminoids (N × 6.25), 3.37; crude fibre, 7.50; nitrogen-free extract (by difference) 68.57.

Turnings of the materials were treated with ammonia, as described above for maize, then extracted with 10 per cent. potash solution, and the insoluble residue with a weaker solution. From each extract the gum was precipitated by alcohol in two fractions, and the four preparations thus obtained were purified, and two of them were analysed in an air-dry condition. The results yielded by the second fraction of gum from the first extraction closely correspond with the theoretical figures for pure mannan, $C_6H_{10}O_5$; the first fraction of gum from the second extraction contained about 0.5 per cent. less carbon, pointing to the presence of another carbohydrate.—L. A.

Dulcine (Sucrol), Detection of, in Beverages. Jorissen. Revue Chim. Ind. 1896, 7, [77], 134.

See under XXIII., page 620.

Sugar in Spain. Ch. of Commerce J., July 1896, 125.

See under Trade Report, page 628.

Honey, Examination of. E. Beckmann. Zeits. Anal. Chem. 1896, 35, [3], 263.

See under XXIII., page 622.

PATENT.

Soluble Starch, An Impd. Process for Preparing. J. Kantowicz, Breslau, Germany. Eng. Pat. 5844, March 16, 1896.

This patent refers to the separation of soluble starch (rendered soluble in any desired manner) from its solution.

This is effected either by the addition of magnesium sulphate to the solution or by subjecting the latter to a temperature of -20° for about 10 hours.—A. K. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

Sugars [Maltose, &c.], Ammonia Derivatives of Certain.
C. A. Lobry de Bruyn and F. H. van Leent. R. tr. ch. P.-R. 14, 134.

Maltose.—20 grms. of finely-powdered maltose are dissolved in 100 c.c. of methyl alcoholic ammonia, saturated at 17° – 18° C. (20 per cent. of NH_3) and set to crystallise (a less coloured product is obtained by replacing the methyl by ethyl alcohol). Water is eliminated in the reaction and *maltosamine* formed. The latter is comparatively stable; it does not lose ammonia in dry air, and may be recrystallised from hot methyl alcohol, from which it separates in needles, melting at 165° C. with decomposition. $[\alpha]_D^{20} = +110$.

Galactose yields two derivatives:—(1.) *Ammonio-galactosamine* ($\text{C}_6\text{H}_{10}\text{O}_5(\text{NH}_2)_2$), in groups of needles, m. pt. 113° – 114° C. This body is very unstable and gradually gives off its ammonia. $[\alpha]_D^{20} = 87^{\circ}3$, diminishing in two days to $62^{\circ}5$, at which value it remains sensibly constant. (2.) *Galactosamine*, ($\text{C}_6\text{H}_{11}\text{NO}_5$), obtained from the mother-liquor of the preceding compound, crystallises in long needles, m. pt. 141° C. It is stable and may be crystallised from boiling methyl alcohol. $[\alpha]_D^{20} = 64^{\circ}3$, very slowly diminishing to $58^{\circ}3$. The fixation of a second molecule of ammonia by this body is more or less prevented by the presence of water, and does not take place at all in an alcoholic solution containing 80 per cent. of water.

Xylose yields an osamine ($\text{C}_5\text{H}_{11}\text{NO}_4$) melting at 130° C. with decomposition. $[\alpha]_D^{20} = -18^{\circ}3$, which rises to $-0^{\circ}46$ in a fortnight.

Arabinose forms a very stable osamine, m. pt. 124° C., which is extremely soluble in alcohol. It may be precipitated by the addition of ether.

Rhamnose also furnishes an osamine, and at the same time fixes a molecule of alcohol. The resulting compound has the formula $(\text{C}_6\text{H}_{13}\text{NO}_5)\cdot\text{CH}_3\text{OH}$. It may be recrystallised from absolute alcohol. It melts at 116° C., and loses ammonia and alcohol even at comparatively low temperatures. $[\alpha]_D^{20} = +38$. The corresponding compound with ethyl alcohol fuses at 80° C. $[\alpha]_D^{20} = +28^{\circ}$.
—H. T. P.

Spirit, Direct Production of Good, from Asphodel and Squill with the use of Pure Cultivated Wine-Yeast.
Rivière and Bailhache. J. de la Distillerie Française, 13, (1), 609.

THE authors have previously shown that in order to obtain alcohol of good quality—that is, free from the greater part of the commonly occurring impurities—from beet juice, it is not sufficient to merely employ pure cultivated wine-yeast for the fermentation, but that an essential condition is the clarification of the juice with 1 per cent. of slaked lime, which effects the removal of objectionable nitrogenous matters. A similar method applied to asphodel (*Asphodelus ramosus*) and squill (*Scilla maritima*) has also given good results. These plants are very abundant in Algiers and Tanis, and the alcohol prepared from them in the ordinary way is of very low quality. In the method adopted by the authors, the plants were cut up, treated with hot water, and submitted to diffusion. The liquor was boiled and, when cold, treated with 2 per cent. of lime; the precipitate was filtered off after 48 hours, and the excess of lime precipitated with sulphuric acid. The exhausted residues were ground fine, boiled with 2 per cent. of sulphuric acid to convert the starch into fermentable sugar, filtered, supersaturated with lime so as to have 2 per cent. excess of the latter, and the treatment continued as above. The two extracts were then mixed, sterilised, and fermented with pure wine-yeast. When the fermentation was finished, the product was distilled, and a spirit obtained of agreeable taste. On analysis, it was found to contain considerable quantities of aldehyde, but no furfural, and only traces of the higher alcohols.—A. K. M.

Raw Grain: A Few Practical Remarks and Experiences.
A. J. Groom. J. Fed. Inst. Brewing, 1896, 2, 320–332.

THE author describes a short brewing of 55 quarters of grist, of which 25 per cent. was maize grits, with Billing's converter (this Journal, 1892, 628). 14 quarters of maize grits and 2 quarters of ground malt (for the purpose of adhesion) are placed in one division of a double-chambered hopper, the remaining 39 quarters of malt being ground into the second division. The converter contains 50 barrels of water; when the latter is raised to 120° – 124° F., the maize grits are run in, the machinery is set in motion, and the temperature increased to 150° F. The mixture is allowed to stand a short time, and the steam turned on full into the jacket in order to burst the starch cells. Some grits require a temperature of 195° F., others 200° F., before being gelatinised. The higher temperature is maintained for 20 minutes and subsequently lowered to the point required for striking the malt. The ground malt is then passed in, and the contents of the converter run into the mash tun. Care should be taken over this operation, as the fine grits may be forced into the slots of the false bottom of the mash tun. Brewings conducted in the above manner yield an extract of 97–98 lb. per quarter. The worts were generally cleaner than when malt alone was used, and there was less deposit on the coolers, fermenting vessels, and racking tanks. Satisfactory fermentations are said to have resulted; the ales are far more quickly acted on by finings, and are sounder and finer than malt beers.—J. L. B.

Slack Malt. N. Van Laer. J. Fed. Inst. of Brewing, 1896, 2, 363–373.

IN the author's opinion, malt containing more than 4 per cent. of moisture should not be used for brewing by the infusion system, since turbidity arising from slack malt is frequently met with in this method of working. In order to establish the cause of dimness in a sample of beer, it is filtered, and if the filtrate be clear, the turbidity is due to the presence of yeast; if the filtrate is cloudy a few drops of iodine should be added as a test for erythroextrin. Should the beer clarify on heating, the turbidity probably arises from hop resin or gluten; the resinous turbidity disappears when the beer is treated with finings, whilst that arising from gluten remains. If the filtered beer is still cloudy when warmed, the turbidity is to be ascribed to the presence of deleterious organised ferments.

IN Belgium, slack malt is worked by the decoction system known as "Dickmaische" or "thick mash," whilst in Germany the "Dickmaische" is used in combination with the "Lautermaische" (the milky and sedimentary wort in the tun after mashing). The principal feature of the Belgian method consists in the drawing off of the "Lautermaische" from the mash and treating it in the copper in various ways. The following is the method generally employed:—The grist is mixed in the mash tun with sufficient cold water to moisten the whole. Whilst the rakes are kept in motion, the goods are raised to a higher temperature by the addition of hot water. The milky liquid is drawn off and conveyed to the copper, where it is subjected to a saccharification temperature for a time sufficient to allow of the complete conversion of the starch, the temperature being subsequently raised to, and maintained at, 175° F. for some time. While this "Lautermaische" is in the copper, water is again run into the mash tun, at a temperature high enough to complete the saccharification of the remainder of the starch of the malt. One or two of the sedimentary worts are taken, according to the quantity of material used. The "Lautermaische" from the copper is filtered through the goods in the mash tun after the saccharified wort has been run off.

The combination of the "Dickmaische" with the "Lautermaische" referred to above, consists of drawing off a quantity of mash and raising it to the boiling point in the copper, after the mixing operations in the mash tun are complete, and then returning it to the mash tun to raise the temperature of the whole mash.

The author questions the use of mechanical devices for oxidising the wort whilst in the copper, when malts having

a tendency to glutinous turbidity are used. When a dried and warm malt is ground and used, it produces clear worts, whereas, if it be allowed to remain before being worked, the converse occurs.

Malt requiring re-drying should be placed on the kiln and kept at a temperature of 120° F. for 10 or 12 hours, the "lowres" being left open to allow of the escape of any moisture. At the end of this time the temperature should be gradually raised in 3 or 4 hours to 175° F., and this heat maintained for 4 hours. The temperature should subsequently be raised to 180° or 190° F., and kept at this for 5—12 hours, according to the quality of the malt treated. Re-drying never entirely removes all defects of slack malt, and care should be taken to prevent slackness by carefully storing the malt.—J. L. B.

Compound Ethers produced by Yeast from Green Malt and Wort. P. Lindner. *Wochenchr. für Brauerei*, 1896, 552—553.

When green malt is kept in a vessel with a plentiful supply of air, a strong odour of compound ethers is developed. If the grain be examined, a quantity of yeast cells will be found adhering thereto, which resemble *Saccharomyces Anomulus*. This yeast, when grown in wort, is known to produce a quantity of these ethers. A noteworthy observation is that the compound ether appears to act as an antiseptic.

The author has observed the production of compound ethers by many varieties of yeast. *Saccharomyces Apiculatus*, when grown in a well aerated solution of dextrose, gave a plentiful amount, but when grown in non-aerated wort, hardly a trace. This yeast has been recommended for estimating dextrose; the author is inclined to prefer *Saccharomyces eruginus*, which does not yield any compound ether.—A. L. S.

Beer, Light, Brilliant, and Sparkling; The Preparation of. O. Reinke. *Wochenschr. für Brauerei*, 1896, 548.

A light, brilliant, and sparkling beer is produced in many districts of Germany from various materials. In East Prussia the moderate local barley is used, but in most districts only the best barley malt, though usually with the addition of some raw grain or sugar; the grain being usually rice, and the sugar ordinary cane sugar.

All these beers are lager beers, and the leading principles underlying their preparation are: short time of boiling both the mash and the wort, and protracted fermentations at low temperatures. It is also found advantageous to harden the mashing water with gypsum.

In using maize there is great danger of producing a raw taste, unless the grain be carefully de-germed. Thin barley and a very slightly grown barley malt are also used. These raw grains are conveniently added in the mash copper.

The author does not recommend the employment of a low-fermentation yeast, and states that he knows breweries that have used Saaz yeast and not found it satisfactory.

—A. L. S.

Malt, The "Withering" of, in Pneumatic Maltings.

O. Reinke. *Wochenschr. für Brauerei*, 1896, 606—607.

The author considers the difficulty which is experienced in satisfactorily "withering" malt in pneumatic malting drums, is due to the expansion of carbonic acid by the large volumes of air which have to be passed through the drums, and he proposes to remedy this by drawing air for withering, from the fermenting cellars, where no difficulty would be experienced in obtaining any quantity of carbonic acid.

—A. L. S.

Oxalic Acid, Free; On the Influence of Temperature on the Formation of, by Aspergillus Niger. C. Wehmer. *Ber. d. Deutsch. Bot. Gesell.* 1891, 163.

Free oxalic acid is only produced at low temperatures, although, if chalk be added, a quantity of oxalate is produced at the higher temperature.—A. L. S.

Malt, Estimation of Diastatic Power in. W. G. Sykes and C. A. Mitchell. *Analyst*, 1896, 21, 122.

See under XXIII., page 621.

Malt, A Method for the Determination of the Diastatic Capacity of. A. R. Ling. *J. Fed. Inst. Brewing*, 1896, 2, 335.

See under XXIII., page 621.

Beer Wort, Nitrogenous Compounds contained in, Quantitative Separation of. H. Schjerning. *Zeits. Anal. Chem.* 1896, 35, [3], 285.

See under XXIII., page 621.

Red Wines, Detection of Foreign Colouring Matters in. A. Belar. *Zeits. Anal. Chem.* 1896, 35, [3], 32.

See under XXIII., page 619.

Denaturing Alcohol [Alcohol Incandescent Lamps]. C. Jacquemin. *Comptes rend.* 122, [25], 1502.

See under II., page 581.

Barley and Malt, Phosphoric Acid in. A. Fernbach. *J. Fed. Inst. Brewing*, 1896, 11, 128.

See under XXIII., page 621.

Cider in France, The Production of. Board of Trade J., June 1896, 648.

See under Trade Report, page 627.

PATENTS.

Alimentary Liquid, An Improved. J. H. Hooker, Buckingham. Eng. Pat. 11,613, June 14, 1895.

A wort is prepared from malt, but in place of hot water, warm peptonised milk is used, or milk which is undergoing peptonisation. The wort is separated from the grains in the usual way, and boiled either with or without hops. Beer is then prepared from the boiled wort in the usual manner.—A. L. S.

Brewers' Mash, Method and Apparatus for Treating. V. Lapp, Leipzig-Lindenau, Germany. Eng. Pat. 14,482, July 30, 1895.

The apparatus consists of a rotary perforated cylinder, within which is a worm conveyor and a hollow perforated shaft. The cylinder is surrounded by a casing provided with exit pipe for the wort and fitted with steam or hot-water jacket. The mash is introduced through a pipe at one end of the apparatus, and as it travels along the perforated cylinder, the wort drains into the outer casing and is carried away through the exit pipe. Whilst the grains are being propelled along the cylinder, they are washed by the water passing through the spray holes of the hollow shaft.—A. K. M.

"Draft" or Spent Grains, Brewers' and Distillers', Utilisation of. R. D. Bailey, Gloucester, and L. P. Ford, London. Eng. Pat. 1788, Jan. 25, 1896.

The spent grains are mixed with water and heated to boiling. The product is cooled to below 60° and treated with diastase, malt extract, or "taka-moto" to convert the starch into maltose and dextrin. Sulphuric or other suitable acid (about 1 per cent.) is then added and the liquor boiled for 30 minutes; the maltose and dextrin are converted into dextrose, and a large proportion of the cellulose of the husk is converted into "fermentable furfuroid sugars." After neutralising, the liquor is settled and mixed with the ordinary wort, or may be used for other purposes.—A. K. M.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Margarin Manufacture in France. A. M. Villon. *Monit. prod. Chim.* 1896, 4.

The separation of the liquid olein from the solid fat of the tallow (premier jus) is effected by pressing the mass—previously formed into flat cakes, 20 × 18 × 2 cm.—in a

hydraulic press, some 200 of the cakes being treated at a time in layers of five, separated by linen cloths, warmed to 50° C. The olein begins to run from the heat of the cloths alone, and pressure is only applied when the flow diminishes.

The oleomargarin forms a yellow crystalline mass, the chief market for which is Rotterdam. The residual solid fat is used for candle-making. To work the oleo up into margarin, it is churned along with milk and cotton-seed oil, arachis or sesame oil, warmed to 45° C. (the melting point of the oleo), the proportions varying with the quality desired and the season:—

Oleomargarin.....	800 kilos, or 500 kilos,
Cotton-seed oil.....	100 " 50 "
Milk.....	500 litres 500 litres.

In winter, 30—40 per cent. of oil is used, whereas in summer it is sometimes entirely omitted. The function of the oil is to impart a buttery consistency to the product. Churning takes about two hours, and, when ended, the margarin is emptied into an inclined trough leading to a large tub. Cold water is sprayed on to the margarin during its descent, to produce granulation, and after floating in the water of the tub, the margarin is collected in sieves and left to drain in a perforated vessel for a couple of hours. Subsequently it is kneaded, to express the milk and render the mass homogeneous, in machines like ordinary butter-workers, and is finally made up in $\frac{1}{2}$ -kilo. pats.

Ice water is sometimes used in the cooling, but is not so suitable, hindering the development of the true margarin flavour produced in the slight fermentation allowed to occur before the mass is drained. The best results are obtained when the margarin encloses a small proportion of milk in setting, for which purpose the water should not be too cold.

"In order to impart the characteristic flavour of butter, the product is moistened, whilst draining, with a small quantity of ferment obtained from fermentation cultures from good butter."

It is stated that the agents of margarin-makers persuade agriculturists that an admixture of 5 or 10 per cent. of their article to butter is both innocuous and undetectable, with the result that as much as 50 per cent. of some butters consists of margarin.—C. S.

Milk, Determination of Lactose in, by Double Dilution and Polarisation. H. W. Wiley and E. E. Ewell. J. Amer. Chem. Soc. 1896, **18**, [5], 128.

See under XXIII., page 622.

Butter, Detection of Borax in. Planchon and Vnaillart. Journal de Pharm. et de Chim. 1896, **4**, [2], 49.

See under XXIII., page 619.

Honey, Examination of. E. Beckmann. Zeits. Anal. Chem. 1896, **35**, [3], 263.

See under XXIII., page 622.

Gluten in Meal, Determination of. M. Balland. Comptes rend. 1896, **123**, [2], 136.

See under XXIII., page 622.

PATENTS.

Fat in Milk and other Articles, Improvements in Apparatus for Determining Volumetrically the Amount of. A. W. Stokes, London. Eng. Pat. 12,181, June 24, 1895.

See under XXIII., page 622.

Meat, Butter, Cheese, and other Animal and Vegetable Substances; Impts. in the Method of and in Means and Appliances for Preserving. J. H. Fitter, London. Eng. Pat. 13,008, July 5, 1895.

The meat is stored in an air-tight room strong enough to sustain a vacuum. The room is encased by an external chamber filled with charcoal, asbestos, or other non-conducting substances.

The meat is first cooled and then placed in the previously cooled room, the door of which is then at once closed and rendered air-tight. A more or less complete vacuum is

then produced by an air-pump. The cooling is effected by the ammonia refrigerating process, the cold pipes being arranged in the inner chamber.

Although cooled, the meat is never actually frozen, and therefore keeps in better condition than by the old plan of freezing.—L. de K.

Cocoa Compounds, Impts. in the Manufacture of. O. Imray, London. From C. Rach, Chicago, U.S.A. Eng. Pat. 14,250, July 26, 1895.

A WEIGHED quantity of cane-sugar is dissolved in about one-tenth of its weight of water at a temperature of 280—290° F., and about an equal weight of cocoa is added, and the whole mixed at this temperature. After about 30 minutes the temperature of the mixture is reduced to 210° F., and four times its weight of milk added; this is thoroughly incorporated and the temperature raised to 240° F. The product is then evaporated, at first under ordinary pressure and finally in *vacuo*, until a dry mass is obtained. This forms the new product.—A. L. S.

Germ [Wheat] Extract, Impts. in the Manufacture of. A. Mackey Parker, London. Eng. Pat. 14,631, Aug. 1, 1895.

100 lb. of germ of wheat are mixed with 40 gallons of water at 100° F., and 300 grains of bicarbonate of potash are stirred in. After keeping the whole at this temperature for 1½ hours, the mixture is strained and the residue once more treated with 15 gallons of water at 100° F.

The mixed liquor, after adding 1 lb. of a preservative compound, such, e.g., as a borate, is placed in a settling vat and kept at a low temperature for 18—24 hours. The clear liquid is then drawn off and evaporated at 130° F. until it has acquired a suitable density, and, after filtering, 5 lb. of the best extract of malt are added. The extract is then ready to be filled in tins, and may be used for making bread biscuits, and certain aerated beverages.

—L. de K.

Alimentary Extract, The Manufacture of a New. E. Kressel, London. Eng. Pat. 15,885, Aug. 23, 1895.

BREWERS' yeast, preferably bottom yeast, is washed three times in pure water. The mixture is strained and then subjected to a temperature not exceeding 58° C., preferably in *vacuo*, to kill the yeast cells, but not to coagulate the albuminoids.

After being heated for three hours, the mass is filtered, and the filtrate evaporated to the consistency of a paste. If a powdered extract be desired, filtering is omitted, and after complete drying, the mass is ground.—L. de K.

Beverage from the By-Products of Dairies, The Preparation of a. A. Bernstein, Berlin, Germany. Eng. Pat. 23,590, Dec. 9, 1895.

TEN gallons of separated milk are poured into a vessel and heated to 35°, when rennet is added. After standing in a slightly warm place for two hours, the curd will be sufficiently contracted, and the whey may then be poured off.

This is then allowed to become sour to a point at which 25 c.c. require 15 c.c. of deci-normal soda for neutralisation. The same object may, however, be obtained by adding to the whey some citric or other suitable acid. The liquid is now heated in steam chambers for two hours to complete the coagulation of the caseine, and the albumin is then cooled to 5°—10° C., and filtered through thick cloth. The beverage thus produced contains the protein matter only in the state of albumose and lactoprotein.—L. de K.

Milk Products, Condensed, Impts. in the Manufacture of. W. F. Maclaren and A. Smith Fleming, both of Glasgow. Eng. Pat. 2081, Jan. 29, 1896.

The object of the invention is to prepare a wholesome condensed milk from separated milk. 40 galls. of the latter are mixed with 28 lb. of sugar and condensed to about 100 lb. To this is then added an emulsive compound consisting of 12 lb. refined beef oil (oleo oil), 8 lb. of lime water, 1 lb. of corn flour, and 12 lb. of sugar. The emulsifying is, preferably, carried out in a steam-jacketed pan provided with an agitator, the lime water being gradually added during the mixing operation.—L. de K.

Meat by the Help of Electricity, Preserving. A. B. Pinto, Rio de Janeiro, Brazil. Eng. Pat. 2176, Jan. 30, 1896.

The meat to be preserved is immersed in a 20 per cent. solution of common salt, and a continuous current of electricity is passed through the solution. In from 10 to 20 hours the salting is complete, and the meat is taken out and hung up to dry.

In working a bath of 3,000 litres of brine in which 1,000 kilos. of meat may be immersed, the current may be of 100 amperes with an E.M.F. of 8 volts. The electrodes must be of platinum, since if other metals such as zinc or iron were used, salts of these metals would be formed, and would be injurious.—A. L. S.

Milk, Cream, and other Liquids, Impts. in Apparatus for Sterilising by Means of Steam. A. T. Pfeiff, Copenhagen, Denmark. Eng. Pat. 7802, April 13, 1896.

The inventor points out the various drawbacks in sterilising milk by using hot water as the heating source.

In the new apparatus as the source of heat, steam is employed, and by means of an inverted U-shaped bell attached to a close-fitting lid, it is compelled to pass through the apparatus under pressure and divide itself into two streams, so that the liquid under treatment will receive heat on both sides. Suitable pipes are provided for carrying off the condensed steam.—L. de K.

Margarine or Butter Substitute, Impts. in the Method of and Apparatus for the Manufacture of. J. C. Uhlenbrock, Neuss, Prussia. Eng. Pat. 8194, April 18, 1896.

The usual ingredients are placed in a churn, and when sufficiently churned, the mixture is allowed to run into a trough, where it is not treated, as usual, with cold water, but with a jet of cooled skimmed milk or butter-milk. The stiffened product is then again churned, this time with the milk. The surplus milk flows through suitable pipes into a receiver, and may be used over again several times.

It is claimed that the margarin thus produced looks more like butter, has a nicer flavour, and keeps better.

—L. de K.

Antiseptic Preparations for the Preservation of Animal and other Foodstuffs, for use in the Manufacture of Butter, for the Prevention of or Removal of Taint from Animal Food Substances, including Beef, Mutton, Bacon, Fish, Game, Poultry, and for use in the Production of Beers, Light Wines, Aërated and Non-Alcoholic and other Drinks, and for other Purposes; Impts. in and connected with. J. Ascoug, Hand-worth, Stafford. Eng. Pat. 9345, May 2, 1896.

The preparations described are made by dissolving sodium carbonate and common salt in a small quantity of water, adding pure boric acid with sodium borate or calcium borate or "tineal sodium borate," stirring the warm mixture until it has become cold and has assumed a finely crystalline state, drying the product, and grinding it to a powder. Various proportions of the different ingredients are given.

—L. A.

(B.)—SANITATION; WATER PURIFICATION.

Carbonic Acid, Rapid Determination of, in Air and Confined Spaces. M. Henriet. Comptes rend. 1896, 123, [2], 125.

See under XXIII., page 617.

PATENTS.

Sewer Water, A Process for Treating, with the Double Object of Improving its Sanitary Condition and Separating and Utilising the Substances contained in it. E. Dussan, Paris. Eng. Pat. 12,388, June 26, 1895.

The process consists of the following successive operations, viz.:—"Spontaneous decantation"; treatment with hydrofluoric acid gas and fluoride of silicon; precipitation by means of lime; coagulation of the fatty matters by means of successive currents of compressed air, steam, and cold air.—L. A.

Sterilisation and Purification of Water [Ozone], Impts. in and Apparatus for. N. Van der Steen, Haarlem, Holland, and A. Schneller, Alfen, Holland. Eng. Pat. 16,308, Aug. 30, 1895.

Ozone is generated according to Eng. Pat. 23,297 of 1894 (this Journal, 1895, 493). The present invention refers in general to the means for bringing the ozone in intimate contact with the water to be sterilised and purified.

Ozone is admitted at the bottom of a chamber containing perforated plates at intervals, water flowing in from the top through the plates and out at the bottom. The water may be broken up, atomised into or within a stream of ozone.

—J. C. R.

Water, Softening and Purifying, Impts. in Apparatus for. O. Guttman, London. Eng. Pat. 11,739, May 29, 1896.

The hard water and the reagent solution are admitted, in regulated proportions, into the softening tank, in which they are heated or merely agitated together by any suitable means; the softened water is conveyed by an overflow pipe into a filter consisting of a long trough-shaped channel, divided by partitions into a number of communicating compartments filled with wood-wool, wherein it is clarified for use.—L. A.

(C.)—DISINFECTANTS.

Quinosol and Diaphtherine. Journ. Pharm. Chim. 1896, 3, [10], 495—496.

DIAPHATHERINE is a compound of one molecule of ortho-phenolsulphonic acid and two molecules of orthohydroxy-quinoline. It is a yellowish crystalline body, readily soluble in water and melting at 82°. Its aqueous solution gives a blue-green coloration with ferric chloride. According to Vulpius, quinosol is potassium oxyquinoline sulphate. The two bodies are easily distinguished by heating on platinum-foil; the former burns completely, the latter leaves a residue containing potassium. An aqueous solution of quinosol is coloured green by ferric chloride, and gives precipitates with HgCl₂ and lime water. The value of a sample may be estimated as follows:—1 gm. is placed in a graduated tube and water added to 10 c.c.; 1 gm. of sodium acetate in 15 c.c. of water is now added, and the mixture shaken out with 15 c.c. of ether; the volume of the ethereal layer is now increased to 20 c.c. and one half of it removed and evaporated; the residue should consist of oxyquinoline, melting at 70°, and should weigh not less than 0.25 gm., corresponding to about half the oxyquinoline in the sample taken.

According to a report from the laboratory of the Pharm. Soc. of London, quinosol is used as an antiseptic in aqueous solution containing from 0.1 to 2 per cent.; it is about 40 times more powerful than phenol.—T. E.

"Cresochine." Journ. Pharm. Chim. 1896, 3, [10], 497—498.

The substance which goes by the above name is composed of neutral quinoline tricrosyl sulphonate and of a compound of quinoline with trieresol. It contains 33 per cent. of quinoline and 17 per cent. of trieresol. The quantities of the different constituents may be determined by acidifying 100 c.c. of the substance with dilute sulphuric acid and extracting with ether. The trieresol left after the ether is evaporated should amount to at least 17 per cent. of the substance taken and should boil at 185°—210°. The aqueous solution is now made alkaline with caustic potash (it becomes blue) and extracted with ether. The quinoline is obtained on evaporating the ether; it should boil at 227°—237° and amount to 33 per cent. of the substance.

Cresochine is distinguished from solutions of cresols by the absence of alkalis; it is not soapy to the touch, and is not caustic; water (even hard water) gives a clear solution containing 5 per cent. of it. As a disinfectant it possesses the advantage of not evolving ammonia, like the alkaline preparations.—T. E.

XIX.—PAPER, PASTEBOARD, Etc.

Wood [for Paper], *The Treatment of, with Strong Acids*. Prakt. Handbuch der Papierfabr. 42, 1896, 1631—1632.

M. Z. ORIOLI, of Pontelarræ, France, has experimented upon a practical scale on the action of strong acids upon wood. It was found that both hydrochloric and nitric acids penetrated the wood and removed the encrusting matters, but the resulting products differed considerably with the different acids. Hydrochloric acid blackens the wood. Nitric acid does not blacken the wood, but it is somewhat costly. A solution of 20 per cent. of nitric acid and 80 per cent. of hydrochloric was found not to blacken the wood. With this solution, pine shavings were digested for 24 hours, producing a pulp that could be easily disintegrated with the fingers, the encrusting matter of the fibres having been entirely removed and converted into pectic acid. It was found that 100 parts of wood yielded 50 parts of long, strong white fibres, after treating with 40 per cent. of the above solution, washing, and then bleaching with 10 per cent. of bleaching powder. The sandstone vessels employed, had a capacity of 1,000 litres, and it was found that the acid penetrated through the cracks, causing considerable trouble. After being treated with acid, the wood was ground under granite stones, and washed. Messrs. Coupiér, Barre, Blondel, and Delaye, have tried at different times to obtain cellulose by boiling the wood with dilute nitric acid, and Baehet and Machard have tried to convert the encrusting matter of the fibres into glucose by boiling with dilute hydrochloric and sulphuric acids, but none of these methods have proved successful in practice. Orioli declares that wood cannot be profitably decomposed without acids, and believes in the treatment of Baehet and Machard, providing suitable plant is used. According to the Ger. Pat. 60,233 of Dr. I. Lifschütz and others, pine wood is treated with a cold mixture of dilute nitric and sulphuric acids in the proportion of 3 parts (by vol.) of the former to one of the latter. After a time the wood is removed and washed in water, and a weak solution of soda, yielding, it is said, 45 per cent. of cellulose. The acid is re-used until the nitric acid is exhausted, when it is practically a saturated solution of oxalic acid which separates out by crystallisation, and the sulphuric acid may be re-used with a fresh supply of nitric acid. Apparently this process has not yet been practically applied. —S. P. E.

The Preservation of Wood Pulp. Translated especially for Hardwood from the *Moniteur Industriel*.

THE Association of German manufacturers of wood pulp has offered a prize of 3,000 marks (150*l.*) for the discovery of an efficacious means of preserving wood pulp in a damp state. It has been known perfectly well for a long time that manufacturers could preserve the pulp for only a short period, although in the moist condition it permits paper-makers to use it without difficulty and without previous preparation. Of course, if the pulp is preserved in a desiccated condition, in the form of coarse pasteboard, which does not add materially to its original cost, it can be kept for some time without any material or deleterious change. But before it can be used in the manufacture of paper it must be macerated or ground up, which adds greatly to the expense, and, besides, many paper mills have not enough of the necessary macerating machinery. Many European paper-makers experienced this trouble in a marked degree during the winter of 1893-94, from the general decrease of the water supply, owing to a widely-spread drought, their mills being run by water-power, and they were obliged to use an old stock of pulp, which could only be procured in a dry state. At the present time two processes of preservation are under trial, which are recommended by Mr. Chr. Braun, of Roehsburg, Saxony. One method consists of running the wet pulp from the machine on to an endless sheet of thin linen, 1.5 to 3 mm. thick, and which is not submitted to any pressure. This leaf or sheet of pulp is extremely spongy, and is either dried in the sun or artificially. The pulp thus prepared, contrary to the ordinary pasteboard pulp, which is pressed to extract the moisture, is thinned very easily in the desiccators, and

keeps in good condition for some years. Nevertheless this process implies the expense and delay of drying the pulp, and this fact has induced Mr. Braun to try the following method at a much less expense:—He dug long trenches in the earth, which he lined and covered with boards to prevent the paste from getting dirty. Down these trenches he ran the wet pulp, and the water separated by gravity, by absorption, and by evaporation, leaving the pulp in a condition still moist enough for use without re-desiccation. It is claimed by Mr. Braun that pulp prepared by this process gives very satisfactory results nearly five years after it is manufactured. This process, notwithstanding, still leaves a want unsupplied, under certain conditions, and this is why the German society has offered a reward of 3,000 marks for an entirely satisfactory process of preservation.

Paper made from Wood Pulp, Durability of. Prakt. Handbuch der Papierfabr. 42, 1896, 1633—1634.

PULP prepared by grinding wood, contains ligneous and other encrusting matters, and the composition is similar to that of the wood itself. Paper made from this pulp turns brown, and becomes brittle and rotten, when exposed to the action of light and air for any length of time. Pure wood-cellulose fibres are not affected by light or air, hence it is assumed that the above results are owing to the presence of the encrusting matters. Paper made from brown pulp is less sensitive to light, since the encrusting matter is partly removed by steaming and lixiviating. Cellulose made from wood by boiling with soda stands the action of light and air without turning brown, although it undergoes considerable change of another kind. Some years ago some blotting paper was made by an American firm from soda wood cellulose, and it was admitted by the makers that after a time the paper lost its absorbing qualities and in a few years became rotten, the fibres becoming again encrusted. A test of blotting paper several years old, confirmed this view. From this and other observations, it is suggested that certain cellulose pulps are liable to return by degrees into the state of the original ligneous fibre. Whether papers made of sulphite fibre will remain unaffected in the course of years is as yet uncertain, although many paper-makers assert that sulphite fibre is as suitable for documents as rag fibre.—S. P. E.

Sulphite Liquors from Wood Pulp, Utilisation of [Fuel]. Papier Zeit. 1896, 21, 1183.

See under H., page 579.

Sulphite Cellulose, Half-Stuff. Prakt. Handbuch der Papierfabr. 42, 1896, 1631.

THE treatment of wood by the sulphite process is preferable to the soda treatment, inasmuch as in the former process 20 to 30 per cent. more fibre is obtained from the wood. The quality of the cellulose fibre obtained by the sulphite treatment may be modified to suit the purpose for which it is to be applied. Boiling for a longer or shorter time at a higher or lower temperature enables one to produce a strong or weak fibre, a hard or soft pulp, having properties similar to hemp, cotton, &c. The chemicals required for its manufacture (lime and sulphur) are so cheap that it is unnecessary to recover them, which operation is essential in the soda and sulphate processes. In addition to the ordinary white ground wood pulp, the brown steamed wood pulp and the soda and sulphite cellulose fibres, some manufacturers are now producing a pulp of an intermediate quality between ground wood and cellulose fibres. A number of mills, especially in Sweden, are now making paper from this semi-cellulose, the method of production having so far been kept a secret.—S. P. E.

Sizing of Paper, The Influence of Sunlight on the. W. Herzberg. Die Chem. Ind. 1896, 19, [7], 137—141.

THE object of sizing paper is to limit the absorption and prevent the spread of ink. To ascertain what the observed destruction of the size in certain cases was due to, five various resin-sized papers were exposed to the influence of sunlight between double windows. The papers were previously tested for the amount of size, and all found normal.

The tests began on June 13th, 1888, when characters written upon them were clear. The papers were inscribed again on August 16th, and again on October 26th, when the sizing was again tested and proved to have altered considerably. The windows faced the east, and the sun could only shine on the exposed samples in the mornings. It is thus probable that the alteration would have been greater under more continued exposure. The appearance of the papers in October, after four months of the exposure referred to, were as follows :—

1. A paper made from linen and cotton without clay. The last characters showed an inclination to run, but the paper proved to be the same in size.

2. A foolscap paper, made from linen, cotton, and sulphite, without clay. The thin characters ran and the thick ones went right through.

3. Invoice paper (an ordinary yellow writing paper), made from wood pulp and sulphite, with 13.5 per cent. of ash. The characters were clear, and the paper proved to be well sized according to Leonhardt's method.

4. A white foolscap paper, made from straw, sulphite, linen, and cotton, with 13.8 per cent. of ash. All the characters ran, and the thicker ones went through.

5. A document paper, made from unbleached linen rags, without clay. The same appearance as No. 2.

The external appearance of the papers was as follows :—No. 5 was unaltered, Nos. 1, 2, and 4 showed signs of becoming slightly yellow, and No. 3 was very much discoloured.

Consequently four of the samples were totally unfit for writing purposes after four months' exposure, whilst the fifth, made from inferior materials, showed the greatest durability. The greatest alteration was in No. 4, made from sulphite and straw.

Other tests were made during 1890. Besides resin-sized papers, animal-sized papers were exposed. One sample was specially sized, by soaking an unsized sample of copper-plate printing paper in a solution of resin in ether. This paper therefore contained only free resin, and was fully sized. The composition of the papers was unequal, some being made from pure rags, some from rags, wood pulp, and sulphite, and some from pure sulphite.

The effect of two years' exposure to light was the same on all papers, the size being destroyed; but the degrees of destruction were unequal. The greatest effect was shown with the paper specially sized with ethereal solution of resin, in which, after exposure for one month (January), the size was weakened so much that the characters written on the paper ran, and the ink went through. The animal-sized papers lost their size completely, the ink spreading and going through.

To prove that only the light caused the loss in sizing, certain of the samples were covered so that, whilst the light could not reach them, the air had free access. After exposure, the covered parts were unaltered. With the animal-sized papers, however, the covered spots were slightly altered, this proving the existence of some other injurious factor.

Warmth was proved to be injurious.

Besides the above experiments, the following are described :—Wolesky and Haase exposed 17 samples of paper, of different compositions and sizing, to the influence of light from October 13th to November 9th, 1895, and made the following observations :—

1. Animal-sized paper does not show any perceptible deterioration in the sizing.

2. Resin-sized, highly glazed paper shows a considerable deterioration after a few days. After three to four weeks such paper loses the sizing so much as become as absorbent as blotting paper.

3. Resin-sized, unglazed papers resist rather more than glazed papers, but the difference is only to the extent of a few days.

Liesegang exposed samples of paper to sunlight, and found that it destroyed the size in resin-sized papers, but if the paper contained wood pulp the alteration was not noticeable.

By the examinations of Wolesky and Haase, and of Liesegang, &c., paper containing wood pulp does not show

any alteration, but in the experiments lasting a longer period (two years), the same papers had lost their size. Also animal-sized papers were not affected in Wolesky and Haase's experiments, but lost their size after two years' exposure. These show that the difference is due to the difference of time during which they were exposed.

A resin-sized paper, made from linen rags, was half covered, and the other half exposed to light. The uncovered part absorbed water in greater quantity and quicker than the covered part. The paper was soaked with a pyrogallol solution, when the part which had been exposed to light turned brown, the other part being only slightly coloured. Paper containing wood pulp gave the same reaction. Liesegang thinks that wood pulp plays a part similar to the Na_2SO_4 used in photography in the pyrogallol developer, the light acting first on the pulp and later on the size.

The surface of a piece of resin, or a glass plate coated with resin, when exposed for a long time to sunlight, becomes dull, and shows numerous cracks and flaws. In resin-sized paper similar action would lead to the spread of ink between such cracks and flaws. Another observation demonstrated that the action of light on resin-sized paper renders resin insoluble. A drop of ether on the samples at first gave on evaporation a distinct border of resin, particularly on the specially resin-sized paper, but after two years' exposure no trace of resin was dissolved by ether.

In animal-sized paper, the alteration of the covered part was undoubtedly due to cracks in the coat of size by changes of temperature, moist and dry air, &c. The following experiment is quoted :—A piece of animal-sized paper crumpled till full of wrinkles has the coat of size broken up and is no longer well sized, the ink penetrating the numerous cracks and spreading, giving thus the same result as in paper exposed to light. (See also this Journal, 1895, 1059.)—S. P. E.

Adansonia Fibre [Paper]. Prakt. Handbuch der Papierfabr. 42, 1896, 1642—1643.

This fibre is the bast of the baobab (*Adansonia digitata* L.), found in the tropics, principally in West Africa, in Senegal, and Abyssinia. The imported adansonia fibre chiefly comes from the Portuguese province of Angola, south of the Congo. The baobab grows in marshy as well as dry soil, on the banks of rivers and on table-lands. The trunks are seldom over 6 metres high, but very bulky, being sometimes 8 metres in diameter. After removing the external bark, which is useless, the bast is cut away, commencing about half a metre from the summit of the stem, and continuing down to within a metre of the bottom. The thickness of the strips is about 2 cm., and the length 1 to 1½ metres. After drying the strips in the sun for about a fortnight, they are ready for sale. The trees do not suffer from this treatment, a new layer of bast of about 1 cm. thick forming again in two years, although four years are generally allowed before cutting them again. Owing to the toughness of the bark, the adansonia fibre is difficult to obtain, and it is only profitable to collect in countries connected with the coast by rivers, overland carrying being too costly. The factories collect the fibre in small quantities, until they have sufficient for shipment, when it is baled in packages of 200 kilos, and sent to Europe. The price at Rotterdam is 17. per 100 kilos. At the paper-mills the strips are cut like ropes, with an ordinary rag-cutter, and are then boiled with 3½ per cent. solution of caustic soda for about 10 hours, under a pressure of 3—3½ atmospheres. The pulp produced is soft, and readily disintegrated. After boiling the raw fibre with a 15 per cent. caustic lime solution for six hours, the pulp was soft enough to beat in the hollander, but contained a large number of small dark specks. To remove these, the pulp was boiled a second time with a 20 per cent. solution of caustic lime, the effect being the production of a softer pulp and darker specks. It is essential that the fibre be covered with the solution before admitting steam, the latter darkening the fibre if dry. Fermentation and decomposition quickly set in when the pulp is stored moist, thereby reducing the strength of the fibre. The pulp requires considerable washing, otherwise the glutinous matter quickly clogs the

machine wire, drums, &c. 40 to 50 kilos. of paper are obtained from 100 kilos. of the raw fibre. Adansonia fibre is principally used for the manufacture of high-class wrapping papers, emery-paper, &c., and the strength of the fibre in a sheet of paper is only surpassed by that of the Japan mulberry tree. Owing to the small dark specks invariably present in the pulp, this material cannot be used for writing or drawing papers.—S. P. E.

Wood Cellulose in Paper. Testing of. Leipziger Papier-testing Inst. Papier Zeit. 1896, [44], 1417.

See under XXIII., page 619.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Ether. M. Klar. Die Chem. Ind. 1896, 19, [7], 141—142.

ATTENTION having been turned to the use of ether as an anæsthetic, it has been proved that it causes less fatalities, and still less secondary effects, than chloroform. Pure ethyl ether is therefore more suitable in most cases than chloroform. Endeavours have been made to obtain a chemically pure ether—a so-called ether *pro narcosi*—for the trade; and recently a preparation obtained by distillation over metallic sodium has been introduced. This preparation even surpasses the claims of the German authorities for a pure ether. On testing it, chemists were surprised to find that such ether gives an aldehyde reaction with fuchsine sulphite (Schiff's reaction, this Journal, 1896, 560), and that it turns moist litmus paper blue, and does not redden phenolphthalein.

The ether, when freshly distilled over sodium, has a specific gravity of 0.717 to 0.718, and answers to the tests of Schering. But if the ether is not, immediately after its rectification, drawn off into bottles and carefully stored, it increases in specific gravity in a short time (0.720). The German authority, D. A. B. (Deutsches Arznei-Buch), requires ether of 0.720 sp. gr., thus allowing minimum traces of water and alcohol. It is extremely difficult to manufacture ether having exactly 0.720 sp. gr. The purest ether is of 0.717 to 0.718 sp. gr., but this absorbs water from the atmosphere, and rises to 0.720 to 0.721 sp. gr., when it assumes a certain steadiness. This property of absorbing small quantities of water is the cause of a good many differences between buyer and seller, as ether which left the manufactory with sp. gr. of 0.720, has, after repeatedly opening the bottles, drawing off, &c., absorbed water and risen to 0.721 sp. gr.

For specific gravity determination, the ether should be brought to 15° C. in a stoppered bottle with a narrow neck, fitted with a thermometer, and the specific gravity determined on the Mohr balance.—S. P. E.

Chloroform, New Method of Preparing. Chem. Rev. [39], 1896, 88—89.

To 75 kilos. of carbon tetrachloride are added, in the cold, 60 kilos. of hydrochloric acid (22° B.), and 50 kilos. of zinc, the whole being then heated in an autoclave. Hydrogen is liberated and reduces one atom of chlorine with the formation of hydrochloric acid which attacks the zinc anew, and the cycle continues until the process is complete, a condition indicated by the cessation of the formation of the hydrochloric acid. The upper layer of the substance is removed and the product refined.—C. S.

Acetone and Acetone-Chloroform, The Manufacture of, from Acetic Acid. E. R. Squibb. J. Amer. Chem. Soc. 1896, 231—247.

THE author has described a process for making acetone from acetic acid by passing the vapour of the acid through a rotating horizontal tube filled with barium carbonate or pumice stone (this Journal, 1895, 506). Since then, a large rotary still, 12 ft. long × 2 ft. diameter, has been set up and has decomposed in 126 hours about 1,700 pounds of absolute acetic acid, giving about 90 per cent. of the theoretical yield against 80 per cent. in the small experimental apparatus. This process and apparatus have

been objected to by the owners of certain patents by G. Rumpf for making acetone from acetates. The acetone made by this process was converted into chloroform, which was also objected to as an infringement of one of Rumpf's patents. The present paper contains the results of an inquiry into the history of acetone and acetone-chloroform, and a critical examination of the claims put forward by Rumpf.

With regard to acetone, it is shown that the manufacture of it from acetates was well known in 1818, and that prior to 1842 Liebig and Pelouze had described the preparation of acetone by leading the vapour of strong acetic acid through a heated tube of glass, porcelain, or iron, filled with pieces of charcoal to increase the surface. Rumpf in his patent application (1886) claims that he has improved the yield of acetone from acetates; but he makes no mention of acetic acid, and his apparatus and process are said not to be applicable to the use of the acid. Nevertheless, infringement is claimed on the ground that acetic acid is made from acetates and acetates from acetic acid. It is also alleged that the author's process is not a destructive distillation of acetic acid, but that the carbonate of barium he uses is first converted into the acetate which is then decomposed; in support of this, it is contended that if the barium carbonate be replaced by an inert substance like pumice very little acetone is formed. A number of comparative experiments was therefore made in the large rotary still, with the result, that whilst acetic acid alone heated in the empty still gave no acetone below 400° C., the presence of pumice caused the production to commence at 300° C., and a much larger yield was obtained at temperatures below 500° with pumice than without. The author also points out that barium acetate decomposes at 400°—405° C., whilst the most suitable temperature for the decomposition of acetic acid is fully 100° higher.

The preparation of chloroform from acetone is no new discovery, having been referred to by Liebig in 1832. Böttger, in 1848, showed how to prepare chloroform from acetates and from acetone, and stated that chloroform made directly from acetone was to be had in the market, 1 oz. of acetone yielding 1½ oz. of chloroform. Why this method of manufacture has not been generally followed up is doubtless owing, it is alleged, to the erroneous statements of Siemerling (1848) and Wackenroder, adopted by such authorities as Gmelin and Watts, who somehow failed to obtain anything like the proportion mentioned by Böttger. Thus Watts (1883), quoting Gmelin, states that the manufacture of chloroform from acetone cannot be usefully carried out, because acetone yields only about one-third of its weight of chloroform when treated with chloride of lime. But it is easily shown that Siemerling used only about half the theoretical proportion of chloride of lime, and he made no attempt to recover and treat again the acetone left unconverted. Rumpf bases his patent (1886) upon Watts' erroneous quotation, and claims the discovery that by using about double Siemerling's proportion of chloride of lime, 180 parts of chloroform for every 100 parts of acetone could be obtained. As proportions and results approximating Rumpf's had been published previous to Siemerling's paper, there is no discovery here. Yet to avoid litigation, and partly because he has found that by taking an excess of acetone the hypochlorite is more economically and promptly utilized, and the resulting chloroform cleaner, whilst the unconverted acetone is easily recovered and treated again, the author proposes to use Siemerling's proportions, and to carry out the whole operation in an apparatus described by himself in 1857, and used for many years for making chloroform from alcohol. It is proposed to use charges of 280 lb. of absolute acetone to 1,400 lb. of 35 per cent. bleaching powder, to pass the resulting chloroform through scrubbers, then distil it through water, and afterwards from a little bleaching powder, then pass it through sulphuric acid scrubbers, and finally rectify it in three fractions, accepting the large middle fraction and working the first and last over again. Part of the large excess of acetone taken is recovered by continuing the distillation after all the chloroform is over, and the remainder is almost wholly recovered from the wash water; this, carefully assayed, is mixed with fresh acetone for the next charge.—L. A.

Lemon Juice, Citric Acid in. H. H. Robins. Chemist and Druggist, 1896, **48**, 742—743.

ACCORDING to the British Pharmacopœia, 1867, lemon-juice was official if it contained $32\frac{1}{2}$ grains of citric acid per fluid ounce. In the present edition, however, the standard is raised to 36—46 grains. The author's experience, extending over many years, as well as that of other workers whom he quotes, indicates that the present standard is too high; also that the proportion of citric acid in natural lemon-juice frequently falls below even the lower limit (36 grains). The bulk of the lemon-juice sold in this country is squeezed from fruit arriving in December and January (lemons of these shipments are considered to be richest in citric acid), and was found to average (during nine seasons) 33.4 grains of acid per ounce. Whilst Palermo and Messina fruit (1895) yielded 33.3 and 23.4 grains respectively, the general average being about 35 grains per ounce. It is suggested, therefore, that in the next edition of the British Pharmacopœia the standard be altered to 33 grains and upwards of citric acid per ounce.

—H. T. P.

Phenylcoumalin. J. A. Leben. Ber. **29**, 1673—1680.

THIS substance, which occurs together with cotoin and *p*-cotoin in coto bark, has been investigated in several directions by the author. Separated by Ciamician and Silber's method the compound melts at 68° C. (Ber. **28**, 1557; this Journal, 1895, 881), and on heating for some time (24 hours to 110° C.) with hydrochloric acid it is polymerised to $(C_{11}H_8O_2)_n$, which melts at 219° C. (Ber. **27**, 845; this Journal, 1894, 756). When reduced with sodium amalgam, or better with hydriodic acid in acetic acid solution, phenylcoumalin yields β -phenylvaleric acid, crystallising in white rhombic plates, melting at 59° C. Phenylcoumalin readily forms addition products with phenolic compounds, of which the oldest known is phenylcoumalin-cotoin (dicotoin). New compounds of this class are those with picric and salicylic acid. By boiling phenylcoumalin with aniline, small yellowish nodules are obtained, which melt at 142° C., and have the composition $C_{11}H_8O_2 \cdot 2C_6H_5 \cdot NH_2$.—T. A. L.

Scopolamine and Atroscine. O. Hesse, Ber. **29**, 1776—1785.

THE alkaloid extracted from the root of *Scopolia atropoides* together with hyoscyamine has been termed scopolamine, although it was subsequently shown to be identical with hyoscyne. The two names are, however, used to denote the origin of the alkaloid, the former being employed when it is obtained from the root of scopolia, whilst it is termed hyoscyne when prepared from hyoscyamus. Scopolamine is said to have more active physiological properties than hyoscyne, and investigation has shown that commercial scopolamine hydrobromide contains, together with hyoscyne hydrobromide, the hydrobromide of a new alkaloid which the author terms atroscine, and identified by its lower rotatory coefficient. The alkaloid, which has the composition $C_{17}H_{21}NO_4$, gives a crystalline hydrate containing $2H_2O$, melting at 37° C. By the action of potash the alkaloid is decomposed into oscine and atropic acid. The substance is a strong base and gives characteristic salts, the solutions of which do not rotate polarised light. Attempts to convert hyoscyne into atroscine were not successful. With regard to the determination of atroscine in hyoscyne or scopolamine hydrobromide, which depends upon the rotation of the plane of polarisation, the following details are given. Hyoscyne hydrobromide, crystallising with $3H_2O$, gives, in an aqueous solution at $t = 15^\circ$ and $p = 4$, $[\alpha]_D = -22.5$. In 25 c.c. of solution, this concentration is obtained by dissolving 1 grm. of the crystallised, or 0.877 grm. of the anhydrous salt. Under these conditions, if the rotation be a and the scopolamine only contain hyoscyne and atroscine, then the percentage of true hyoscyne hydrobromide in hyoscyne or scopolamine hydrobromide is $\frac{100a}{22.5}$ or $\frac{100a}{25.7}$ if the anhydrous salt be used. Since a determination of the water of crystallisation must always precede that of a , it is preferable to employ the anhydrous salt. Based on this

method the author gives some numbers which he has obtained:—

	I.	II.	III.	IV.	V.
a	-22.1	-12.7	-12.1	-10.0	-11.3
Hyoscyne hydrobromide	85.9	43.4	47.1	38.5	43.9
Atroscine hydrobromide	15.0	50.6	52.9	61.5	56.1

The values can be easily converted into those for the crystallised salt, since both atroscine and hyoscyne hydrobromide contain $3H_2O$. With regard to its physiological properties, atroscine appears to act similarly to atropine and scopolamine so far as its action on the pupil is concerned, but is from two to four times more powerful in affecting the accommodation. In cases of iritis too, the new alkaloid acts more powerfully. For the oculist, therefore, it is of importance to have a hyoscyne hydrobromide with a low rotation, and the author, in conclusion, points out that the term scopolamine is superfluous, and should be no longer used.

—T. A. L.

New Method of Treating the Vanilla Pod. Board of Trade J., Aug. 1896, 207.

THE *Independent Créele* of Réunion contains a paper by Mr. Dolabaratz, upon a new process of treating the vanilla pod.

According to M. Dolabaratz the operation consists of drying the vanilla in an hermetically closed vessel by means of chloride of calcium, in the proportion of about 1 kilo. for every kilo. of dried vanilla obtained. The chloride of calcium is not lost, as it can be easily regenerated by heating it in an iron or copper receptacle; one lot of chloride of calcium is thus sufficient for several processes if kept, after regeneration, in an hermetically closed vessel.

According to information received, 2.981 kilos. of raw vanilla will produce about a kilo. of prepared vanilla.

It can be easily understood that vanilla dried in an airtight vessel must lose much less vanillin than when dried by the ordinary process, by which it is exposed in the open air for several weeks.

Licarcol, Licarhodol, and Limonol, Action of Gaseous Hydrochloric Acid on, Relation between the three Alcohols. P. Barbier and L. Bonveault. Bull. Soc. Chim. 1896, **15**, [3], 594—597. (See this Journal, 1893, 783.)

THE above isomeric alcohols all absorb hydrochloric acid readily, with evolution of heat, water being eliminated, and when saturated with the gas and fractionated, yield as chief product one and the same compound, an oily liquid, distilling under 10 mm. pressure at 120°—125° C. The oil has the composition corresponding to the formula $C_{10}H_{15}Cl_2$ (sp. gr. 1.0569), and appears to consist of a mixture of two isomeric bodies. When boiled with an acetic solution of dry potassium acetate, the chlorine is abstracted, and the product on fractionation yields (1) A mixture of hydrocarbons ($C_{10}H_{16}$) boiling at 170°—180° C.; (2) Limonol acetate from which, by saponification, a very pure inactive limonol may be regenerated. The limonol used in this investigation was derived from the essence of *Andropogon schoenanthus*.

The authors maintain, however, that licarcol and licarhodol are distinct chemical species, differing in constitution not only from each other, but also from limonol.—H. T. P.

Methylamines, a new Method of Separating them.

M. Delépine. Comptes rend. 1896, **122**, 1064—1066.

TWO methods of Hofmann and of Heintz are not very satisfactory. The new method is based on the action of formaldehyde on the methylamines. Henry has shown that monomethylamine reacts with formaldehyde to give a body $(CH_2 \cdot N(CH_3))_3$ boiling at 166°; whilst dimethylamine gives two compounds, $OH \cdot CH_2 \cdot N(CH_3)_2$, and $CH_2 \cdot N(CH_3)_2$, boiling between 80° and 85°. Trimethylamine, which boils at 9°, does not react. In putting the process into practice, the concentrated solution of the hydrochlorides of the amines is treated with caustic soda and the gas evolved

is collected in a 40 per cent. solution of commercial formaldehyde. By treating the liquid so obtained with an equal weight of caustic potash the greater part of the trimethylamine is evolved, and the liquid itself separates into two layers. The upper layer is dried over solid caustic potash, and submitted to fractional distillation; the remainder of the trimethylamine having passed over, fractions are collected boiling at 67–68° and at 166°. The former fraction contains a quantity of methyl alcohol derived from the impure formaldehyde. The amines may be regenerated by boiling the condensation products with alcoholic hydrochloric acid.

The process thus yields trimethylamine in solution, and the pure hydrochlorides of di- and mono-methylamine; it is simple, and does not, like the method with ethyl oxalate, necessitate the desiccation of the amines.—T. E.

Carbon Tetrachloride as a Substitute for Benzine [*Petroleum Spirit*]. Neueste Erfind. u. Erfahrungen, 1896, 3.

See under V., page 588.

Iodine Compounds, Soluble; Method for Titration of. E. Riegler. Zeits. anal. Chem. 1896, 35, [3], 395.

See under XXIII., page 616.

Benzonaphthol, some Reactions of. A. Christomanos. Chem. Zeit. 1896, 20, 583.

See under XXIII., page 619.

Caffeine, Determination of. Georges. Journal de Pharm. et de Chim. 1896, 4, [2], 53.

See under XXIII., page 622.

PATENTS.

Mandelic Acid and Nitrile of Mandelic Acid, Impts. in the Manufacture of. Chemische Fabrik, vormals Hofmann und Schoetensack, Gernsheim, Germany. Eng. Pat. 11,886, Aug. 6, 1895.

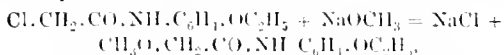
The production of the nitrile by action of an aqueous solution of potassium cyanide upon an alkaline bisulphite compound of benzaldehyde is claimed, also the conversion of the nitrile into mandelic acid by agitation with concentrated hydrochloric acid, and finally heating.—A. C. W.

Camphor, Process for Preparation in the condition of Powder. W. Schmidt, Philadelphia, U.S.A. Eng. Pat. 17,351, Sept. 17, 1895.

PULVERULENT camphor is claimed as a new article of manufacture and the process for obtaining it by dissolving in a solvent of low boiling point (60–100° C.), and subsequent removal of excess of solvent by distillation, after a previous filtration, if necessary.—A. C. W.

Alkylglycollic Acid Derivatives of p-Amidophenol Ethers, Manufacture of. Basle Chemical Works (Bindschedler), Basle, Switzerland. Eng. Pat. 8770, April 25, 1896.

This patent claims substances of the above class and their processes of manufacture by the reaction (1) of haloacet-p-amidophenol ethers with sodium alcoholates—



(2) of the alkylglycollic acids with p-amidophenol ethers.



The bodies formed by these reactions are valuable as antipyretics and antineuralgics.—A. C. W.

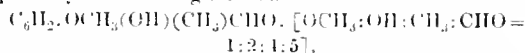
Artificial Musk, Impts. in Process for Making. Gretsche and Mayer, New York, U.S.A. Eng. Pat. 9521, May 5, 1896.

THE following process and portions of it are claimed. Cold sulphuric acid is saturated with the soluble constituents of naphtha or kerosene, the solution so obtained is nitrated, gradually heated, neutralised, and the odoriferous substance precipitated by the addition of a metallic soap. In the last operation an alkaline resin soap is used and then a

suitable salt, e.g., aluminium sulphate, added, the precipitate is washed with water and then with alcohol, the alcoholic solution containing the purified musk.—A. C. W.

New Perfume or Odoriferous Principle [*Homovanillin*] and *Process for the Manufacture of.* Chemische Fabrik von Heyden, Radebeul, Germany. Eng. Pat. 11,166, May 22, 1896.

A PERFUME having the composition of a homovanillin, together with its manufacture by the action of chloroform on homoguaiacol in alkaline solution (Tiemann and Reimer's reaction) is claimed. The homovanillin thus obtained has probably the following formula—



has an adhering smell similar to that of vanillin, and crystallises from alcohol in colourless scales, melting at 165° C.—A. C. W.

XXI.—PHOTOGRAPHY.

Photography, Recent Impts. in. J. M. Eder and E. Valenta. Dingl. Polyt. J., 300, 42–43.

ACCORDING to Belitzky a very good emulsion for collodion paper is obtained by the preparation of the following solutions:—

First Solution.—Strontium chloride, 30 parts; lithium chloride, 10; distilled water, 62; and alcohol (absolute), 138 parts.

Second Solution.—Silver nitrate, 12 grms.; water, 16; and alcohol, 30 grms.

Third Solution.—Citric acid, 20 grms.; alcohol, 80 grms.

Fourth Solution.—Glycerin and alcohol, equal parts.

Four hundred grms. of crude collodion of 3 per cent. are mixed with 10 to 20 grms. of the first solution; then 20 grms. of glycerin-alcohol, prepared as described, are added; after that a small portion of the second solution is added, and the mixture well shaken; finally 20 grms. of the third solution, together with 50 c.c. of ether, are added. Baryta paper is used for the emulsion thus obtained.

Emulsion of Silver Chloride Collodion for Diapositives.—Zinc chloride, 6 grms.; citric acid, 2 grms. tartaric acid, 1 grm.; and alcohol, 240 c.c.

To the solution thus obtained one drop of ammonia, 12 grms. of collodion-wool, and 450 c.c. of ether are added. When this "chloride-collodion" is completely dissolved, the following "silver collodion" is added:—Silver nitrate, 30 grms.; water, 20 c.c.; and alcohol, 450 c.c.

To this solution there are added 12 grms. of collodion-wool and 240 c.c. of ether.

The emulsion is allowed to stand for six to eight hours, and then the plates are thickly coated with it. Before copying, the plates are for a short time exposed to ammonia vapours.

The number of developers for dry plates is daily increasing. Lumière and Seyewetz recommend phenyl-hydroxylamine as follows:—Phenylhydroxylamine, 1 grm.; sodium sulphite (anhydrous), 3 grms.; and water, 100 cc.; potassium bromide (1:10), 6 cc.

Andresen recommends amido- and hydroxy-compounds of p-phenylenediamine and p-toluylenediamine as developers.—H. S.

Photography, Recent Progress in. J. M. Eder and E. Valenta. Die Chem. Ind. 19, [13], 1896, 259.

DURING the past few years Hauff's "metol" (methyl-paramidometaacresol) has become very largely used as a developer. It may be improved for portraiture especially by the addition of sodium thiosulphate. A suitable formula is (A) metol, 15 grms.; sodium sulphite, 150; water, 1,000 c.c. (B) "hypo," 1 grm.; sodium carbonate (cryst.), 330; water, 1,000 c.c. 20 c.c. of A and 10 of B are diluted for use with 30 c.c. of water. The Berlin Actien Gesellschaft have patented as developers:—The diamido naphthalene sulphonic acids prepared from α- and β-naphthylamine mono- and disulphonic acids; the amido acids from α- and β-naphthol mono- and disulphonic acids;

α - and β naphthohydroquinones, $\alpha_1\alpha_2$, $\alpha_1\beta_3$, $\alpha_1\beta_1$, and $\beta_1\beta_3$ -dihydroxynaphthalenes, and their mono- and disulphonic acids; $\alpha_1\alpha_2$, $\alpha_1\beta_1$, and $\beta_1\beta_3$ -amidonaphthols; $\alpha_1\beta_1$, and $\alpha_1\alpha_2$ -naphthylenediamines; and α -amido- β -naphthol mono- and disulphonic acids. Andresen has patented paramidophenol and cresol, and its chlorine, bromine, and iodohydroxy-derivatives. The developers are prepared by dissolving 30 grms. of the dry potassium sulphite having the formula $K_2S_2O_3$ in 100 c.c. of water, adding 10 grms. of paramidophenol hydrochloride, and then strong caustic soda till the precipitate just redissolves. One part of the solution is diluted with 5 to 50 parts of water before use.

All the foregoing substances require the addition of caustic alkali, which has several photographic disadvantages. Andresen has, therefore, patented paraphenylene and paratolylene diamine and their amido and hydroxy-derivatives. These work in the presence of alkaline carbonate or sulphite. The developing solution consists of a 10 per cent. solution of sodium sulphite containing 1 per cent. of amidoparatolylene-diamine hydrochloride. Lumière Bros. have recommended substituting for the caustic or carbonated alkali employed in the ordinary quinol developer, the tribasic sodium phosphate:—(A) quinol, 5 grms.; anhydrous sodium sulphite, 20; and water, 400 c.c. (B) Na_3PO_4 , 40 grms.; water, 200 c.c.; equal parts of each to be used.

A bromide emulsion paper with a glossy surface has lately been put on the market, and is treated in the usual manner. The polished appearance makes it unsuitable for enlargements, but it is well adapted for contact prints, especially when they are prepared by means of an automatic printing and developing machine. Patents have been taken out in Germany by J. Junk for a positive paper consisting (chiefly) of bromide of silver emulsified in a mixture of gelatin and starch. Adrianoff has given the following improved formula for "Aristo" paper:—(a) sodium chloride, 0.1 gm.; citric acid, 3; gelatin, 50 grms.; water, 500 c.c. (b) silver nitrate, 10 grms.; water, 500 c.c. *a* is warmed to 50° C., and *b* poured in slowly. The emulsion is squeezed through canvas, washed, &c., and finally coated on "barium paper" (see below). A matt surface may be obtained by the addition of starch as usual.

Complaints have been made about the inferior keeping qualities of many collodion papers, the deterioration being due to the decomposition of the silver salts. To obviate this the emulsion is spread on "barium paper"—the name given to a material which has been prepared with a layer of gelatin and barium sulphate. Liesegang has improved on this by incorporating tartaric and citric acids in the substratum, with the result that the collodion emulsion will keep its colour for months. Vollenbruch floats the back of the barium paper on a freshly prepared solution of hard gelatin, 1 gm.; sugar candy, 10; and citric acid, 18, in 1 litre of water. To avoid the curling of these papers in the different baths, Krügener paints the back with a solution of substances insoluble in water, such as nitrocellulose, shellac, &c.

Valenta has described a collodion paper in which the silver salts are the chloride, citrate, and chromate; the object of the latter being to diminish the number of different tones in the prints, so that the pictures appear to be exceptionally brilliant, and the paper becomes specially valuable for printing weak and over-exposed negatives. To prepare the normal emulsion, 200 c.c. of a 2.5 to 3 per cent. collodion are mixed with 0.36 gm. of strontium chloride and 0.18 of lithium chloride dissolved in 4 c.c. of a warm mixture of equal parts of 96 per cent. alcohol and glycerin. 1 gm. of citric acid dissolved in the minimum of alcohol is added, and the whole thoroughly shaken. In the dark room a solution of 3.2 grms. of silver nitrate in 4 c.c. of water is gradually run in, and after a further agitation the emulsion is filtered. So prepared it gives prints corresponding to ordinary paper, but by the addition of 0.4 or 0.8 c.c. of a 10 per cent. solution of chromic acid, or of 0.2 gm. of ammonium, or preferably, calcium bichromate to every 200 c.c. of the emulsion, the range of tones is considerably diminished, and it may be used for flat negatives as already mentioned. It is finished in a "combined" toning and fixing bath, containing lead nitrate 10 parts, "hypo"

200, water 1,000, to which 5 to 8 c.c. of a 1 per cent. solution of gold chloride are added just before use.

The objection to the employment of chromic acid and its salts, is that the prints lose very considerably in depth during the finishing process; and further experiments have shown that a similar emulsion, also giving abnormally hard prints, may be prepared by replacing the strontium and lithium chlorides by an equivalent quantity of cupric chloride. In this case if the prints are completely washed before toning, they only lose the usual amount, but if the washing be omitted, they are practically bleached. Tranyl chloride gives still better results; by the total or partial substitution of the chlorides mentioned, by an equivalent weight of the uranium salt, an emulsion may be made giving as brilliant prints from weak negatives as may be desired, while it loses but little in fixing, prints quickly, and tones well and uniformly in either the "combined" or the separate sulphocyanide or other gold baths in general use.

Stripping collodion papers are now being made, having a layer of gelatin between the paper and the collodion, so that by immersion in warm water the film may be removed and fixed on to any desired article.

The original "hot bath" platinum printing paper appears to be giving way to the newer "cold-bath" process, and Lainer recommends the following formula:—(A) potassium platinum chloride 10 parts, water 60; (B) ammonium bichromate 100, 10 per cent. oxalic acid solution 30, water 60. 7.2 c.c. of A are mixed with 4.8 c.c. of B, and smooth Rives paper, previously treated with gelatin or arrowroot, painted with it. To increase the brilliancy, 0.1 to 0.3 c.c. of a 2 per cent. solution of the bichromate may be added to the liquid.

A new paper requiring only immersion in water to work it, and giving white lines on a brown ground, has been introduced. It is prepared by dissolving 80 to 100 grms. of the double citrate of iron and ammonium, 10 to 20 of silver nitrate, 15 to 20 of tartaric acid, and 10 to 15 of gelatin in 1 litre of water.

For mounting purposes ordinary paste has been found useless in the case of heavy papers, and also for gelatin emulsions prepared with an "enamelled" surface, as it spoils the gloss. A large number of materials are now on the market composed of varying mixtures of starch, gum, dextrin, and gelatin dissolved in water or weak spirit, and usually containing an antiseptic, and often some glycerin to prevent "cockling" of the mount.—F. H. L.

Photographic Plates, Action of Zinc on. R. Colson.

Comptes rend. 1896, 123, 49.

A GELATIN-bromide plate placed in contact with a partly cleaned sheet of zinc and then developed, shows a deep grey tint in the part which was in contact with the cleaned surface. This is said to be due to reduction of silver bromide by zinc vapour and not to any radiation. The author concludes that if zinc be used at all in photographic apparatus it should have a compact covering through which the vapour will not pass.—A. C. W.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitroglycerin, Boiling Point of. C. A. Lobry de Bruyn. R. tr. ch. P.-B., 14, 131.

ACCORDING to Champion, nitroglycerin boils at 183° C. This figure is shown to be incorrect. As a matter of fact, ebullition was not observed even at 160° C. under a pressure of only 15 mm. The author is of opinion, however, that nitroglycerin might be distilled in a more perfect vacuum.

—H. T. P.

PATENTS.

Explosives [Safety], Impts. in the Manufacture of. G. G. André, Glenlean, Argyllshire, and C. H. Curtis, London. Eng. Pat. 23,443, Dec. 7, 1895.

A "flameless" explosive, consisting of 12 per cent. of wood-meal or similar substance, 85 per cent. of ammonium nitrate, and 3 per cent. of potassium nitrate.

The materials are incorporated in a drum with wooden balls without the addition of any liquid.—R. B. P.

Safety Explosives, Impts. in the Manufacture of. R. Pierre, Brefeld, and W. Pottgiesser, Königshof, both in Barmen, Germany. Eng. Pat. 6,555, March 25, 1896.

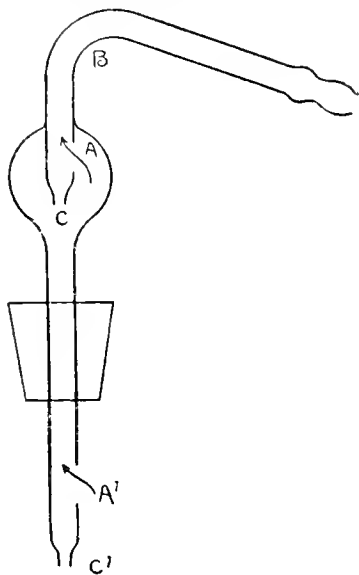
An explosive, consisting of 93 parts of ground ammonium nitrate, 5 parts of "aniline nitrate," and 2 parts of dioxide of manganese, lead, or chromium, intimately mixed together. —R. B. P.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Nitrogen Determinations, A New Safety Distillation Tube for Rapid Work in. C. G. Hopkins. J. Amer. Chem. Soc. 1896, 227—228.

THE tube shown in the figure is made from tubing about 7 to 8 mm. internal diameter. The side openings A and A' should be nearly as large, and the bulb about 5 cm. in



diameter. The length of the tube below the bulb is 12 cm., and that above the bulb about the same. The jets C and C' are 2 mm. inside diameter. In use, the tube is pushed through the cork of the distilling flask until the opening A' is below the cork; the vapour then passes through the side openings, and whatever condenses in the tube below the bend B runs back into the flask through the jets C and C', which always remain filled with liquid. —L. A.

Gas Analysis, Apparatus for. O. Bleier. Ber. 29, [11], 1761—1762. (See also Ber. 28, 2423; 29, 260, this Journal, 1896, 294.)

THE apparatus described by the author (*loc. cit.*) may be conveniently modified, to permit of the attachment of another series of absorption pipettes, by providing a vertical branch on the horizontal pipe just in front of the last three-way tap, which branch may be closed by means of a piece of india-rubber tubing and a glass rod, when not in use. Another modification consists in affixing a third and fourth gas pipette, filled respectively with ammoniacal and hydrochloric cuprous chloride, the latter for absorbing the final traces of carbon monoxide and ammonia vapour.

In place of the Hempel pipette, it is proposed to use a simpler form, the capillary tube of which can be filled with liquid by pressing a caoutchouc bulb attached to the filling tube. The pipette can then be affixed to the above-named branch on the main apparatus by a connecting piece of capillary glass tube with india-rubber connections.

Blowing into the pipette for filling, and the necessity for filling the connecting piece with water, are thus dispensed with. —C. S.

INORGANIC CHEMISTRY.—QUALITATIVE.

Phosphorus, Spectrum of, in Fused Salts and Metallurgical Products. A. de Gramont. Comptes rend. 1896, 122, 1534—1536.

SPARKS are passed between two fragments of minerals or fused salts connected to the poles of an induction coil, and also to a condenser. Under these circumstances the spark spectra exhibit not only the characteristic lines of the metals but also of the metalloids. Thus, fused phosphates (of soda and potash) give a fine spectrum of lines of phosphorus. Of these the most easily distinguished, by their position and appearance, are the triplet Pa (wave lengths 604.2, 603.45, and 602.5) in the red, and the doublet Pe (wave lengths 460.3 and 458.85) in the blue. These characteristic lines are also distinctly shown by certain meteorites and by metallurgical products in which phosphorus is combined with iron or copper. —D. E. J.

Nitrites, Detection of, by Means of Cuprous Compounds. P. Sabatier. Comptes rend. 1896, 122, 1417—1419.

CUPROUS oxide, in contact with a solution of silver nitrate, entirely displaces the silver, and finally a grey substance is obtained (Rose, *Annal. Pogg.* 1857, 101). This contains a cuprous, or cupro-cupric nitrate, and when treated with an excess of strong sulphuric acid gives a magnificent blue-violet coloration, which is at once destroyed by water, and disappears spontaneously after some days.

The colour is readily obtained by adding cuprous oxide to a solution of sodium nitrite in strong sulphuric acid. All cuprous and cupro-cupric compounds give the reaction, but not immediately in the case of the chloride and iodide. Metallic copper also gives the reaction, finely powdered (reduced) copper immediately, shavings gradually. Cupric, mercurous, mercuric, lead, silver, stannous, stannic, manganese, cobalt, and nickel compounds give no reaction.

The violet colour is quickly destroyed by oxidising agents as nitric and persulphuric acids, and by agitation in dry air. Water containing one-fifth its bulk of sulphuric acid does not destroy the colour.

To detect nitrous acid, a drop of the solution, on a white plate, is mixed with a drop of strong sulphuric acid, and a few grains of cuprous oxide added. The violet coloration will be produced in solutions containing only $\frac{1}{50}$ mol. of nitrous acid per litre.

The violet compound is cupric nitrosodisulphonate.

—N. H. J. M.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Ammonium Molybdate Solution, Modified, for Analytical Purposes. A. L. Winton. J. Amer. Chem. Soc. 1896, 18, [5], 445—446.

1. DISSOLVE 1,000 grms. of molybdic acid in 4,160 c.c. of a mixture of ammonia (sp. gr. 0.90), one volume, water, two volumes.

2. DISSOLVE 5,300 grms. of ammonium nitrate in a mixture of 6,250 c.c. of nitric acid (sp. gr. 1.42) and 3,090 c.c. of water.

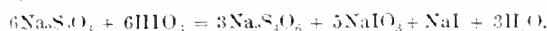
ADD 1 to 2 slowly with constant stirring, allow to stand for a few days in a warm place, and decant the clear liquid. This solution has the composition recommended by Fresenius, but contains in addition 15 grms. of ammonium nitrate in every 50 c.c. —H. T. P.

Iodine Compounds, Soluble; A New Method for Titration of. E. Riegler. Zeits. Anal. Chem. 1896, 35, [3], 305—307.

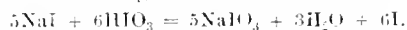
THE principle of this method consists in liberating the iodine in an iodide by means of iodic acid, removing the iodine by agitation with petroleum ether, and then estimating the excess of iodic acid by titration with decinormal sodium thiosulphate solution. The reactions are given in the following abstract. The iodic acid is employed in the form of a decinormal solution, which is obtained by dissolving 17.6 grms. to 1,000 c.c. —A. K. M.

*Titration of Thiosulphate Solution with Iodic Acid.*E. Kieglér. *Zeits. Anal. Chem.* 1896, **35**, 308.

THE reaction involved depends upon the following equation—



A solution of starch is used as indicator, and is added to the thiosulphate solution. The addition of the slightest excess of iodic acid produces a blue coloration, owing to the liberation of iodine, which is brought about in accordance with the following reaction:—



Iodic acid is readily obtained in a state of absolute purity, and merely requires to be dried over sulphuric acid.

—A. K. M.

*Nitrous Acid, Estimation of Minute Quantities of.*L. Zambelli. *Monit. Scient.* 1896, **10**, 351.

THE author refers to a paper by Lunge and Lwoff (this Journal, 1895, 67; also *Monit. Scient.* 1895, 117), in which a colorimetric method of the author's is mentioned. He points out that he has described two methods, and that he has given the preference to the one which Lunge and Lwoff have ignored. The method advocated is the following:—2 grms. of sulphamic acid and 2 grms. of phenol are dissolved in 50 c.c. of dilute sulphuric acid (equal vols. of acid and water). A measured quantity of the solution to be tested is introduced into a flask, 2 or 3 c.c. of the above solution added, and the flask is well shaken. At the end of 10 to 15 minutes the solution is made just alkaline by the addition of ammonia, and if nitrous acid be present a yellow coloration will be produced. The colour has to be matched by repeating the reaction, using in this case, however, a standard solution of silver nitrite. Results are given showing the accuracy of the method which the author also recommends on account of its simplicity.—A. K. M.

Hydrofluoric Acid, Volumetric Analysis of: Some Applications of the Acid. K. F. Stahl. *J. Amer. Chem. Soc.* 1896, **18**, [5], 415—425.

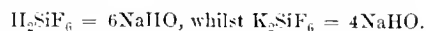
COMMERCIAL hydrofluoric acid always contains as impurities, hydrofluosilicic and sulphuric acids—introduced during the process of manufacture—owing to the disturbing influence of which the specific gravity of the acid is only a rough index as to its real strength. The following method for determining these impurities, as well as the percentage of hydrofluoric acid, is stated to be rapid and reliable.

1. *Total Acids.*—2 grms. of the sample are added to a measured volume (25—50 c.c.) of normal NaHO, sufficient to neutralise almost the whole of the acid. A few drops of alcoholic phenolphthalein are now added, the solution heated to 50° C., and the titration completed as usual.

2. *Hydrofluosilicic Acid.*—2 grms. are diluted in a platinum dish with 5 c.c. of water, and partially neutralised with potassium carbonate (0.65 grm. K_2CO_3 for each 1 c.c. of normal NaHO used under 1). 15 c.c. of 50 per cent. spirit are then added, followed by sufficient absolute alcohol to elevate the alcohol content of the whole to 50 per cent. After one hour, the gelatinous precipitate of K_2SiF_6 is filtered off, washed with 50 per cent. alcohol, transferred (including filter-paper) to a platinum dish, warmed to 50° C. with 25 c.c. of water, and slowly titrated with normal NaHO and phenolphthalein.

3. *Sulphuric Acid.*—4 grms. of sample are evaporated in a platinum dish on the water-bath, until acid fumes are no longer evolved. The syrupy residue of H_2SO_4 is diluted, and titrated with alkali.

In calculating out results it must be noted that—



Amongst the more recent commercial applications of hydrofluoric acid, its employment in dilute solution (1—2 per cent. HF) for cleaning iron castings from sand and scale has found great favour. It is stated to be, for this purpose, far superior to sulphuric acid, being more rapid, uniform, and thorough in its action.—H. T. P.

Carbonic Acid, Rapid Determination of, in Air and Confined Spaces. M. Henriot. *Comptes rend.* 1896, **123**, 125.

THE sample is taken in a six-litre flask provided with a tap funnel and tube with stop-cock passing through the cork. In the laboratory the flask is cooled, 15 c.c. of potash (8 grms. to the litre) coloured with phenolphthalein, and 2 c.c. of ether are placed in the funnel, the latter to protect the potash from the air. The potash is washed into the flask with boiled water, and then well shaken; after standing an hour, standard acid is added to complete decolorisation. Twice the difference between the acid so required and that needed to neutralise 15 c.c. of the potash is equivalent to the carbonic acid in the sample, since bicarbonates are neutral to phenolphthalein.—A. C. W.

Pyrites, Determination of Sulphur in. T. S. Gladding.*J. Amer. Chem. Soc.* 1896, **18**, [5], 446—449.

THE author shows by direct experiment that—

1. When the whole of the barium chloride is added at once (as Lunge directs) the barium sulphate carries down with it a proportion of barium chloride equivalent to about 0.5 per cent. of the sulphur present.

2. The occlusion of barium chloride is almost entirely prevented if the reagent be added (as the author recommends) drop by drop from a burette to the solution of the ore.

3. The solubility of barium sulphate in the acid liquid of precipitation, is so small that the loss due to it amounts only to about 0.02 per cent. of sulphur. Lunge's claim, therefore, that in his method the occlusion of barium chloride is almost exactly compensated by the solubility of the precipitate, is shown to be inaccurate. *Per contra*, the results obtained by the process must be too high by several tenths per cent. As regards the trace of sulphur (0.20 to 0.10 per cent.) occasionally carried down with the ferric hydrate precipitate, the author maintains that it may be accurately determined by dissolving the precipitate in hydrochloric acid, and precipitating with barium chloride.

—H. T. P.

Gold Solvents, Estimating the Efficiency of. W. J. Sharwood. *Eng. and Mining J.* 1896, **61**, 613.

IN testing cyanide and other solutions, as regards efficiency in dissolving gold, the real object is to find the weight dissolved from a given area in a given time. A better way when comparing different solutions is to find the time required to dissolve a layer of gold of known thickness.

The author gives the following method:—Ordinary microscope square "cover glasses" are carefully cleaned and coated on one side with an alcoholic solution of shellac. When most of the alcohol has evaporated off, the glasses are pressed upon a perfectly smooth sheet of gold leaf. The shellac is allowed to harden, and the ragged edges of the gold leaf are then rubbed off. In taking gold leaf from the book, it should not be removed from the paper, but cut out bodily and laid on a smooth surface. The test-pieces of metal thus produced are of uniform weight and thickness, so that the results obtained by noting the time taken by different solvents to effect complete solution are strictly comparable. The test-pieces should be kept on edge when immersed in the solvent.

The author found by repeated trials that the thickness of gold leaf in two books used was very uniform, and that the variation in the weight of sheets of equal size was less than 0.25 per cent.—A. S.

*Silver from Gold, Separation of, by Volatilisation.*J. W. Richards. *J. Franklin Inst.* **141**, [846], 447—451.

IN the blow-pipe assay of gold and silver, where the button of precious metal is too small for weighing, and its weight has to be calculated from an accurate measurement of its horizontal diameter, it is found that the gold and silver may be parted on charcoal by oxidation and volatilisation. The charcoal must be dense so as not to burn away too quickly, and should leave a white ash. The button is heated in a sharp-pointed oxidising blow-pipe flame to a bright yellow heat, but not to whiteness, when the silver volatilises easily and steadily until there is less than 5 per cent. of it remaining in the gold. The temperature is estimated at 1,100° to

1,200° C., or a little above the melting point of copper. To remove the remainder of the silver the temperature is now raised to 1,500° C., when the silver is entirely eliminated, and the gold also begins to volatilise. The last fact is indicated by a faint crimson coating on the charcoal ash close to the button and there is a trace of gold lost which, however, is immeasurable. The flame to be used is a very sharp-pointed needle-like oxidising one, about 1 cm. in length to the blue tip, and the button should be brought to within about 1 or 2 mm. of this visible blue tip. If the alloy on starting, be white, it is found that after three to six minutes of this treatment, it has become pale yellow. When it exhibits a brass yellow colour, the heat should be raised for two minutes, when the gold colour will appear but without the crimson coating. After this, one minute at a white heat will complete the separation. The gold button is then taken out, expelled, and measured.

It was suggested that the method might be practicable if an electrically-heated furnace could be devised in which the gold and silver buttons could be placed on suitable supports and kept at the proper temperature with a current of air passing over them. The movement to the hottest part of the furnace would suffice to remove the last traces of silver, just as the last traces of lead are removed in cupellation in an ordinary muffle.—A. W.

Zinc Analysis by Electrolysis. E. Jordis. Zeits. für Elektrochemie, 1896, 2, [30], 655—657.

THE objections have been raised against the electrolytic method of estimating zinc that:—(1.) The deposition of copper upon the platinum dish takes time. (2.) About two hours are required for the deposition of 0.12—0.2 gram. of zinc. (3.) The edges of the deposit soon oxidise or become dissolved. (4.) In general, the zinc can only be separated from other metals by chemical processes. The author shows how the first three objections are overcome. The dish must be coppered to a height of about 2–3 mm. above that at which the zinc solution will stand; thus, if 250 c.c. of zinc solution are to be used, 250 c.c. of copper solution must be taken. If the zinc solution be properly made up, there is no risk of the precipitated zinc redissolving. It should contain not less than 0.3—0.5 gram. of zinc, and is prepared for electrolysis by adding to the neutral solution 2 grms. of ammonium sulphate and 5–7 grms. of ammonium acetate and acidifying with a few drops of lactic acid. After the current has been passing for about 25 minutes the electrolyte should be nearly neutralised with ammonia. A saturated solution of copper sulphate with 5 per cent. of nitric acid may be used; or else a solution of the double oxalate of copper and ammonia in oxalic acid. When the electrolyte is stirred and a moderately high current-density is used, about 85 per cent. of the zinc is deposited in 35 minutes, and about 96 per cent. of it in an hour. The deposition of the remainder of the zinc can be accelerated by pouring the solution out into a fresh coppered dish and finishing the electrolysis in this. If this be done from 40 to 60 minutes after the start, the whole analysis only takes about 1½ hour. (See this Journal, 1896, 280—281; also 379.)—D. E. J.

Ammonium Citrate Solution, used in the Analysis of Fertilisers, A Simple Method for Determining the Neutrality of. N. W. Lord. J. Amer. Chem. Soc. 1896, 18, [5], 457—458.

A QUANTITY of distilled water is distinctly coloured with purified litmus, and a portion of the solution is further diluted with its own volume of water. Two Nessler jars are filled with the weaker solution, and a trace of sulphuric acid is added to one, and of ammonia, to the other. The jars when placed one behind the other and viewed by transmitted light furnish a standard neutral tint with which is compared a third Nessler jar charged with the stronger litmus solution plus 5 c.c. of the ammonium citrate under examination. The slightest deviation of the citrate from neutrality may thus be perceived, and its amount determined by cautiously adding semi-normal acid or ammonia to the single jar until the two tints are exactly equal. A corresponding correction having been applied to the bulk of the citrate solution, the latter should be again tested to make sure that exact neutrality has been attained. The process

is simple; and solutions thus neutralised have always been found correct when tested by Hutton's method (with alcoholic calcium chloride solution).—H. T. P.

Silica, Analytical Determination of, Notes on. F. G. Wiechmann. School of Mines Quart. 1896, 17, [3], 220—225.

THE following analytical scheme is given for the determination of total silica, silicates soluble in water, crystalline silica and silicates insoluble in caustic potash solution (1 : 4), and amorphous silica (diatomaceous earth).

Total Silica.—Mix $\frac{1}{2}$ gram. with 10 grms. of mixed carbonates of sodium and potassium (1 : 1), fuse, dissolve in dilute hydrochloric acid and proceed as usual.

Silica Soluble in Water, &c.—Boil 1 gram. with 100 c.c. of water for half-an-hour, filter, and wash with boiling water. Acidify the filtrate and washings with hydrochloric acid, evaporate to dryness and proceed as usual. Wash the residue from the treatment with boiling water into a beaker with the least possible quantity of water, and boil it with 100 c.c. of caustic potash solution (25 per cent.) for one hour; filter and wash with hot water. This filtrate is evaporated with hydrochloric acid for determination of the amorphous silica, while the residue on the filter is dried and fused with the mixed carbonates for determination of the crystalline silica and silicates insoluble in caustic potash solution.—A. G. B.

ORGANIC CHEMISTRY.—QUALITATIVE.

Alkalimetry, Resazurin as an Indicator in. L. Crismer. Bull. de l'Assoc. Belge des Chimistes 10, [1], 22—24.

RESAZURIN is capable of detecting the presence of smaller quantities of acid than are revealed by litmus. It may be prepared by adding 8 grms. of fuming nitric acid to a solution of 10 grms. of resorcinol in 500 grms. of ether cooled down to -5 or -8° C. After leaving at rest for two days in the cold, the resulting crystals are collected, washed, and purified by means of sodium carbonate, which produces red-brown crystals of the sodium salt of resazurin, that of resorufin remaining in solution. After washing the crystals with sodium carbonate solution (concentrated), resazurin crystals may be obtained by slightly acidifying the aqueous solution of the sodium salt with sulphuric acid. The test solution consists of 0.20 gram. of resazurin dissolved in 40 c.c. of decinormal ammonia and made up to 1 litre with water. This $\frac{1}{5000}$ solution is very stable, and of an intense blue shade (rose by transmitted light), turning red in presence of acid, two or three drops being sensitive to one of decinormal sulphuric, hydrochloric, or oxalic acid, and conversely, ammonia, alkalis, or borax. It may, therefore, be employed as an indicator for the latter substance, for which purpose litmus and phenolphthalein are unsuitable; on the other hand, resazurin gives only uncertain results with nitric acid and monobasic organic acids, but is in common with litmus and phenolphthalein—though within more restricted limits—susceptible to the action of carbon dioxide. By the action of reducing agents resazurin, in alkaline solution, is converted into resorufin, and it is therefore advisable not to prepare resazurin test papers until just before use.

An idea of the sensitiveness of this indicator is afforded by the fact that the acid solution will detect the alkali dissolved by heating water (200—300 c.c.) in a flask of Jena glass even before the point of ebullition is attained.—C. S.

Sandmeyer's Reaction. J. Walter. J. prakt. Chem. 1896, (2), 53, 427—430.

THE author supposes that the conversion of diazobenzene chloride into chlorobenzene by the action of cuprous chloride takes place in two stages: (1) reduction to phenyl hydrazine, the CuCl being oxidised to CuCl_2 ; (2) oxidation of the phenyl hydrazine to chlorobenzene, CuCl being reformed. That a trace of CuCl does not suffice to bring about the reaction may be due to its mechanical enclosure by the oily chlorobenzene. Where soluble sulphonic acids are used, a very small quantity of cuprous chloride is, according to G. Tobias (Ber. 23, 1629; this

Journal, 1890, 824) sufficient. To test his view the author tries the action of CuCl_2 on phenylhydrazine in presence of hydrochloric acid and 16 grms. of chlorobenzene were obtained from 36 grms. of phenylhydrazine. Since the reaction might have consisted of an oxidation of the phenylhydrazine to diazobenzene and subsequent formation of chlorobenzene from this in the usual way, he tried the action of ferric chloride, because, according to Sandmeyer, ferrous chloride produces no chlorobenzene by its action on diazobenzene; 14 grms. of chlorobenzene were obtained from 27 grms. of phenylhydrazine. Attempts to demonstrate the formation of phenylhydrazine by the action of cuprous chloride on diazobenzene were unsuccessful. Dihydroxy-tartaric acid is recommended as a very delicate reagent for phenylhydrazine, producing a yellow precipitate or coloration in solutions containing 1 part of the hydrazine in 10,000 parts of water. It is suggested that the conversion of chlorobenzene into iodobenzene by hydriodic acid alone, is due to its reducing properties, the reaction being similar to that taking place with cuprous chloride.—T. E.

Benzonaphthol, Some Reactions of. A. Christomanos. Chem. Zeit. 1896, 20, 583.

BENZONAPHTHOL (β -naphthol benzoic ester) is at the present time used in medicine in preference to β -naphthol, and the author proposes the following test as delicate and characteristic.

Benzonaphthol dissolves, in the cold, in about three times its weight of conc. sulphuric acid, with the formation of a pale yellow colour. On warming the solution, the colour darkens until, at about 200 °C., it becomes a dirty violet-red, the solution at the same time exhibiting a green fluorescence. The fluorescence persists on dilution, but the diluted solution thickens on cooling, with separation of crystalline flakes which redissolve on warming. Addition of ammonia solution to the strongly diluted solution obtained by heating with sulphuric acid, produces a very intense and permanent bright bluish green fluorescence similar to that given by fluorescein or aesculin. This fluorescence is not given by any phenol ester but is produced by traces of the benzonaphthol.

Boiling benzonaphthol with caustic soda solution, diluting with water and acidifying with concentrated hydrochloric acid causes the solution to assume a rose coloration on cooling. The addition of a few drops of concentrated nitric acid hastens the appearance of the colour, making it faint cherry red.—J. T. C.

Dimethyl-m-amidophenol, Reactions of. L. Lefèvre. Bull. Soc. Chim. 1896, 15, 900.

See under IV., page 584.
(Also this Journal, 1895, 992.)

Textiles [Testing Army Cloth], Chemical Technology of: Report on Progress made during 1895. O. N. Witt and A. Buntrock. Dingl. polyt. J. 300, 185.

See under VI., page 589.

Tussah Silk, the Examination of, in Textile Fabrics. F. Filsinger. Chem. Zeit. 20, 324.

THE cross-section of the Tussah fibres is larger and flatter than that of ordinary silk, and shows many fine air-tubes. Moreover, characteristic bands frequently cross the fibres in an oblique direction, the fibres thereby approaching cotton fibres in their microscopical appearance. The Tussah fibres are not soluble in basic zinc chloride, concentrated hydrochloric acid, and other reagents in which ordinary silk is readily dissolved. Finally, Tussah silk is more inflammable than ordinary silk.—H. S.

Butter, Detection of Borax in. Planchon and Vuattart. J. de Pharm. et de Chim. 1896, 4, [2], 49—51.

TWENTY grms. of the butter are melted and dissolved in petroleum spirit. The solution is poured into a separating funnel with the rinsings of the basin, which is rinsed once with 10 c.c. of petroleum spirit and twice or three times with 10 c.c. of water. After shaking and settling, the aqueous portion and any supernatant film are run into a platinum basin, evaporated and incinerated. The ash is fused

with 0.5 gram. of potassium carbonate, a trace of copper oxide added, and the mass again fused. Borax shows itself by a greenish-blue or violet-blue coloration; whilst the residue from a pure butter is grey or reddish-grey. The only other substances which give a reaction at all similar to borax are silicates, and they are never likely to occur in such circumstances. The method allows the detection of 2 parts of borax in 1,000 of butter, or a still smaller proportion if a larger amount be taken for analysis. The same method has not proved very satisfactory for the detection of borax in wine, beer, or milk.—J. T. D.

Red Wines, Detection of Foreign Colouring Matters in. A. Belar. Zeits. Anal. Chem. 1896, 35, 322—323.

AN addition of rosaniline to wine may be readily detected and the amount estimated by agitating about 5 c.c. of the wine with an equal volume of nitrobenzene. Methylene blue imparts a green colour to nitrobenzene, whilst rosaniline, purpurin, and safranin are taken up by and dissolve in it, without change of colour. Eosine imparts a wine-red colour whilst indigo carmine is insoluble in nitrobenzene and, in fact, behaves like the blue colouring matter of plants. The experiments are being continued with other dyes.—A. K. M.

Wood Cellulose in Paper, Testing of. Leipzig Paper Testing Inst. Papier Zeit. 1896, 44, 117.

THE whiteness of cellulose pulp is no indication of its purity. A white unbleached wood pulp may contain a less pure cellulose fibre than one of a darker colour. Upon the assumption that the durability of wood pulp papers depends upon the purity therein of the cellulose fibres, a means of testing such papers was desirable. It has been found that aniline dyes are most suitable for this purpose. Good bleached wood cellulose is not coloured in the least by a solution of aniline, but unbleached wood fibres, prepared either by the sulphite or soda process are turned to a distinct bluish green colour. The less pure the cellulose, the more dense is the greenish hue, and this is more pronounced with fibre prepared from wood cut in the autumn, when the reaction with the aniline is similar to that obtained with mechanical wood pulp. Should the sample of pulp remain uncoloured after adding the aniline solution it is safe to assume that fibre of such purity could only have been obtained on a practical scale by bleaching. The aniline colour employed is that known as Malachite green. It should be dissolved in water containing 2 per cent. of acetic acid. The action upon the fibres is very rapid and the colour cannot be removed by washing and even soaking in water for several weeks. If the sample to be tested be composed simply of wood cellulose, the examination can be made with the naked eye, but with a sample of paper in which other materials are present, it is necessary to disintegrate the web and examine a portion under the microscope. The paper may be prepared for the microscope by boiling in a 1 per cent. solution of soda, providing the fibres are afterwards rapidly washed free from alkali on a very fine wire gauze filter. A small quantity of the prepared fibre is placed upon a slide under the microscope and a drop of the dye solution then added. Rosaniline sulphate also serves to distinguish between wood pulps prepared by the sulphite and the soda processes. A saturated solution is prepared to which is added a little alcohol and then sulphuric acid, until the carmine-red solution shows a faint violet shade. When the cellulose fibre is placed in such a solution, the following colours are imparted:—(1.) Unbleached sulphite fibres turn to a deep violet red. (2.) Bleached sulphite fibres turn only slightly red with only a very faint shade of violet. (3.) Unbleached soda pulp becomes still less coloured than bleached sulphite. (4.) Bleached soda pulp assumes but the faintest tinge of red, and under the microscope the fibres prepared from summer-cut wood are practically colourless, whilst those prepared from autumn-cut wood are occasionally slightly coloured, the colour being mainly due to the presence of medullary cells. As regards bleached sulphite and unbleached soda fibres, any difficulty of distinction by other reactions may be settled by the Malachite green test.—S. P. E.

Dulcine (Sacrol), Detection of, in Beverages. Jorissen. *Revue Chim. Ind.* 1896, **7**, [77], 134—135.

This substance, which resembles saccharine in its sweetening powers, and is sometimes used for adulterating foods, was discovered by Berlinerblau in 1885, and has the composition $\text{NH}_2\cdot\text{CO}\cdot\text{NH}\cdot\text{C}_6\text{H}_4\cdot\text{O}\cdot\text{C}_2\text{H}_5$. It may be readily detected as follows in a beverage.—About one-twentieth of its weight of plumbic carbonate is added to the liquid, and the whole evaporated to a syrupy consistency. The syrup is then extracted with alcohol, the alcohol distilled off, the residue extracted with ether, and the ether evaporated off; the residue then contains the dulcine. Mercuric nitrate free from excess of acid is prepared by dissolving 1—2 grms. of precipitated yellow mercuric oxide in dilute nitric acid, adding caustic soda till a permanent precipitate just forms, diluting with water to 15 c.c., allowing to stand, and decanting the clear liquid. The residue to be tested for dulcine, is suspended in about 5 c.c. of water, 2—4 drops of the nitrate solution are added, and the test-tube containing the mixture is introduced into a water-bath for 5—10 minutes. The solution will then have assumed a more or less marked violet tint. A small quantity of plumbic dioxide is added, when a brilliant violet coloration is produced. A centigram. of dulcine gives a very strong reaction, a milligram a visible, though faint one. Neither saccharine, benzophenol, urea, nor sugar give this reaction, which is more certain than Morpurgo's reaction.—L. T. T.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Wood, Yield of Charcoal, Methyl Alcohol, Acetic Acid, &c., from different kinds of. E. Parillat. *Rev. de Chim. Ind.* 1896, **7**, 100.

See under III., page 584.

Methylamines, New Method for the Separation of. M. Delépine. *Bull. Soc. Chim.* 1896, 701—704.

THE method depends on the fractional separation of the compounds of formaldehyde with mono- and dimethylamines, whilst trimethylamine does not combine. Mono-methylamine gives the compound $\text{CH}_2\cdot\text{N}(\text{CH}_3)$, boiling at 166° C., and dimethylamine forms either $\text{CH}_2\cdot[\text{N}(\text{CH}_3)_2]_2$ or $\text{HO}\cdot\text{CH}_2\cdot\text{N}(\text{CH}_3)_2$, both of which boil at 80°—85° C. The boiling point of trimethylamine being 90° C., the fractions are easily separated. As a matter of fact, the fraction containing the dimethylamine boiled at about 67° C., owing to the presence of methyl alcohol in the formaldehyde employed, which formed a molecular compound with the condensation product. The bases are regenerated by saturating aqueous solutions thereof, boiling at 166 or 167° C., with pieric acid. On evaporation, the pierates of mono- or dimethylamine crystallise out. The former melts at 207° C. and the latter at 156° C. In place of using the pierates, the compounds may be decomposed by the prolonged action of hydrochloric acid and alcohol, when, on evaporating the solutions, the hydrochlorides of the bases are obtained. Methylamine hydrochloride crystallises in mother-of-pearl plates, melting at 210°—220° C., whilst dimethylamine hydrochloride forms long prisms, melting at about 171° C., and much more easily soluble in water or alcohol than either methyl- or trimethylamine hydrochloride. In some cases it is advantageous to employ bis-muth iodide for separating the base from the fraction, boiling at 166° C. Methylamine forms red hexagonal plates of the formula $(\text{CH}_3\text{NH})_2\cdot 2\text{BiI}_3$, from which the base can be obtained by boiling with potash or soda.

Finally, Nessler's solution gives an insoluble, yellowish, flocculent precipitate with methylamine, whilst di- and trimethylamine give white precipitates soluble in water, and hence this reagent serves as a test for the purity of a given trimethylamine.—T. A. L.

Fats and Oils, Vegetable and Animal; The Determination of the Solid Fat in Artificial Mixtures of. J. H. Wainwright. *J. Amer. Chem. Soc.* 1896, **18**, [3], 259—264.

"Compound lard" or "lard compound" has in recent years become an important article of commerce, and consists

essentially of cotton-seed oil and oleostearin made from beef fat mixed in different proportions, sometimes containing a proportion of genuine lard. Attempts to deduce the percentage of oleostearin in the mixture from determinations of the ordinary "constants" being unsatisfactory, the following simple process was devised:—

About 150 grms. of the sample are melted in a beaker at 212° F. The substance is then allowed to cool to from 75°—80° F. After standing for 12 hours longer in a moderately warm place, the solid fat commences to crystallise. The solid (crystallised) contents of the beaker having been thoroughly mixed by stirring, 50 grms. are carefully wrapped in flannel and subjected to pressure in a screw press. The pressure should be applied very gradually, especially at first, and continued until the greatest pressure obtainable has been exerted. Usually at least one hour is required. The cake of solid fat is then detached from the cloth and weighed. The results of numerous assays of known mixtures show that the method is reliable within about 1½ per cent., the extreme errors in 13 experiments, in which the proportion of oleostearin added varied from 19.6 to 29.2 per cent., being — 0.8 and + 1.6 per cent.—L. A.

Tannin, Estimation of. B. Weiss. *Der Gerber*, 1896, **22**, 62—64.

COMMENTING on Cerych's paper (this Journal, 1896, 51) the author says that he has evidence that the insoluble matter left when the Mitrowitz oak-wood extract is dissolved, is not ellagic acid alone, but contains also a metallic compound of tannin, which is not so insoluble as

ellagic acid is. He agrees with Cerych that it is essential to use a constant weight of extract dissolved in a constant volume of water, and to work at the same temperature; these points, however, he claims to have already insisted upon himself. It is shown that hide powder, which has been washed and dried as recommended by Cerych again yields a solution which gives a turbidity with tannin when soaked in water, as though the hide fibre were converted into gelatin by the action of water at the ordinary temperature. This is to some extent prevented by treating the hide powder with an antiseptic such as lysol or mercuric chloride.

The author approves of Cerych's suggestion to mix filter paper with the hide powder, and proceeds as follows:—35 grms. of pure unsized filter paper are pulped in 2 litres of a 2 per cent. lysol solution; to this 100 grms. of hide powder are added and allowed to remain for several hours. The mass is drained on a funnel, pressed, and treated, once with pure water, once with dilute alcohol, and once with strong alcohol. The mixed powder and paper are allowed to dry overnight, powdered, and 6½—7 grms. thereof are packed in the filter tube so that the moistening of the powder and the filtration of the tannin solution may be completed in 2—3 hours.—A. G. B.

Glue, Valuation of. C. Stelling. *Chem. Zeit.* 1896, **20**, 461—462.

IN view of the difficulties met with in the direct determination of chondrin and gelatin, the non-gelatinous constituents of commercial glue are estimated. To this end, 15 grms. of the glue to be tested, are placed in a 250-c.c. flask, covered with 60 c.c. of water, and left for 12 hours. The flask is next heated on the water bath till complete solution of the glue is effected. The water evaporated from the flask, in accomplishing this, having been replaced, the flask is filled almost to the mark with "alcohol of 90°," allowed to cool, and then filled to the mark and well shaken. It is then placed aside for 6 hours, after which the liquid is filtered, 25 or 50 c.c. of the filtrate are evaporated to dryness, and the residue is dried at 100° and weighed. The method yields only approximately accurate results, but is trustworthy and useful for comparative tests.

The following are some of the results obtained:—Gelatin (5 samples) contained on an average 3.39 per cent. of non-gelatinous compounds; bone-glue (from bones treated with hydrochloric acid, first extract) (4 samples), 10.33 per cent.; bone-glue (obtained under pressure with the use of

little or no acid) (17 samples), 20.66 per cent.; glue employed for clarifying wine (2 samples), 33.2 and 59.3 per cent.—E. B.

Sugar House Analysis, Two Sources of Error in. E. C. Shorey. J. Amer. Chem. Soc. 1896, 18, 162.

See under XVI., page 603.

Malt, Estimation of Diastatic Power in. W. G. Sykes and C. A. Mitchell. Analyst, 1896, 21, 122—128.

In order to obtain a diastatic value in one operation, the authors have devised a method which to some extent combined the methods of Kjeldahl and Lintner. Into a wide-mouthed 200-c.c. flask are placed 100 c.c. of a 2 per cent. solution of soluble starch, and 1 c.c. of the filtered extract, prepared by digesting 25 grms. of ground malt with 500 c.c. of water for six hours at the ordinary temperature. The whole is well shaken and allowed to stand at a temperature of 70° F. for one hour; 50 c.c. of Fehling's solution are then added and the flask covered by a watch-glass, placed on wire gauze over a Bunsen flame and heated to 98° C. It is then removed from the flame and immersed in boiling water for seven minutes. It has been found experimentally that by this procedure the contents of the flask are submitted to conditions of temperature and time closely approximating those employed in Lintner's method. The cuprous oxide is collected in a Soxhlet's filter tube, reduced in hydrogen, and weighed. The weight of the copper found, divided by 0.458 (the quantity of copper contained in 50 c.c. of Fehling's solution) and multiplied by 100, gives the diastatic power.

—J. L. B.

Malt, A Method for the Determination of the Diastatic Capacity of. A. R. Ling. J. Fed. Inst. Brewing, 1896, 2, 335—346.

AFTER giving a résumé of researches on which the present methods of estimating diastatic power are based, the author describes the following method:—A determination is first of all carried out by Lintner's method, and those tubes in the series are selected in which reduction is almost complete, the contents are transferred to a boiling flask and the unreduced Fehling's solution titrated with a solution of glucose of known titre, containing conveniently 2 grms. per litre, potassium ferrocyanide being used as indicator. The necessity is pointed out of taking the contents of the tubes for titration which are nearly reduced. If tubes showing slight reduction are selected, erroneous results are obtained. The diastatic power can be calculated by the formula $DP = \frac{100(5-y)}{5x}$ in which x represents the volume in c.c. of normal malt extract taken, and y the volume in c.c. of unreduced Fehling's solution found by titration. This method obviates the preparation of a second series of tubes, and by means of it two or three concordant values may be rapidly obtained from the first series of tests.—J. L. B.

Barley and Malt, Phosphoric Acid in. A. Fernbach. J. Fed. Inst. Brewing, 1896, 11, 128—140.

THE author has examined samples of a number of barleys, and of the malts obtained from the same barleys, and in each he has determined both the total and the soluble phosphoric acid. The analyses were made on the basis of the 1,000 corns method, so that the results obtained with any given malt were strictly comparable with those yielded by the corresponding barley. For the determination of the soluble phosphoric acid in a malt, the author makes use of the hot mash; he adds a little yeast to remove as much saccharine matter as possible, and the whole is then evaporated and incinerated. A similar method is adopted in the case of barley, the saccharification being brought about by the addition of malt, which is of course allowed for in the calculation. The main fact which is brought out by the results given is, that a remarkable amount of phosphoric acid is converted into a soluble form during the malting process. As an example, the following may suffice:—In a barley containing 9.66 total P_2O_5 , the soluble P_2O_5 amounted to 4.44, or 45.96 per cent. of the total. The malt obtained from this barley contained 8.46 total P_2O_5 , and 6.87 (or 80.99 per cent. on total) of soluble P_2O_5 .

This change is attributed to the formation, during germination, of acids which act upon the secondary and tertiary phosphates of lime and magnesia, transforming them into soluble primary phosphates. In the case of one barley, 97 per cent. of the phosphoric acid was in a soluble form, whilst in the corresponding malt only 83 per cent. was soluble. This result is attributed to the hardness of the steeping water, which would bring about the precipitation of the phosphoric acid in an insoluble form. In all cases (except one, in which there is an unexplained discrepancy) there is a decrease in the total phosphoric acid after germination, which is due partly to the action of the steeping water in removing some of the soluble phosphates, whilst a further portion is removed by the rootlets of the young barley plant.

With regard to the determination of the acidity of malt, the author condemns the use of litmus as altogether unreliable, whilst he advocates the employment of methyl-orange and phenolphthalein. The last of these he recommends as a safe indicator for acid salts, whilst he employs methyl-orange for the detection of free acid; he states that acid salts such as primary phosphates are neutral, and secondary phosphates are alkaline, to methyl-orange. By the combined use of these two indicators, the author contends that he has proved that the acidity of malt is due to acid salts such as primary phosphates, and that there is no free acid in malt. Contrary to the generally accepted opinion, he also maintains that the least amount of free acid is unfavourable to the action of diastase, which, however, is not the case with the acid phosphates.—A. K. M.

Beer Wort, Nitrogenous Compounds contained in; Quantitative Separation of. H. Sehjerning. Zeits. Anal. Chem. 1896, 35, [3], 285—296. (See also this Journal, 1894, 1103, and 1895, 763.)

IN this paper the author describes the preparation of the precipitants, the relationship of the different precipitates to one another, and some improvements which the continuation of the work has led to. Four precipitants are made use of, and by means of these the author professes to be able to determine the quantities of albumin, denuclein, propeptone, and peptone.

1. Stannous chloride solution is prepared by dissolving 50 grms. of tin in an excess of concentrated hydrochloric acid, with the addition of a little platinum chloride; the solution is evaporated to about 130 grms., diluted to 1 litre, and filtered.

2. An approximately 10 per cent. solution of lead acetate is made by dissolving the normal salt in boiling water, filtering, and adding 10—12 drops of acetic acid to the litre.

3. Dilute acetic acid containing 15 c.c. of acid (45 per cent.) in the litre.

4. A saturated (about 10 per cent.) solution of uranium acetate.

Albumin is estimated by mixing about 5 c.c. of No. 1 solution with 25 c.c. of wort; the mixture is allowed to stand for 4—6 hours, the precipitate filtered off, washed with cold water, and the nitrogen determined by Kjeldahl's method.

Denuclein is precipitated together with the albumin, when about 6 c.c. of No. 2 solution are added to 25 c.c. of wort or beer and the mixture heated to boiling. Owing to the partial solubility of the precipitate, a correction has to be applied in this case equal to 0.15 c.c. of 1/10 normal acid for every 100 c.c. of filtrate and wash liquor. The denuclein = Pb — Sn.

Propeptone.—40 c.c. of No. 3 solution are diluted with 100 c.c. of water, and 0.8 gm. of ferric acetate added; the solution is heated to boiling, 20 c.c. of the wort or beer added, the mixture again boiled, and the precipitate at once filtered off and washed. The precipitate (Fe) contains also the albumin and denuclein, and the propeptone is consequently represented by Fe — Pb.

Peptone.—A mixture of 25 c.c. of wort or beer with 20—25 c.c. of No. 4 solution is heated to boiling, and then set aside in a dark place until the following day; the precipitate is then filtered off and washed with a cold 1—2 per cent. solution of uranium acetate. A correction is applied equal to 0.1 c.c. of 1/10 normal acid for every

100 c.c. of filtrate and wash liquor. The peptone is = $1r - Fe$.

A better method than that given above for the estimation of the propeptone is the following:—Five drops of acetic acid (45 per cent.) are added to 20 c.c. of wort or beer, which are then heated to about 36°; 18–20 grms. of pure powdered magnesium sulphate are added, and when this has dissolved, the mixture is allowed to stand for from a half to one hour at the ordinary temperature; the precipitate is finally washed with a cold saturated solution of magnesium sulphate containing 4–5 grms. of acetic acid (45 per cent.) to the litre. The precipitate contains the albumin and the propeptone.—A. K. M.

Milk, Determination of Lactose in, by Double Dilution and Polarisation. H. W. Wiley and E. E. Ewell. J. Amer. Chem. Soc. 1896, **18**, [5], 428–433.

In Wiley's original method, an arbitrary correction is applied for the volume of the coagulum (not separated before making up to the "mark") in the clarified milk. This correction it is now sought to determine in each individual case.

Process.—Two portions of milk, each of 65.82 grms. (with this quantity, diluted to 100 c.c., and using a Schmidt and Haensch polarimeter, each unit of rotation in 100-mm. tube corresponds to 1 per cent. of lactose), are separately treated, each with 10 c.c. of mercuric nitrate solution, diluted, the one portion to 100 c.c., the other to 200 c.c., filtered bright, and their respective rotations (a and b) observed at about 20° C. The corrected rotation (a^1) corresponding to a , when allowance is made for the volume of the coagulum, is found by the equation—

$$a^1 = \frac{ab}{a-b}$$

Similarly the volume (x) of the precipitate by—

$$x = \frac{100(a-2b)}{a-b}$$

The mercury solution is prepared by dissolving the metal in twice its weight of nitric acid (sp. gr. 1.42), and diluting with 5 volumes of water.—H. T. P.

Fat in Milk and other Articles, Improvements in Apparatus for Determining Volumetrically the Amount of. A. W. Stokes, London. Eng. Pat. 12,184, June 24, 1895.

The apparatus consists of a glass tube open at both ends, the top end being fitted with a rubber stopper and the other with a screw cap. The tube has two bulbs at its upper end, and is so marked that the exact quantities of reagents and milk may be introduced without using any measures. The lower part of the tube below the bulbs, is so graduated that every division may represent 0.1 per cent. of fat.

Amylic alcohol is first poured in up to the lower mark, then sulphuric acid to the second mark, and then milk to the top mark. After thoroughly shaking, the tube is put for an hour in water at 150°–180° F., the screw end being turned vertically uppermost. The fatty layer may then be read off. The separation of the fat is much accelerated by whirling the tube in a centrifugal apparatus. By removing the stoppers and rinsing with hot water, the tube may be readily cleaned.—L. de K.

Gluten in Meal, Determination of. M. Bolland. Comptes rend. 1896, **123**, [2], 136.

DIFFERENT samples of meal, having the same percentage of nitrogen, give different amounts of gluten according to their quality and method of grinding. This is due to the varying amounts of bran present, which cause loss of gluten in the ordinary process for its determination. A gluten estimation is thus not sufficient to fix the content in nitrogenous matters, or the nutritive value of a meal.

—A. C. W.

Honey, Examination of. E. Beckmann. Zeits. Anal. Chem. 1896, **35**, [3], 263–284.

Detection of "Starch Syrup" and Commercial Dextrin.—The sample is dissolved in water, methyl alcohol added, and the precipitate tested with iodine. Honey gives no colour reaction with iodine, whilst the above adulterants give an

intense red to violet coloration. The method proposed by Haenen, of dialysing a solution of honey, is condemned by the author, who finds that starch dextrin passes through the membrane, although more slowly than the natural dextrin of honey; there are also differences in their behaviour with yeast, the dextrin of honey being most readily attacked.

Detection of Commercial Glucose in honey depends upon the presence of dextrin in the former. For the qualitative test, 5 c.c. of a 20 per cent. solution of honey are mixed with 3 c.c. of a 2 per cent. solution of barium hydrate, and 17 c.c. of methyl alcohol are added. If the honey be pure, the solution will remain bright after agitation, but if adulterated with starch dextrin or glucose, a distinct precipitate will be formed. For a quantitative test, a more concentrated solution of the honey (up to 50 per cent.) is used, the precipitate being collected in a Gooch crucible and weighed. An addition of cane sugar to honey is not easy to detect with certainty, since it forms a normal constituent, and, according to different authorities, the maximum amount is placed at from 5 to 16 per cent.

Detection of Molasses.—This substance is characterised by the precipitate it gives with basic lead acetate and methyl alcohol. The solution to be tested should not, however, contain more than 25 per cent. of honey. The precipitate is attributed partly to the raffinose present in molasses.—A. K. M.

Quinazol and Diaphtherine. J. Pharm. Chim. 1896, **3**, [10], 495.

See under XVIII. C., page 609.

"Cresochline." J. Pharm. Chim. 1896, **3**, [10], 497.

See under XVIII. C., page 609.

Caffeine, Determination of. Georges. Journal de Pharm. et de Chim. **4**, [2], 58–59.

THE substance containing caffeine is mixed with fine sand and the caffeine completely extracted by an aqueous solution of sodium salicylate. The solution and washings are concentrated on the water-bath, and the caffeine dissolved out by chloroform; on evaporation pure caffeine remains, and can be weighed.—J. T. D.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Magnesium Nitride, Some Reactions of. O. Emmerling. Ber. **29**, [11], 1635.

ALTHOUGH readily attacked by water, this compound is indifferent towards a number of reagents, alcohol and ethyl iodide having no action, even at 200° C. in sealed tubes. The anhydrides of organic acids, however, appear to react readily upon it, though acid chlorides are inert. If acetic anhydride be added to the pulverised nitride, heat is evolved, and the product yields, on fractional distillation, 15 per cent. of acetonitrile. In the case of benzoic anhydride, heat is also developed, accompanied by an odour of oil of bitter almonds, and up to 42 per cent. of benzonitrile. The acids of these anhydrides are, however, entirely without action.—C. S.

Rhodium, Iridium, and Palladium, Solubility of Carbon in. H. Moissan. Comptes rend. 1896, **123**, 16.

THESE metals, like platinum, dissolve carbon at the temperature of the electric furnace, but do not unite with it, the whole of the carbon being separated as graphite on cooling.

—A. C. W.

Nitro-Disulphonic Acid, Deep Blue. P. Sabatier. Comptes rend. **122**, [25], 1479–1482.

THE author has succeeded in preparing this acid synthetically, by acting on dilute sulphuric acid (the commercial acid plus one-fifth or one-sixth of its volume of water) saturated with sulphur dioxide and cooled to 0° C. with a mixture of equal volumes of nitrogen trioxide and air. After a short time, nitric acid is evolved and the liquid turns a deep violet-blue. The resulting acid solution gradually decomposes, but is more stable than the potassium salt obtained by Fremy and Raschig, being able to resist a temperature of 100° C. for half an hour.—C. S.

New Books.

JAHRBUCH DER CHEMIE. Bericht über die wichtigsten Fortschritte der reinen und angewandten Chemie. Unter Mitwirkung von H. BECKURTS, C. A. BISCHOFF, E. F. DÜRRE, J. M. EDER, P. FRIEDLANDER, C. HAUSSERMANN, F. W. KÜSTER, J. LEWKOWITSCH, M. MÄRKER, F. RÖHMANN, and K. SEUBERT. Herausgegeben von RICHARD MEYER. V. Jahrgang. 1895. Friedrich Vieweg und Sohn, Braunschweig. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 16s.

Svo. volume, bound in cloth, containing a report for the year 1895 of the progress of Pure and Applied Chemistry. The subject-matter fills 555 pages, preceded by a table of contents, and followed by alphabetical indexes of subjects and authors. The various branches of Pure and Applied Chemistry treated of are as follows:—I. Physical Chemistry. F. W. Küster. II. Inorganic Chemistry. K. Seubert. III. Organic Chemistry. C. A. Bischoff. IV. Physiological Chemistry. F. Röhmnn. V. Pharmaceutical Chemistry. H. Beckurts. VI. Chemistry of Food, &c. H. Beckurts. VII. Agricultural Chemistry. H. Märker and W. Naumann. VIII. Metallurgy. E. F. Dürre. IX. Fuel and Inorganic-chemical Technology. C. Häussermann. X. Explosives. C. Häussermann. XI. Technology of the Carbohydrates and of the Fermentation Industries. H. Märker and W. Naumann. XII. Technology of Fats and Petroleum Oils. J. Lewkowitsch. XIII. Coal-tar and Dyestuffs. Richard Meyer. XIV. Chemical Technology of Textile Fibres. XV. Photography. J. M. Eder and E. Valenta.

COMMERCIAL ORGANIC ANALYSIS: A Treatise on the Properties, Proximate Analytical Examination, and Modes of Assaying the Various Organic Chemicals and Products employed in the Arts, Manufactures, Medicine, &c., with Concise Methods for the Detection and Determination of their Impurities, Adulterations, and Products of Decomposition. By ALFRED H. ALLEN. Second Edition, Revised and Enlarged. Volume III.—Part III. Vegetable Alkaloids (concluded), Non-basic Vegetable Bitter Principles, Animal Bases, Animal Acids, Cyanogen and its Derivatives. J. and A. Churchill, 7, Great Marlborough Street, London. 1896. Price 16s.

THIS, though nominally Part III. of Vol. III., is practically Vol. V. of Allen's Commercial Organic Analysis. It contains preface, table of contents, and text covering 497 pages. An alphabetical index is added.

The work treats of the following subjects:—**VEGETABLE ALKALOIDS.** Alkaloid of Papaya, Alkaloids of Colchicum, Laburnum and Furze, Stavesacre, Celabar Bean, Gelsemium, Ipecacuanha, Pomegranate, Jaborandi, Pepper, Sabadilla, the Hellebores, Potato, and Aconite. **NON-BASIC VEGETABLE BITTER PRINCIPLES.** Glucosides of Conifers; of Willow and Poplar; of Mustard, Saponins. Glucosides of Digitalis; of Strophanthus; of Jalap and Scammony. Nonglucosidal Bitter Principles. Aloes, Bitters, or Aloins. Artemisia Bitters. Colocynth Bitters. Bitters of Cocculus Indicus. Bitters and Resins of Hops. **ANIMAL BASES.** Diamines. Amides. Betaines. Urea and Analogues. Imido Bases. Xanthine or Alloxan Bases. Ptomaines. **ANIMAL ACIDS.** Acids of Urine. Hippuric Acid. Glycuronic Acid. Acids of Bile. Lactic Acids. **CYANOGEN AND ITS DERIVATIVES.** Simple Cyanides. Double Cyanides. Cyanates. Thiocyanates. The text of the work is illustrated with 25 woodcut illustrations.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

FRANCE.

Tariff Decisions.

The following decisions recently given by the French Customs have been received at the Board of Trade:—

Lard, mixed with oil, with or without the addition of tallow, cannot be classed under "alimentary fats" (*graisses*

alimentaires), it not being made up to present the outward appearance of butter. "Bromotorm" and "Santonine" are no longer to be classed amongst chemical products in the manufacture of which alcohol has been used. Santonine will be classed under the second paragraph of Art. 282; and bromotorm will pay the same duty as bromine.

ITALY.

Tariff Classification.

According to a Ministerial Notice published in the *Bollettino di Notizie Commerciali*, "Mildiol," for tariff purposes is assimilated to "Creoline," and is to pay duty under "Drugs, not denominated (non-alcoholic)," according to No. 69 of the Customs tariff.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

ARTICLES OF INTEREST TO TECHNOLOGISTS.

The following reports, though unsuitable for abstraction, will repay perusal:—

Manufacture of Pulque in Mexico.—U.S. Consular Reports, July, 396.

Italian Sulphur Trust.—U.S. Consular Reports, July, 489.

Sugar Production in the British Colonies.—U.S. Consular Reports, July, 478.

New Sugar Export Bounties in Germany.—U.S. Consular Reports, July, 510.

The Sugar Industry of Formosa.—U.S. Consular Reports, July 530.

New Butter Making Machine.—U.S. Consular Reports, July, 492.

Purification of Water by Metallic Iron.—U.S. Consular Reports, July, 571.

Cider Making in France.—U.S. Consular Reports, July, 576.

German Enterprise in the East.—U.S. Consular Reports, June, 221.

The Effect of the Commercial Treaties of Germany.—Board of Trade Journal, August, 147.

FOREIGNERS IN GERMAN TECHNICAL SCHOOLS.

U.S. Consular Reports, July 1896, 588.

Consul Doederlein, of Leipsic, transmits the following to the Department:—It is a well-known fact that the technical schools in Saxony are celebrated throughout the world for their excellence, and it is also well known that it is almost impossible for foreigners to gain admittance, especially to those of the textile branch. The following clipping from the *Leipziger Tageblatt* shows the animus of Saxon exporters and manufacturers. It runs thus:—

"The fact that many foreigners are received into the technical schools of Saxony, and that the knowledge acquired thereat is subsequently used in order to create undertakings abroad which are intended to compete with our Saxon industry, has induced a number of our textile manufacturers in Limbach to represent to the Saxon Government the desirability of not permitting foreigners to attend the technical schools. The Government has not complied with this wish, but rather replied in the sense that the standpoint is a too narrow-minded one, and that the competition existing abroad has arisen less through students of the technical schools than through the large number of volunteers who have been accepted in Saxon business firms. It is by the admission of such volunteers that the manufacturers themselves train up their own subsequent competitors."

GERMAN EXPORTS TO THE UNITED STATES.

U.S. Consular Reports, June 1896, 225.

The exports of Germany to the United States during the quarter ending March 1896, so far as the northern consulates only are concerned, and exclusive of Dresden and Zittau, show a decided increase over the exports from the same consulates during the like period of 1895.

At Berlin, paper were nearly doubled (37,259·21 dols., against 67,064·73 dols. this year), and gloves and glove leather jumped from 60,932·18 dols. to 159,963·84 dols., while sheep guts and rennets increased from 37,494·21 dols. to 124,810·55 dols. Chromos and photographs also doubled in export values, from 20,361·18 dols. to 40,061·97 dols.

Hamburg's large increase (457,551·59 dols.) is due almost exclusively to beet sugar, 716,493 dols. worth having been exported this year, against only 38,981 dols. in the corresponding quarter of 1895. The same causes—reduction of the great stores of sugar in the United States and the war in Cuba—produced like effects as regards Magdeburg, a great beet-sugar region, whence sugar to the value of 1,148,409 dols. was exported, as against 121,990 dols. last year. At Hamburg, as at Magdeburg, chemicals have increased. At Magdeburg, as at Stettin, Portland cement shows a large increase. At Hamburg, notable decreases are seen in coffee (56,304 dols.), rags (11,344 dols.), crude india-rubber (44,326 dols.), india-rubber manufactures (23,818 dols.), and raw hides (122,083 dols.).

Magdeburg shows an increase in muriate of potash and kainite.

Stettin repeats Hamburg's and Magdeburg's increase in raw beet sugar (855,631 dols.), and has slight increases in seeds, hemp, and ozoerite.

At Bremen, the large increase in raw-sugar export (144,000 dols.) has not been enough to overcome a decrease in other articles of export.

Brunswick's export of raw sugar fell to one-half what it was last year; refined sugars increased, however, about 36,000 dols. The export of chemicals was about tripled, that of animals doubled, and that of muriate of potash increased to about five times the amount of last year's first quarter.

At Breslau, a great increase is to be noted in leather gloves (1,215,850 dols.), and smaller in porcelain and china (17,467 dols.) and chemicals (5,138 dols.).

The falling off at Chemnitz (121,462 dols.) is chiefly in cotton hosiery (338,883 dols.), silk gloves (81,320 dols.), and woollen hosiery (23,029 dols.).

Hanover's decrease of 102,552·36 dols. is pretty evenly distributed, the largest falling off being in cement, which is 40,593 dols. behind last year's quarter, and paper stock, decrease 23,394 dols.

Finally, Leipzig is to be noted with a decrease of 66,388·69 dols., for part of which a falling off of about 30,000 dols. in beet sugar is responsible, while increases are to be seen in leather gloves (25,000 dols.), essential oils (2,000 dols.), and china (6,000 dols.).

Twelve southern consulates of Germany (Frankfort and consulates thereunder) show likewise an advance in value of exports in the first quarter of this year as compared with the first quarter of 1895, but not so large an advance in proportion to the total export as in the 13 northern consulates.

The total exports to the United States from the northern consulates, including Dresden and Zittau, amounted in the first quarter of 1896 to 3,211,997·36 dols., and in the first quarter of 1895 to 2,142,847·61 dols., showing an increase of 772,149·72 dols.

The fact that 26 consulates of Germany show about 1,000,000 dols. more in exports for the first three months this year than they did during the same period in 1895, is remarkable when the almost steady falling off of the annual exports from all Germany to the United States in the past down to the beginning of 1895 is considered: In 1890, 98,800,000 dols.; 1891, 97,300,000 dols.; 1892, 82,900,000 dols.; 1893, 96,200,000 dols.; 1894, 69,100,000 dols.

SCHEDULE OF IMPORT DUTIES LEVIABLE IN BRITISH CENTRAL AFRICA.

U.S. Consular Reports, July 1896, 527.

(1.) A duty of 5 per cent. *ad valorem* on all goods except guns, gunpowder, and ammunition (which are subject to a duty of 10 per cent.), and machinery, agricultural implements, and materials for making railways, tramways, or roads, materials to be used as coffee manures (as defined below), vehicles, and live stock, which are allowed to be imported free of duty.

The substances defined as coffee manures, which are allowed to be imported free of duty, are the following:—Sulphate of ammonia, sulphate of potash, nitrate of soda, nitrate of potash (saltpetre), carbonate of potash, guano, dissolved guanos, fish guanos, fray beutos guano, sombrero, bone-ash, dissolved bones, burnt bones, raw and bruised bones, phosphatic manures (embracing the different forms in which this mineral may be obtained as a marketable commodity, such as superphosphates), coprolites, gypsum, dried blood, horn dust, shoddy, ponaac, sulphuric acid, insecticides, with appliances for using the same.

(2.) A duty of 10 per cent. *ad valorem* on guns, gunpowder, and ammunition.

(3.) The following duties on alcohol or liquids containing alcohol:—On wine, ale, porter, and beer of every sort, per case of 1 dozen old wine bottles or part thereof, 5 per cent. *ad valorem*; on brandy, whisky, rum, gin liquors, and miscellaneous spirits or strong waters not being sweetened or mixed with any article so that the degree of strength cannot be ascertained by Sikes's hydrometer, where the degree of strength does not exceed proof, for each Imperial gallon or part thereof, 12s., and for every degree or part of a degree overproof, an additional duty, per Imperial gallon or part thereof, of 1s.; on brandy, whisky, gin, rum, and miscellaneous spirits or strong waters, these being sweetened or so mixed that the degree of strength cannot be ascertained, per each Imperial gallon or part thereof, 12s.

REPORT OF COMMITTEE ON FOOD PRODUCTS ADULTERATION.

(*Eyre and Spottiswoode, 1896. Price 9d.*)

The report of the Select Committee appointed to inquire into the working of the Margarine Act, 1887, and the Sale of Food and Drugs Act, 1875, and any Acts amending the same, has recently been issued. The Committee, of which Mr. T. W. Russell, M.P., was the chairman, was originally appointed in the year 1894, and met on 31 occasions, examining 68 witnesses, among whom were witnesses on behalf of the following interests:—Provisions, butter, margarine, cheese, lard, cocoa, coffee, spices, groceries, drugs, and analysts. They find that where the Acts have been well administered they have been most beneficial, but that very considerable differences exist throughout the country as to the efficiency with which local authorities exercise the powers conferred on them. The Committee are strongly of opinion that a local authority which includes even a considerable minority of tradesmen, and which has been found persistently to neglect the enforcement of the Adulteration Acts, should in this matter be superseded by some other authority. Some witnesses complained that the Government laboratory is frequently too lenient, owing to the deliberate adoption of unreasonably low food standards. The Committee see no reason to believe that the standards adopted therein are below those which are capable of justification under the present law. The Committee, however, see no sufficient reason why information as to the methods adopted by the Government laboratory should not have been communicated to the public analysts without awaiting requests for information. An important recommendation is that of a scientific authority or court of reference, which should be empowered to deal with the subject of prescribing limits and standards of quality and purity of food. After dealing with the adulteration of various food products in detail, the Committee summarise their principal recommendations as follows:—

1. That in districts other than county boroughs, where the local authorities fail to put the Acts in force, the County Council should, by their own officers, take samples for the purposes of the Acts.

2. That in connection with the sale of mixed articles it should be obligatory upon the vendor to supply the purchaser with a label setting forth that the article is mixed.

3. That the statement of admixture on labels should be legibly and distinctly printed and so as not to be obscured by other printed matter, and that existing labels should be subject to the proviso mentioned in the concluding paragraph of the section of this report headed "Labelling and sale of mixed articles."

4. That, subject to the limitations indicated in the report, invoices and equivalent documents should have the force of warranties in the cases of all articles to which the Sale of Food and Drugs Act apply.

5. That the Commissioners of Customs be authorised to examine and take samples of all food imports at the port of entry with a view to subsequent action, as indicated in the body of the report.

6. That dealers who obtain supplies of foods from abroad should be required to submit to the Customs guarantees of purity given by the foreign vendor, together with evidence that they have taken measures to see that the goods are such as they are guaranteed to be.

7. That retailers should be empowered to refuse to sell an article otherwise than in a manufacturer's unopened labelled tin or packet.

8. That the powers of section 3 of the Sale of Food and Drugs Act Amendment Act, 1879, as to the taking of samples of milk in transit, should be extended to other articles.

9. That the *maximum* penalty for refusal to sell a sample to the authorised officer be increased.

10. That the division of the sample after purchase and delivery of a portion to the vendor should be compulsory.

11. That samples should be divided into four instead of three parts, and that one of these parts should be at the disposal of the wholesale dealer.

12. That the provisions of section 5 of the Margarine Act, 1887, as to the exemption of an employer from penalty in certain cases, and punishment of an assistant, should be extended to offences under the Sale of Food and Drugs Acts.

13. That it should be obligatory upon the magistrates or court to refer articles to the Government laboratory for analysis when such course is desired by either of the parties to the case.

14. That a defendant who proposes to rely upon the warranty defence should be required to intimate this to the prosecutor within a reasonable time of the service of the summons.

15. That the time allowed for appeal to quarter sessions from decisions of local justices should be extended from three to fourteen days.

16. That any person guilty of a second offence under the Sale of Food and Drugs Acts should be liable to a *minimum* penalty of 5*l.*, and that in respect of the third or subsequent offences under those Acts and the Margarine Act, 1887, the punishment of imprisonment without the option of a fine may be inflicted at the discretion of the magistrates or court.

17. That magistrates should be authorised to make orders, at their discretion, requiring a person convicted of offences under the Acts to publish a notification of his conviction in the public press of the locality where the offence occurred.

18. That the definition of the word "food" as used in the Acts should be amended so as to include expressly all articles intended to enter into or be used in the preparation or flavouring of food.

19. That an authority should be constituted who should act as a court of reference upon scientific and other questions arising under the Acts, and who should be empowered, at their discretion, to prescribe standards and limits of the quality and purity of food.

20. That candidates for appointment as public analysts should be required to produce evidence that they possess the requisite knowledge of analytical chemistry, in the shape of a diploma or certificate given in respect of such knowledge by a recognised school of chemistry or scientific examining body, and that in the case of candidates other than duly registered medical practitioners specific tests of the requisite knowledge of microscopy and the bearing of adulterations upon health should be prescribed.

21. That the remuneration proposed to be given to a public analyst should be subject to the approval of the central authority.

22. That the artificial colouring of margarine to resemble or imitate butter be prohibited.

23. That the mixing for sale of margarine and butter be prohibited.

REPORT OF THE DANGEROUS TRADES COMMITTEE.

(London: Eyre and Spottiswoode. Price 3½*d.*)

There has recently been issued an interim report of the Departmental Committee appointed by the Home Office to inquire into, and report upon, certain miscellaneous dangerous trades. The Committee consists of Mr. H. J. Tennant, M.P., Miss May Abraham (now Mrs. H. J. Tennant), Her Majesty's Superintending Inspector of Factories; Mr. Thomas Oliver, M.D., physician to the Royal Infirmary, Newcastle-on-Tyne; and Captain Hamilton Smith, an inspector of factories, who has acted as secretary. The Committee was directed to inquire into the conditions of work as they affect the health of the operatives in the following industries and processes:—India-rubber works; paper staining, colouring and enamel; dry cleaning; basic slag works and manufacture of silicate cotton; electric generating works; sole stitching by American machinery; glass polishing; file cutting; bronzing and metallachrome powder in lithographic works; flour mills; the use of converters in metal works; the use of steam locomotives in factories; licking of labels for reels in thread mills; the use of inflammable paints in shipbuilding yards; galvanised iron works; the process of dyeing with arsenate of soda; the manufacture and use of grindstone and emery wheels; the use of lead in various forms in print and dye works; the filling of bottles by compressed air; the bottling of aerated waters; the manufacture of salt; "ending and mending" in velvet works.

The interim report deals only with the following:—Bronzing in lithographic works; paper staining, colouring, and enamelling; use of steam locomotives in factories; india-rubber works; use of inflammable paints; dry cleaning; and aerated waters.

In pursuit of their inquiry the Committee have examined 153 persons and visited 134 works. Connected with the industries upon which they now issue their report, 103 witnesses have been examined. The Committee mention circumstances which have added difficulty to their labours and made the present report necessarily incomplete. For example, "in their visit to Middlesbrough . . . after they had left that district the reference of the Committee was extended to salt works, of which there are several examples on a large scale in this neighbourhood. The time at the disposal of the Committee has not admitted of their visiting Wales, without which they do not feel they would be justified in making a report upon the use of converters in metal works. The Committee wish it to be understood that, although they believe the trades with which they now deal to be chiefly in need of regulation, their choice has necessarily been governed by the circumstances described above; they are therefore unable to report on other trades which may be equally in need of regulation, but respecting which their inquiries are incomplete."

As regards the use of locomotives in factories and the use of inflammable paints, the Committee is uncertain "within what limits the special rules can be legally applied." With reference to electricity, again—Is the Home Secretary allowed by the Factory Acts to exercise his authority over electric generating works, or is he not, and where does the Board of Trade come in? Electricity extends its operations daily, and there are many accidents which attend its use and application. Towards embracing these within the protecting arm of the State the Committee make this suggestion: they would have the words "factory or workshop" reckoned as including any sort of "premises, area, or occupations" indoors or out of doors in which the work of men's hands is employed for purposes of gain, included "in any amending or consolidating Factory Bill."

The Committee appear to have been at great pains to consider the interests of manufacturers. They have paid attention to the state of the labour market in each several industry, and to the amount and influence of foreign competition, and so far as they could they have in every way endeavoured to consider the employer, while bent on the protection of the labourer.

After a statement of general principle the report passes into details. An account is given of the conditions of labour in all the occupations enumerated above.

THE GLASS INDUSTRY OF GERMANY.

U.S. Consular Reports, June 1896, 222.

The glass industry of Germany is divided into two branches, one branch making glass by melting silicic acids with alkali salts, lime, &c., the other making articles from the glass made by the first method. Both branches employ 50,000 workers in 312 factories, of which 187 are in Prussia, 54 in Bavaria, and 68 in the other states of the Empire. Coming down to details, 207 factories make bottles and hollow ware; 76 make table glass, with a yearly production of 1,250,000 sq. m.; 18 make crystal and half-crystal glass, 28 make mirrors, 47 make pressed glass, and 3 make optical goods. To these may be added 163 factories, employing 9,000 hands, helping, in one way and another, in the further manufacture of glass or glassware. This makes a total of 475 factories, distributed as follows:—Prussia, 211; Bavaria, 108; Saxony, 33; Saxe-Meiningen, 17; Saxe-Weimar, 11; Württemberg and Schwarzburg-Rudolstadt, 10 each; Brunswick, 8; Baden, 7; Alsace-Lorraine and Saxe-Coburg-Gotha, 6 each; Schwarzburg-Sondershausen, 5; the free cities, 4; Schaumburg-Lippe, 4; Oldenburg, 3; and Mecklenburg, 2.

Competition at home and abroad is so close that no efforts can be spared to keep what has been won by hard work. Recent tariff legislation in Belgium takes that country from Germany and gives it to France.

The import of uncut glass into Germany has increased during the last three years, Great Britain and Belgium sending the largest quantities. In 1893, there came 32,275 double centners,* and in 1895, 51,299 double centners, an increase of 58.9 per cent. There were increased imports in other kinds of glass, viz., in small plates and glass pearls (from Italy and Austria chiefly); also, in hollow green glass, in which France took the lead; in raw glass and enamelling and glazing materials, these coming mostly from Great Britain.

Of glass plates, pearls, &c., 7,995 double centners were imported in 1893, 12,253 double centners in 1894, and 11,206 double centners in 1895. During the same year, raw glass and enamelling and glazing materials were imported to the extent of 6,630, 9,514, and 10,825 double centners respectively.

The export figures are very much in the Empire's favour, as shown by the following table:—

Year.	Common Green Hollow Glass.	Simple White Glass.	Table and Decorated Glass.	Mirror Glass, Uncut.
	Double Cent.	Double Cent.	Double Cent.	Double Cent.
1885	53,569	13,248	3,638	2,700
1886	59,569	13,248	3,638	2,700
1887	59,888	14,771	3,696	2,958
1888	62,180	16,299	3,809	3,125
1889	46,663	13,790	3,523	2,858
1890	55,270	11,424	4,657	3,001
1891	57,270	17,493	3,482	3,315
1892	65,152	17,553	3,439	3,572
1893	76,578	20,663	2,791	3,496
1894	79,100	19,611	3,204	3,982
1895	83,496	25,422	3,262	4,688

Here we have an increase in 10 years of nearly 100 per cent. in white glass, 58.6 per cent. in common hollow green glass, and 59.1 per cent. in cut, table, and mirror glass.

AUER-WELSBACH PATENTS AND MONAZITE IN GERMANY.†

U.S. Consular Reports, June 1896, 242.

The long-pending litigation over the German patents covering what is known as the Auer von Welsbach incandescent gas-burner terminated on the 7th November last in a decision by the German Patent Office which had the outward appearance of a substantial victory for the patentee, but which has led to a situation in this country so anomalous as to claim the interest of not only makers of

incandescent gas burners in other countries, but of producers of monazite, thorite, and other minerals, from which the thorium and other rare oxides used in such manufacture are derived.

The German patents of Dr. Carl Auer von Welsbach, the Viennese inventor of the incandescent gas-burner which bears his name, are four in number, viz.:—The original patent, No. 39,162, of September 23, 1885, and three additional or subsidiary patents, No. 41,945, of April 29, 1886; No. 44,016, of January 20, 1887; and No. 74,745, of August 15, 1891, all of which will, of course, expire with the lapse of the original patent on the 22nd of September 1900.

The enormous profits reaped by the *Deutsche Gasglühlicht Gesellschaft*, at Berlin, which controls the Auer patents in Germany, have started up a swarm of competitors, who have put on the market burners of similar construction at prices which forced the Berlin company several months ago to reduce its retail price from 15s. to 10s. per burner. The Berlin company thereupon began suit against these rival makers for infringement of the Auer patents, and, pending the decision, published warnings against the makers and users of the infringing gas-burners.

The decision is to the effect that the scope of claim 3 in the original patent (which describes the construction of the incandescent mantle, which forms the essential feature of the invention) is restricted so as to cover only the combinations of rare earths which are definitely specified in claims 1 and 3 of the same instrument; and, further, claim 3 of the additional patent No. 41,945 is cancelled altogether. Now, claim 1 of the original patent specifies certain combinations of oxides for the impregnation of mantles, which render a gas flame incandescent and produce therefrom a white, yellow, or greenish light. The substances named in this clause are magnesia and the oxides of lanthanum, yttrium, and zirconium for white light, to which is added "neodymium" to produce a yellow light, and erbium to give the flame a greenish tinge. Neither in clause 1 nor in clause 3 of the original patent is there any mention of thorium oxide (thoria), which, as is well known, forms the principal material in all modern incandescent mantles, the proportion of thorium ranging in some formulae as high as 98 or even 99 per cent., the remaining ingredient being an oxide of cerium, yttrium, erbium, or zirconium, to modify the colour of the light produced.

This importance of thorium seems to have been realised by Dr. Auer only after long experiment, and its use for the purpose named was covered by claim 3 of his supplemental patent (No. 41,945), of April 29, 1886. But in the recent trials it has been shown that the use of thorium for this purpose was not original with Dr. Auer, and that clause of his patent is therefore annulled, leaving the use of pure thorium open and free to everyone in Germany. But, as is generally known, pure thorium produces under such conditions a greenish, ghastly light of no industrial value. In order to give out the white and yellow shades of incandescent light required for ordinary use, it must be combined, as above stated, with other oxides of the cerium-erbium group. Experts declare that the exact formula by which the Welsbach mantles of the Berlin Gasglühlicht Gesellschaft are actually made is not described or even mentioned in any of the Auer patents, and, as the use of thorium for this purpose is free, they rely upon the fact that thorium, when derived from monazite, usually contains small percentages of cerium and erbium oxides, and may therefore be used directly, in its natural condition, for the manufacture of incandescent mantles. As a natural combination of chemical elements cannot be patented, it would be very difficult to prove whether the combination of thorium and other oxides used by a rival manufacturer were natural or artificially composed. So confident are many experts of their ability to evade the existing patents that there are now in the field not less than 12 manufacturers of gas-burners more or less similar in type to the Auer. Of these rival makers, seven, including the Meteor Gaslight Continental Company, are located at Berlin, and there are others at Dresden, Munich, Karlsruhe, and other German cities.

These makers, undismayed by the decision of November 7, have pushed the competition vigorously, and to the

* 1 double centner = 220.46 lb.

† See also this Journal, 1895, 405, 610, 835.

great temporary advantage of the public. The Auer Company, at Berlin, was forced to again reduce its price to 5s. per burner, while the Meteor Company furnishes burners of apparently identical brilliancy and permanence for 5s. each, and at these rates the use of incandescent gas-burners is becoming all but universal in Germany. Further litigation is certain to follow, but the power of the original monopoly is apparently broken, and its former exorbitant prices can probably never be re-established.

The Market for Monazite.

From the American standpoint, one of the most interesting results of this controversy is its influence upon the current demand for monazite. According to Professor Nitze, assistant State geologist of North Carolina, the product of monazite sand in the Carolinas was 65 tons in 1893, 300 tons in 1894, and about 600 tons in 1896, and as such sand, containing from 60 to 75 per cent. of monazite, is worth in Germany from 25*l.* to 27*l.* per ton, the subject is one of definite commercial importance. Thus far, the European market has been largely dominated by the supply of monazite sand from Brazil, where it is found in the form of a fine, washed seashore sand, containing usually only from 2 to 3 per cent. of thorium, whereas the Carolina monazite abounds in crystals of all sizes up to that of a grain of wheat, and contains generally from 3 to 6 per cent. of thorium. But for the reason that the Brazilian sand is uniformly fine, free from particles of titaniferous iron, and can be put directly into the extracting process, without being artificially pulverised, it is preferred by the Auer-Welsbach companies at Vienna and Berlin. The North American monazite, on the other hand, must first be ground to a fine powder, which, in consequence of the hardness of the crystals, is a somewhat tedious process, unless the best machinery is employed. For these reasons, and owing to the fact that large consignments of Brazilian monazite sand have been recently received at Hamburg, the market is now somewhat congested, and the prices offered no longer tempt exporters in the United States. A ton of Brazilian monazite sand, costing at present in Hamburg 2*4* *l.* 15*s.*, yields, when well worked out, from 20 to 25 kilos, of pure thorium, which is worth from 500*l.* to 625*l.*, according to degree of purity.

The whole situation confirms the suggestion already made in these reports, that the ultimate and effective plan of organising the monazite industry in our country would be to establish there, at a convenient point in the mining district, a laboratory, where, by employing the most improved and economical methods, the monazite—including the poorer sands which have been concentrated by a process recently perfected—may be worked up, the thorium extracted, and made available as a finished product in all countries where incandescent gas-burners are manufactured.

Thorium oxide is now worth in Germany from 25*l.* to 31*l.* per kilo., according to purity, and the demand is thus far greater than the supply. Most manufacturers of incandescent burners would prefer to buy their supply of thorium ready for use than to conduct a separate laboratory for extracting and preparing it.

The one pertinent question, from an economic standpoint, would be whether the chemicals which are used in extracting thorium can be transported from New York or Baltimore to the Carolina monazite district more cheaply than the crude sand can be brought from there to Europe, where from 96 to 98 per cent. of its bulk becomes at the first operation absolute waste material. The chemicals required for this process are neither rare nor costly, and with a well-chosen site, at which water power may be utilised for pulverising the raw material, the success of such an enterprise would, in the opinion of competent authorities, be practically assured.

MINERAL AND METAL TRADE OF SPAIN.

U.S. Consular Reports, July 1896, 590.

Under date of April 18, 1896, Consul-General Bowen, of Barcelona, transmits the following statistics covering the exports and imports from and to Spain of minerals and metals during the year 1895:—

Exports of Minerals.

Description.	Quantity.	Value.
	Tons.	Dols.
Iron	5,179,761	7,586,600
Copper	501,408	3,183,000
Zinc	29,346	244,500
Lead	9,206	635,800
Manganese	29,507	235,000
Antimony	9	500
Common salt	251,232	635,500
Pit coal	8,318	33,200
Pyrites	488,699	814,500
Total	6,503,943	13,852,100
Total in 1894 .....	..	11,204,000

Exports of Metals.

Description.	Quantity.	Value.
	Tons.	Dols.
Iron	22,660	265,300
Copper	59,507	3,642,000
Zinc	1,367	105,500
Lead	151,429	7,043,300
Quicksilver .....	..	1,240,000
Gold .....	..	94,600
Silver .....	..	6,965,000
Total .....	..	13,343,700
Total in 1894 .....	..	13,200,000

Imports of Minerals and Metals.

Description.	Quantity.	Value.
	Tons.	Dols.
Pit coal	1,515,504	6,825,000
Coke	255,043	1,148,000
Tar	33,766	563,000
Petroleum, crude	43,992	1,009,500
Iron	38,336	1,650,000
Tinned iron plate	1,241	86,800
Tin ingots	825	346,000
Gold .....	..	100,000
Silver .....	..	4,000,000
Alkaline carbonates	27,591	1,046,000
Nitrate of soda	26,385	1,320,000
Sulphur	6,813	1,016,000
Machines and boilers	3,367	720,000
Total	1,956,145	19,750,300

The importations of minerals and metals into Spain during 1895 amounted to 650,000 dols. less than in 1894.

THE PRODUCTION OF CIDER IN FRANCE.

Board of Trade Journal, June 1896, 648—651.

The year 1895 has been a good one for cider manufacturers in France, the amount produced having risen to 25,586,514 hectolitres, or an increase of 11,803,785 hectolitres over the average of the last ten years. The most characteristic feature of the year is, however, not so much the total production of cider as the sale of apples, which has taken place to an enormous extent with Germany. These apples are there manufactured into cider and "German champagne," in which Germany does a large export trade, very little of the products being consumed at home. At the present time France exports on an average barely 13,000 hectolitres of cider, while Germany, which grows scarcely any apples at all of her own, exports ten times as much, and at very high prices. The cider manufacture is an important industry in the city of Frankfurt, which has five large factories and 15 of less importance, French apples being entirely used. In this connection the advantage of agricultural syndicates for production and sale is pointed out.

The country between Vimontiers and Argentan and the district around produces the best kinds of cider. The nature of the soil has, doubtless, much to do with the excellence of French ciders: the variety of apple used is also an important factor; thus:—*Acid* apples give an abundant, clear, and light juice, but the cider made from them is

liable to turn black, and is generally weak and difficult to keep. *Sweet* apples give a clear cider which is agreeable to the palate while new, but as soon as the sugar is exhausted it turns sour and acquires a bitter flavour. *Bitter* or *sour* apples give the most generous cider, which is of a fine colour and keeps well.—J. G. W.

THE ALGERIAN PHOSPHATE DISPUTE.

Chemical Trade Journal, August 15th, 1896, 98.

Sir Lambert Playfair, in his last report on Algeria, refers to the recent attacks in the French Senate and press on the English phosphate owners at Tebessa (*Chemical Trade Journal*, 145 and 147). Sir Lambert reported some time ago on a visit which he made to the phosphate quarries at Tebessa belonging to Mr. Crookston, and described the manner in which the latter had, by his intelligence and practical good sense, turned to his own profit and to the benefit of the colony a branch of industry which had been entirely discredited by the failure of those who had previously risked their capital in it. An English house had taken over a concession made to a Frenchman, M. Wétérli, near Souk Abras; he lost 48.00% in the speculation; a French firm lost even more in attempting to work the deposits in the valley of the Chélif; so when M. Chapelle discovered the deposits at Tebessa he could find none of his countrymen, either in Algeria or in France, disposed to engage in what was then considered a most risky speculation. He finally addressed himself to Mr. Crookston, of Bône; thus this gentleman became associated with the enterprise. Instead of giving Mr. Crookston the credit due to him for having so successfully developed this important industry, the press, both in Algeria and France, broke out into a fury of invective for the way in which the mineral wealth of Algeria was being squandered for the benefit of Englishmen. There was a general demand that something should be done to preserve this valuable produce for the benefit of the colony, and that export duties should be imposed on all mineral shipped by the English to foreign countries. A violent attack was made in the French Senate by M. Pauliat. "Do not forget," said he, "that the English who work these deposits make a profit of 10*l.* to 15*l.* a ton; calculate therefore an extraction of from 15,000,000 to 20,000,000 tons annually during centuries to come." The fact is, says the Consul-General, that the concession was only granted for 18 years, and that there was no possibility of Mr. Crookston extracting more than 60,000 tons per annum under the most favourable circumstances. The alleged profit of from 12*l.* to 15*l.* per ton should in reality be 1*l.* 7*s.* 0*d.* per ton. The actual cost of extraction, transport, shipping, &c., of mineral averaging 60 per cent. of phosphoric acid is 34*l.* 3*s.* 0*d.*, and the price realised, April 1895, did not exceed 36*l.* per ton for second quality. Since then the prices have fallen still further, with the result that a marked restriction in the shipments of phosphates from Bône has taken place, as only the highest quality can now be profitably worked, the lower qualities, for the present at least, being abandoned. The total production towards the close of 1895 had reached 600 tons daily, but it has now fallen to 300 tons per day, and a still further reduction is to be feared unless the Government intervenes in order to reduce the present rate of railway charge, so as to enable the exploiters to compete on more favourable conditions with the American mines than they do at present. Of the three companies actually engaged in phosphate mining in the Tebessa district, the Société Française had completely suspended operations, the Constantine Company of Leith has reduced its output to 100 tons per diem, while the Crookston have reduced their production to 200 tons. As the last firm hold very large stocks of phosphate at Bône, a still further reduction of their output is contemplated. "Thus it is seen to what insignificant proportions this enormous natural treasure is now reduced, and how exaggerated have been the expectations regarding it. It cannot be doubted that this industry, once so promising, has been shrivelled up, mainly owing to the political campaign that was directed against it, and to the subsequent action and interference of the State, which, one would think, had the greatest interest in seeing it develop and flourish. It is a proof of what

requires no proof, of the wisdom of leaving unfettered well-directed private enterprise, and of the advisability of the State only intervening to foster and encourage it."

GENERAL TRADE NOTES.

SUGAR IN SPAIN.

Chamber of Commerce Journal, July 1896, 125.

Only a few years ago Spain was dependent upon other countries for a part of the sugar she consumed beyond that produced at home and in her colonies. France supplied refined, and Germany, Holland, and England manufactured sugars. According to a *Bulletin* of the French Chamber of Commerce at Barcelona, the position is now changed, and with the aid of her colonies, Spain is able to satisfy her own requirements. The same authority states that the sugar industry has existed in Spain from time immemorial; the cultivation of the sugar-cane on the shores of the Mediterranean, in the valleys between the provinces of Malaga and Almeria, has always been one of the sources of well-being of those parts, and the sole agricultural wealth which has favoured them in a constant manner. There were, at one time, about 29 cane-sugar factories in the Peñinsula; the number is now reduced to about 19, in consequence of the inherent vicissitudes of this class of undertakings; they are situated in the two provinces of Malaga and Almeria. In spite of the disappearance of some of the factories, the *Bulletin* believes that the production of cane-sugar has not at all diminished, owing to the extension of the plant of those factories which have survived their difficulties, and whilst it would be difficult to establish exactly the production of the existing factories, it is estimated that their output exceeds 15,000 tons per annum. A new impetus has also been given to the industry by beetroot cultivation. Fifteen years ago MM. Crens and Rubio, of Grenada, undertook the first experiments in the fertile neighbourhood of that town; these did not give much encouragement at the outset, but led to the hope that by judicious selection of seed, and the diffusion among the growers of knowledge of the means of cultivation likely to produce the best saccharine yield, that they could create an industry as important and as flourishing as in other countries. They therefore installed a factory of modest proportions, and obtained at the end of a few years some satisfactory results. This attracted capital to the industry, and in a short time 11 factories were founded in the district, all of them more imposing than the pioneer. There are now said to be 20 factories in Spain exclusively concerned with beetroot, and their output is estimated to exceed 20,000 tons per annum, or larger than that of the older cane-sugar industry. In addition to the cane and beetroot factories there have been founded also four refineries (two of them very old establishments), which treat raw Colonial sugar; the home production goes into consumption as it leaves the producing factories.

TANNING IN UNITED STATES.

Chamber of Commerce Journal, July 1896, 125.

The statements we give below will, we doubt not, appear somewhat startling, but they appear in the *Moniteur Officiel du Commerce* as received from a correspondent at New York. The correspondent says: "I have been able, in the course of my travels in the west and centre of the United States of America, to see for myself the progress made in the great industries of the country, in tanning particularly. The large industrial companies of the United States concerned with the production of leather annually import about ten million cow and ox hides from the island of Madagascar. Commercial relations between the States and Madagascar are so well founded with their agents, and the coasting trade so cheap, that all the large industrial companies obtain these hides at less than 20 centimes per kilo, delivered here (U.S.A.). In manufacturing terms, the hides, after having been soaked and cleaned by various chemical processes, are introduced into vats containing the first tanning liquor. This tanning operation is generally performed here by divers mechanical processes, with or without the application of electricity. The tanning is completed by an increase

of the tannic strength (*degré tannique*), according to the thickness of the hides, from—and commencing at—1 up to 20°. The average cost price of a Madagascar cow or ox hide weighing 18 kilos. (as a minimum) delivered at a United States port is 3 frs. This hide, being generally tanned in 120 days, yields about 60 per cent. or 10 kilos. 80 of leather, and its tanning has cost about 2 frs. 50. Such leather sells on the American market, or for export, at the rate of 1 fr. 75 per kilo. According to this rough estimate an average hide of 18 kilos. costs up to the point of conversion into leather 5 frs. 50, and consequently such a hide, yielding 60 per cent. or 10 kilos. 80 of leather, gives a profit of 13 frs. 40 per hide, or 134,000,000 frs. profit that the United States tanners obtain from this industry to the detriment of the French tanning industry. It is necessary to remark that the figures above given are absolutely short of the truth, and that this one commercial branch secures to the United States tanners rather 150 than 134 million francs."

THE GERMAN CHEMICAL INDUSTRY.

Chemist and Druggist, August 15th, 1896, 278.

The chemical factory "Harburg" at Stassfurt report that the sale of their principal article of manufacture—*viz.*, refined saltpetre—has declined by about 5 per cent. during their last business year, as compared with the year 1894-95. Since July 1895, the factory has entirely stopped the manufacture of refined camphor, because the price of the raw material was forced up to a figure at which the refined article left no profit. Owing to the Spanish-German tariff war, the exports of the factory to Spain fell from 222 tons in 1894 to 122 tons in 1895. The chemical works "Buckau," in Magdeburg, are about to lay down plant at their Stassfurt works for the manufacture of ammonia salts. Many other German potash factories are also taking up the manufacture of new articles. This applies particularly to the manufacture of caustic potash for soapmakers' use, for which several new plants have been put down. Up to the present, caustic potash is made chiefly by the chemical works at Griesheim, their branch factory at Bitterfeld, and the electro-chemical factory, also at Bitterfeld. All these works appear to make a considerable profit out of the article, small quantities of which (all of excellent quality) are also made by the United Chemical Factory at Leopoldshall. All of this, however, is at present used by the factory for its own consumption, but the commercial production of the article will be discussed at the next general meeting. The Leopoldshall works have recently purchased the prussiate and cyanide of potash factory of Schachnow and Wolff, and they are also considering the erection of a special factory for chromate of potash.

COAL DISCOVERED IN ONTARIO.

Engineering and Mining Journal, July 18th, 1896, 53.

A most important discovery has lately been made in the Sudbury district. It is well known that lignite coal exists around James Bay, coming down in one place to within 200 miles of the main line of the Canadian Pacific Railway. But no one had ever imagined that coal would be found to the south of the "Height of Land," that forms the backbone of Northern Ontario from the Ottawa River to Lake of the Woods, and especially as Sir William Logan had declared over 40 years ago that there was "no coal in Upper Canada," as the Province of Ontario was then called. Of course at that time little or nothing was known of these great northern regions, except along the shores of the Georgian Bay and Lake Superior. Even after the building of the Canadian Pacific Railway, and until the publication of Mr. Bell's map of the nickel belt in 1892, the rocks of the Sudbury district were supposed to be too old for the existence of coal in any of them, being mostly of Laurentian and Huronian origin. But in the trough between the two main nickel ranges there is one oblong area of Cambrian formation, consisting of dark-coloured sandstones and black slates about 10 miles wide and some 40 miles in length, extending in a north-easterly direction from the township of Trill almost to Lake Wahnapiatae. In this Cambrian strip, a few

miles south of the railway and 15 miles west of Sudbury, a prospector looking for gold has discovered a bed of fine anthracite coal, very clean, compact, and said to be equal in quality to the best Pennsylvania hard coal. The extent of the deposit has not been ascertained yet, but the outcrop is over 20 ft. in width, and a number of men are at work stripping along the strike of the ledge. There is every probability that other coal beds occur in the same locality, and though the matter has been kept very quiet, several parties have already gone out to explore around there. It is quite possible that coking coal may be found farther to north, and in that event the Sudbury district would become one of the great mining and industrial centres of the world. In any case, if this coal deposit is of permanent depth and equal in quality to the surface samples, it will prove of immense benefit to Ontario, which now has to import all the coal used in the province.

CALCIUM CARBIDE.

Electrician, August 21st, 1896, 531.

We learn that the Acetylene Illuminating Company have concluded arrangements with the British Aluminium Company, by which they will be able to erect works of several thousand horse-power for the manufacture of calcium carbide—using water-power. Pending the construction of such works, the Acetylene Company have obtained the use of a considerable portion of the spare water-power of the existing works of the British Aluminium Company at Foyers, and a carbide plant is now being erected there, which, it is expected, will be in full work during the month of October next.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st July	
	1895.	1896.
	£	£
Metals	1,765,951	1,820,632
Chemicals and dyestuffs	533,417	534,570
Oils	742,991	718,230
Raw materials for non-textile industries	4,798,757	5,196,149
Total value of all imports	35,097,511	34,382,850

SUMMARY OF EXPORTS.

Articles.	Month ending 31st July	
	1895.	1896.
	£	£
Metals (other than machinery)	2,565,418	2,904,666
Chemicals and medicines	703,682	622,917
Miscellaneous articles	2,684,215	2,835,046
Total value of all exports	20,559,486	21,334,785

IMPORTS OF OILS FOR MONTH ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Cocoa-nut	Cwt. 1,297	9,239	1,496	10,041
Olive	Tuns 1,714	1,005	62,556	34,978
Palm	Cwt. 133,396	101,862	139,545	104,812
Petroleum	Gall. 15,022,126	13,558,795	248,450	279,008
Seed	Tons 3,906	2,217	71,950	42,949
Train, &c.	Tuns 4,424	3,956	72,843	66,778
Turpentine	Cwt. 83,822	93,141	89,909	85,739
Other articles .. Value £	..	..	59,742	90,895
Total value of oils ..	..	..	742,991	718,230

IMPORTS OF METALS FOR MONTH ENDING
31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore..... Tons	8,502	15,293	67,371	84,718
Regulus..... "	10,559	8,198	257,821	295,651
Unwrought..... "	3,910	1,680	139,324	228,539
Iron:—				
Ore..... "	110,133	590,131	292,870	116,201
Bolt, bar, &c. "	7,897	6,114	63,267	49,397
Steel, unwrought. "	981	1,504	8,336	15,501
Lead, pig and sheet .. "	11,935	15,065	119,332	165,086
Pyrites..... "	57,660	47,820	106,611	78,610
Quicksilver..... Lb.	68,260	35,809	6,636	3,176
Silver ore..... Value £	..	..	109,771	102,737
Tin..... Cwt.	71,384	49,041	228,867	117,581
Zinc..... Tons	5,925	5,618	85,723	95,834
Other articles... Value £	..	..	198,029	228,111
Total value of metals	..	..	1,765,051	1,820,622

IMPORTS OF CHEMICALS AND DYE-
STUFFS FOR MONTH
ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	11,331	8,477	19,816	6,329
Bark (tanners', &c.) .. "	11,791	35,957	19,747	15,218
Brimstone..... "	21,520	51,820	4,917	11,801
Chemicals..... Value £	..	..	121,680	129,836
Cochineal..... Cwt.	341	541	2,126	2,860
Catch and gambier Tons	1,372	1,613	95,695	36,879
Dyes:—				
Alizarin..... Value £	..	..	24,901	20,100
Aurifer and other .. "	..	..	36,138	14,383
Indigo..... Cwt.	2,495	3,737	29,789	61,576
Nitrate of potash .. "	16,713	10,872	16,171	31,407
Valonia..... Tons	1,311	1,192	17,419	15,018
Other articles... Value £	..	..	123,630	160,273
Total value of chemicals	..	..	533,417	534,570

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian .. Cwt.	799	2,406	1,097	5,546
Bristles..... Lb.	127,657	126,894	58,836	57,515
Caoutchouc..... Cwt.	18,533	32,642	172,954	310,820
Gum:—				
Arabic..... "	7,180	5,828	19,652	13,917
Lac, &c..... "	10,458	20,293	59,014	99,842
Gutta-percha..... "	1,051	4,543	19,937	36,271
Hides, raw:—				
Dry..... "	53,100	28,623	126,153	72,593
Wet..... "	77,086	48,180	176,739	108,379
Ivory..... "	1,197	1,178	51,258	46,831
Manure:—				
Gaano..... Tons	6,758	324	58,411	1,322
Bones..... "	3,404	5,480	14,154	23,220
Nitrate of soda..... "	7,622	9,051	60,658	71,568
Phosphate of lime .. "	39,646	22,017	67,535	34,190
Paraffin..... Cwt.	17,667	52,081	19,555	50,308
Linon rags..... Tons	2,299	1,250	23,104	10,829
Esparto..... "	16,600	17,340	68,112	73,192
Pulp of wood..... "	25,764	35,379	129,558	175,437
Resin..... Cwt.	161,002	186,358	39,891	45,290
Tallow and stearin .. "	172,280	191,581	205,256	199,557
Tar..... Barrels	8,815	16,835	5,922	10,639
Wood:—				
Hewn..... Loads	262,144	293,215	534,134	595,087
Sawn..... "	870,448	951,120	1,813,155	2,009,371
Staves..... "	16,402	15,514	42,682	71,648
Mahogany..... Tons	2,840	4,586	50,692	36,717
Other articles... Value £	..	..	947,247	826,012
Total value .....	..	..	4,798,757	5,106,119

Besides the above, drugs to the value of £. were imported, as against £. in

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,290	9,543	37,392	37,812
Copper:—			£	£
Unwrought.... "	45,299	39,139	101,121	99,610
Wrought..... "	20,541	18,128	55,519	56,513
Mixed metal.... "	16,295	7,285	34,753	18,444
Hardware..... Value £	..	..	155,295	172,555
Implement..... "	..	..	108,186	128,330
Iron and steel... Tons	280,762	326,991	1,814,818	2,213,696
Lead..... "	3,925	3,994	14,620	47,682
Plated wares... Value £	..	..	28,104	30,579
Telegraph wires .. "	..	..	82,421	53,139
Fin..... Cwt.	10,400	7,185	35,245	24,607
Zinc..... "	14,266	10,430	10,279	7,738
Other articles... Value £	..	..	58,235	73,331
Total value .....	..	..	2,565,418	2,961,036

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	491,591	351,753	129,884	95,712
Bleaching materials .. "	127,351	86,644	42,621	28,885
Chemical manures .. Tons	31,077	37,328	152,857	110,788
Medicines..... Value £	..	..	81,078	87,092
Other articles... "	..	..	392,615	269,630
Total value .....	..	..	703,082	622,017

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 31ST JULY.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder..... Lb.	890,800	769,500	17,143	16,420
Military stores.. Value £	..	..	149,383	215,094
Candles..... Lb.	1,983,900	1,611,900	33,789	21,217
Caoutchouc..... Value £	..	..	109,995	113,652
Cement..... Tons	49,621	32,600	65,533	53,911
Products of coal Value £	..	..	110,693	111,962
Earthenware ... "	..	..	171,198	159,617
Stoneware..... "	..	..	15,793	17,400
Glass:—				
Plate..... Sq. Ft.	161,909	170,324	8,710	10,857
Flat..... Cwt.	7,493	7,719	15,872	17,833
Bottles..... "	55,978	62,896	25,867	30,135
Other kinds.... "	19,403	21,589	13,971	17,698
Leather:—				
Unwrought "	13,836	11,040	124,312	99,519
Wrought..... Value £	..	..	28,910	33,280
Seed oil..... Tons	3,573	4,285	71,868	81,088
Floorcloth..... Sq. Yds.	2,042,200	1,931,800	85,082	82,025
Painters' materials Val. £	..	..	145,632	153,893
Paper..... Cwt.	78,186	87,183	119,103	130,349
Rags..... Tons	4,256	4,602	24,984	23,850
Soap..... Cwt.	50,500	59,739	52,949	63,422
Total value .....	..	..	2,684,215	2,835,046

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 15,987. T. F. May. See Class II.
- 16,015. A. Hunter and F. Jordan. Improvements in furnace doors for burning smoke. July 20.
- 16,163. W. R. Wilson. Improvements in the filtration of liquids. July 21.
- 16,192. W. C. Wakefield. Wakefield's thermometer protector. July 22.
- 16,196. J. G. Chamberlain and J. Weddell. Improvements in evaporative surface condensers. July 22.
- 16,306. W. Oliphant. Improvements in apparatus for drying solid materials. July 23.
- 16,352. R. H. F. Finlay. Improved evaporating apparatus. July 27.
- 16,355. W. McG. Greaves. Improvements in appliances for the prevention of smoke from furnaces. July 27.
- 16,659. J. Foster. Improvements in and relating to apparatus for condensing steam vapour or gases, applicable also as a feed-water heater. July 28.
- 17,053. J. Foster. Improvements in and relating to evaporating apparatus. Aug. 1.
- 17,105. F. D. Cummer. Improved means applicable for use in the separation and collection of solid matters held in suspension in aeriform fluids. Aug. 1.
- 17,279. G. St. John Mildmay. Improvements in or connected with means for charging vessels with liquefied or compressed gases. Aug. 5.
- 17,365. D. J. Morgan. Improvements in furnace fire-bars and the manufacture of same without patterns. Aug. 6.
- 17,408. H. Hirzel and R. Hoffmann. Improvements in apparatus for mixing and roasting materials of approximately equal specific gravity, and for separating materials of different specific gravity. Complete Specification. Aug. 6.
- 17,428. A. C. Halse. Improvements in apparatus for the generation of gases. Aug. 7.
- 17,530. G. Helps. Improvements in and relating to regenerative furnaces for heating gas retorts and the like. Aug. 8.
- 17,532. T. Nicholson. Improvements relative to the heating of boilers, kilns, and flues, and furnaces generally, by radiation instead of direct firing. Aug. 8.
- 17,546. J. Liddle.—From W. Hardie. Improved method of separating or extracting the oil from and filtering the feed water for steam boilers and apparatus connected therewith. Aug. 8.
- 17,559. W. McG. Greaves. Improvements in furnaces. Aug. 8.
- 17,821. T. B. Booth and A. Robinson. Improvements in apparatus for carbonating liquids. Complete Specification. Aug. 11.
- 17,862. C. A. Künzel, jun. Improvements in filters. Aug. 12.
- 17,980. W. L. Wise.—From Solvay and Co. Improvements in decanting apparatus. Aug. 13.
- 18,137. J. L. Dobell. Improvements in means or apparatus for condensing nitrous acid or other fumes or vapour. Aug. 15.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

- 15,103. E. A. Pellet. Manufacture of refractory substance and apparatus therefor. Aug. 12.
- 15,565. F. W. Saatzmann. Drying and absorbing apparatus. Aug. 5.
- 16,693. W. J. Lomax and C. J. Lomax. Filtration of liquids. Aug. 12.
- 17,742. S. Cutler. Safety fittings for water-gas generators. July 29.
- 18,218. J. Foster. Evaporators. July 29.
- 19,103. A. M. Hugill, J. Overton, and R. H. Catley. Apparatus for heating, evaporating, and concentrating infusions and liquids. Aug. 19.

1896.

2543. H. H. Lake.—From A. S. Nichols. Improvements in drying kilns, and in the method of operating the same. July 29.
7251. L. M. G. Delannay-Belleville. Distilling apparatus for the production of fresh or drinking water. Aug. 5.
9560. A. H. Wethey. Calcining furnaces. Aug. 12.
- 13,386. F. Grumbacher. Improved aeration and fermentation apparatus for yeast, indigo, and the like. Aug. 5.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 15,987. T. F. May. Improvements to aid combustion in grates, furnaces, &c., to simplify and economise construction, to economise fuel, lessen smoke, and destroy germs. July 20.
- 16,003. J. Patison, sen. Improvements in utilising smoke peat or peat bog by neutralising the organic acids therein. July 20.
- 16,027. A. W. Knotts. An improved process in connection with illuminating gases. July 20.
- 16,157. N. B. Taylor and J. C. Dias. Improvements in coke ovens. July 21.
- 16,244. M. H. Hawes and P. Cannell-Bunn. Improvements in the manufacture of mantles for gas and other burners. July 22.
- 16,277. L. V. Prati and P. Marengo. Improvements in the production of pure hydrogen gas and the application of hydrogen to the obtaining of light, heat, and power. July 22.
- 16,345. R. Haddan.—From A. Boter. Apparatus for production of acetylene gas. Complete Specification. July 23.
- 16,425. G. Shenton and D. A. F. de Villepigue. Improvements in means for vaporising and burning liquid fuel. Complete Specification. July 24.
- 16,432. A. Schmidt. Improvements in the production and purification of acetylene gas and in apparatus therefor, also in and connected with portable lighting apparatus for burning such gas. July 24.
- 16,443. O. Imray.—From C. V. Potter. An improved method of and means for increasing heat production and more perfect combustion in furnaces. July 24.
- 16,541. M. Ekenberg. Improvements in the manufacture of solidified petroleum. Complete Specification. July 25.
- 16,692. W. L. Wise.—From E. Thomson. Improvements in the manufacture of gas and apparatus therefor. July 28.
- 16,728. A. J. Boulton.—From F. Alexandre. Improvements in the production of acetylene gas, and in the means or apparatus employed therein. Complete Specification. July 28.
- 16,735. S. Marcus. Improvements in burners for gasifying and burning hydrocarbons, chiefly designed for the production of light by incandescence. Complete Specification. July 28.

16,843. R. P. Pietet. Improvements in the purification of acetylene and in apparatus therefor. Complete Specification. July 29.

16,844. R. P. Pietet. Improvements in the manufacture of acetylene and in apparatus therefor. Complete Specification. July 29.

16,847. P. Woog. Improvements in and relating to acetylene generators and lamps. July 29.

16,966. W. Nicholls. Improvements in the manufacture of incandescence bodies for illuminating purposes. July 30.

16,984. H. Strache. An improved method or process of and apparatus for removing gaseous iron compounds from water-gas. July 31.

17,038. L. T. FitzGibbon. Improvements in and connected with apparatus for generating and storing acetylene gas. July 31.

17,066. T. Birnbaum. Improvements in means or apparatus for burning illuminating gas. Aug. 1.

17,134. G. Allemann and La Maison Frères Stemmer. Improvements in automatic apparatus for generating and storing acetylene gas, and for utilising the same for illuminating and other purposes. Aug. 1.

17,194. W. L. Voelker. Improvements in materials for incandescing mantles and processes for manufacturing the same. Complete Specification. Aug. 4.

17,198. B. Grau. Improvements in cooking ovens. Aug. 4.

17,209. G. C. Fowler and M. B. Fowler. Improvements in the manufacture of night lights. Aug. 4.

17,228. A. Verley. Improvements in apparatus for the production of ozone. Aug. 4.

17,450. W. C. Clarke. Apparatus for generating acetylene gas. Complete Specification. Aug. 7.

17,514. H. C. B. Forester. Improvements in or relating to the manufacture of artificial fuel. Aug. 7.

17,596. W. P. Thompson. — From W. Buddens. An improved incandescent body or mantle for incandescent gas light. Aug. 8.

17,605. W. H. Wheatley. — From C. Schmid. Improvements in the manufacture of incandescence bodies for illuminating purposes. Aug. 8.

17,644. R. Goodwin. A gas plant and system to make and produce acetylene gas, or acetylene and carbonic acid gas combined. Aug. 10.

17,646. M. Duffield. An improved acetylene gas generator. Aug. 10.

17,678. A. C. Fraser. Improvements in process and apparatus for generating and liquefying acetylene. Filed Aug. 10. Date applied for Feb. 21, 1896, being date of application in United States.

17,714. A. J. B. Lege and A. D. Pennellier. Improvements in the production and burning of acetylene gas. Aug. 11.

17,729. I. N. Knapp. Improvements in the treatment of illuminating gas. Complete Specification. Aug. 11.

17,778. B. T. L. Thomson. Improved means for producing carbonic acid and hydrogen gases. Aug. 11.

17,904. H. H. Lake. — From O. Grenier and J. Grand. Improvements in and relating to apparatus for generating and utilising acetylene gas for lighting purposes. Aug. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,366. T. G. McEwen. Manufacture of gas. Aug. 19.

16,272. A. Perlich. Lamp for the production of spirit gas incandescent light with lighting and extinguishing contrivance. July 29.

17,568. O. Rose. Method of producing peat charcoal and apparatus therefor. July 29.

17,742. S. Cutler. See Class I.

18,248. C. J. Fox. Apparatus for projecting liquid fuel intimately mixed with air and steam in a state to be burnt for heating steam boilers and for other purposes. Aug. 5.

18,334. F. Livezey. Apparatus for the extraction of cyanides and other compounds from illuminating and other gases. Aug. 5.

18,877. P. Dvorkovitz. Means or apparatus for distilling, applicable also for enriching gases by means of hydrocarbons. Aug. 19.

1896.

5051. R. G. Shadbolt and J. Wilson. Means for enriching coal-gas. Aug. 19.

7477. P. Schroedter. Incandescence gas burners. Aug. 5.

10,568. V. I. Feeny. — From P. Carmien, A. Yvonne, and M. Billon. Automatic gas-producing apparatus and burner therefor. July 29.

11,707. E. F. J. C. Bauweraerts. Burner for acetylene gas. Aug. 12.

11,708. E. F. J. C. Bauweraerts. Apparatus for the generation of acetylene gas. Aug. 5.

14,929. A. H. J. Schultke. New or improved apparatus for the production and combustion of acetylene for illuminating purposes. Aug. 19.

15,167. M. Meyer. Incandescent light burners. Aug. 12.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

15,992. P. W. H. Gray. Improvements in the manufacture of inks. July 20.

16,039. J. J. M. Ville. New red colouring matters—rodazines—of the triphenylmethane group, and method of producing the same. July 20.

16,449. K. Vidal. Improvements in colouring matters. July 24.

16,582. T. R. Shillito. — From J. R. Geigy and Co. Improvements in the production of azo colours. July 27.

17,064. I. Levinstein and Levinstein, Lim. Production or manufacture of new colouring matters. Aug. 1.

17,065. I. Levinstein and Levinstein, Lim. Manufacture or production of new colouring matters. Aug. 1.

17,168. A. Bang. — From G. A. Dahl. New dyestuffs and the production of the same. Aug. 4.

17,207. O. Imray. — From G. H. Weiss. Manufacture of amino-oxy-carbanilic acid and azo dyestuffs therefrom fixed on chrome mordants. Aug. 4.

17,226. E. H. Temple. Improved ink. Aug. 4.

17,293. M. Lange. Process for the manufacture of intermediate compounds containing two diazo groups. Complete Specification. Aug. 5.

17,382. C. Uffelmann. Manufacture of a solid paste or soap compound for dyeing all kinds of textile materials. Aug. 6.

17,444. M. Ward and I. Ward. Improvements in the manufacture of liquid blue for laundry use. Aug. 7.

17,590. S. Pitt. — From L. Cassella and Co. Improvements in the manufacture of primary disazo dyestuffs. Aug. 8.

17,591. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co. The production of dyestuffs on fibre. Aug. 8.

18,020. W. H. Claus, A. Rée, and L. Marchlewski. Production of new azo dyes. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,276. G. W. Johnson. — From F. von Heyden Nachfolger. A process for the manufacture of aromatic nitrosulpho-chlorides. July 29.

17,639. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new diamido bases derivatives of azimidobenzene and of azo dyes from these. Aug. 5.

17,660. B. Willeox.—From The Badische Anilin und Soda Fabrik. The manufacture and production of new mordant-dyeing colouring matters. July 29.

71,738. H. E. Newton.—From The Farbwerke vormals F. Bayer and Co. The manufacture or production of dye-stuffs for cotton. July 29.

19,253. H. H. Lake.—From The Farb. Mulheim. Manufacture of sulpho acids of the naphthalene series, and of colouring matters derived therefrom. Aug. 19.

20,530. H. H. Lake.—From K. Ochler. Manufacture of colouring matters. Aug. 12.

20,548. I. Levinstein and Levinstein, Lim. Manufacture of a sulpho acid which may be employed in the production of colouring matters. Aug. 5.

1896.

12,743. H. Imray.—From F. Petersen. Manufacture of substantive cotton dyestuffs from benzidine sulpho acids. July 29.

13,744. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of new disazo, trisazo, and polyazo colouring matters. July 29.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

16,336. H. K. Tompkins. Improvements in the manufacture of artificial silk. July 23.

16,570. T. Illingworth. Improvements in the means or method of rendering wool fibres and yarns spun from wool unshrinkable. July 27.

16,578. J. E. L. Barnes.—From W. Wall. Improvements in machinery for treating cotton seed. July 27.

16,840. E. Edwards.—From F. A. Bernhardt. Improvements in the process of what is known as "Mercerizing" fabrics composed of vegetable fibres. July 29.

17,841. W. Grimshaw. Improvements in and in means for ornamenting textile and other fabrics or materials. Aug. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,143. S. W. Wilkinson and The Grove Co., Lim. An improved method of and apparatus for removing tar, pitch, oil, grease, and similar matter from wool, fur, and the like. Aug. 5.

17,028. A. Hitchon. Apparatus for breaking up or opening cotton and other textile materials. Aug. 19.

18,765. H. H. Lake.—From A. K. J. von Gerkan and E. Zietz. Process of producing floor-covering material and the like from the needles or leaves of pine trees. Aug. 12.

23,942. W. P. Thompson.—From E. Clavier. Process for the manufacture of yarn or thread from paper, and apparatus therefor. Aug. 12.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

16,786. J. Lees and H. Arnold. Improvements in bleaching apparatus. July 29.

17,157. R. Pickup. Coloured resists, with aniline black. Aug. 4.

17,692. C. Dratz. Process and apparatus for printing multicoloured designs upon fabrics and warp chains. Aug. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

19,444. R. Michel. Producing print patterns in colours on cotton fabrics by the aid of safranine-azo dyestuffs. Aug. 19.

1896.

3991. H. H. Lake.—From J. C. Blundell. Yarn-dyeing machines. Aug. 12.

12,500. H. Schirp. Improvements in dyeing, washing, and rinsing apparatus for textile goods. July 29.

13,191. E. Heberlein. Process and apparatus for the production of colours with silk-like gloss on vegetable fibres and textile fabrics; also on wool, india-rubber, leather, wood, metal, and other substances. July 29.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

15,999. T. Parker. Improvements in the manufacture of certain salts of sodium and potassium. July 20.

16,128. C. H. Simpson and F. H. T. Allan. See Class XII.

16,146. J. A. Wanklyn and W. J. Cooper. An improvement in the manufacture of cyanides. July 21.

16,255. L. M. Bullier. Improvements in the manufacture of carbides of the earth-metals and alkali-earth metals. Filed July 22. Date applied for Dec. 28, 1895, being date of application in France.

16,877. D. Bray. A still or tank for the distillation, boiling, and holding of acids, alkali, and other corrosive liquids. July 30.

16,944. H. Kunheim. An improved process for the manufacture of liquid chlorine, and apparatus therefor. July 30.

17,009. J. B. Kasten. A mode or process of making nitrates. July 31.

17,055. W. Mills. Improvements in preparing ammoniac silicofluoride. Aug. 1.

17,127. J. C. Graham. An improved process for the preparation and purification of solutions of copper. Aug. 1.

17,243. V. Beanquet. Improvements in the manufacture of alkaline cyanides. Aug. 4.

17,488. A. Kumpfmüller and E. Schultgen. Improvements in and connected with evaporation and concentration of solutions of salts. Complete Specification. Aug. 7.

17,607. J. R. Wyld, J. W. Kynaston, and J. Brock. Improvements in the manufacture of hydrochloric acid free from arsenic. Aug. 8.

17,839. H. Brewer. See Class X.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

9052. J. C. Butterfield. See Class X.

1896.

7002. H. H. Lake. From L. Sternberg. Production of ammonia from waste products, such as the waste lyes resulting from the extraction of sugar or the manufacture of alcohol from molasses. Aug. 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

17,008. A. Simmons. Improvements in ornamenting or decorating glass, earthenware, metal, and other plates and sheets. July 31.

17,193. J. Kotzur. A novel grooved cement tile. Aug. 4.

17,278. R. Thomson. An improved joint for connecting taps to stone bottles, glass bottles, and the like; also manufacturing stone bottles and glass bottles on improved principles. Aug. 5.

17,390. P. T. Sievert. Process and apparatus for the manufacture of glass sheets, glass tubes, and cylinders for the production of glass sheets and other articles. Complete Specification. Aug. 6.

17,391. P. T. Sievert. Improvements in the manufacture of sheets, cylinders, and other forms of glass. Aug. 6.

17,599. H. Sturm. Improvements in continuous ceramic furnaces with heated movable soles. Aug. 8.

17,871. J. R. Gilman. Improvements in the process of transferring designs to china or earthenware, and an improved manufacture of transfer sheets for the purpose. Aug. 12.

COMPLETE SPECIFICATION ACCEPTED.

1896.

13,676. J. B. Vernay. Machines for manufacturing bottles and other articles of glass. Aug. 5.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

16,258. A. Gibbs and Eastwood and Co., Lim. Improvements in the burning of bricks and other material, and in apparatus therefor. Complete Specification. July 22.

16,307. W. Millar. The utilisation of a waste product in the manufacture of a hydraulic cement, cement mortar, or the like. July 23.

16,310. W. Millar. The utilisation of a waste product in the production of a wall, ceiling, or other plaster. July 23.

16,436. J. Leuba. Improvements in paving blocks. Complete Specification. July 24.

16,525. E. Selberg. New or improved building and insulating material. Complete Specification. July 25.

16,892. T. R. Jones. An improved process for hardening stone. July 30.

17,281. M. Bernstein. Improved process for producing artificial veined coloured marble. Complete Specification. Aug. 5.

17,627. W. Millar and O. J. Owen. Improvements in the composition and manufacture of artificial stone and slate. Aug. 10.

17,636. G. Hutchinson, T. H. Lawson, and A. J. Lawson. An improved compound for use as paving. Aug. 10.

17,799. E. T. Dumble. See Class XII.

17,830. J. Foster. Improvements in the construction of kilns for burning limestone, cement, and other similar material. Complete Specification. Aug. 12.

18,026. F. M. David. An improvement in the construction of fireproof partitioning for buildings. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,962. A. Patriek. Manufacture of finely-pulverised substances for use in the production of Portland cement, pigments, and the like. Aug. 5.

18,109. G. de Bruyn. Fireproof ceilings. Aug. 12.

18,576. G. de Bruyn. Slabs for building and like purposes. Aug. 12.

20,246. Count A. de Sainte-Marie and A. Hoffmann. Treatment of wood. Aug. 5.

1896.

9838. J. Wilkinson. New or improved manufacture of compositions suitable for use as building materials for architectural and other purposes. Aug. 12.

12,169. A. J. Boulton.—From M. Thys. Manufacture of artificial stone. Aug. 12.

13,649. R. F. Strong. A new or improved process for the treatment of peat and other ligneous substances for producing paving blocks, slabs, tiles, slates, conduits, and fuel. July 29.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

16,032. W. H. Hyatt. Improvements in apparatus for separating gold from other materials. July 20.

16,085. J. Bigwood and T. C. Bigwood. Certain improvements in machinery for galvanising or otherwise coating metal sheets with metals or alloys. July 21.

16,180. J. B. Torres. Improvements in and connected with the manufacturing and refining of iron, steel, and their alloys. July 22.

16,312. A. M. Clark.—From E. A. Ashcroft. Improvements in the treatment of solutions of ores containing zinc for the recovery of zinc as oxide. July 23.

16,372. W. R. Renshaw. Improved means for and method of cleansing and detinning waste tin plates, old manufactured plates, such as biscuit tins and the like, and depositing tin and other metals in conjunction. July 24.

16,419. P. M. Justice.—From J. H. King. Improvements in the extraction of metals from their ores. July 24.

16,485. D. Colville, jun. Improvements in the manufacture of composite armour plates. July 25.

16,603. C. F. W. A. Focke. Improvements in processes for cleaning iron and steel. July 27.

16,604. F. Ellershausen. Improvement in the treatment of complex sulphide ores. July 27.

16,685. C. Vautin. An improved method for the production of metals and alloys. July 28.

16,698. F. W. Golby.—From M. Liebig and The Aetien Gesellschaft für Zink Industrie, vormals W. Grillo. A new or improved process for separating zinc and analogous metals from their sulphur compounds. July 28.

16,756. Elkington and Co., Lim., and H. T. Fellows. Improvements in muffles for annealing metals and for other like purposes. July 28.

16,820. W. Huselton and N. Moore. Improvements in ore concentrators. July 29.

16,831. W. T. Sugg. Improved metallic alloy. July 29.

17,074. T. Andrews. Improvements in apparatus for consolidating metallic scrap. Complete Specification. Aug. 1.

17,076. L. Albrecht. Improvements in tin-plate furnaces. Complete Specification. Aug. 1.

17,299. E. F. Turner. An improved process for the treatment of zinciferous ores. Aug. 5.

17,372. L. H. Goodman. Improvements in furnaces for the disintegration of quartz and other minerals. Aug. 6.

17,474. J. Williams, sen. Improvements in the method of and means for reducing lead scum or litharge. Aug. 7.

17,493. C. W. H. Göpner and H. L. Diehl. Improvements in the recovery of gold and silver from their solutions. Aug. 7.

17,551. E. F. Goodyear, G. W. Goodyear, and T. Kennelly. Improvements in appliances to be used in connection with brazing hearths, and other apparatus employed in the heating and fusion of metals. Aug. 8.

17,593. I. A. Timmis. Improvements in cupolas and blast furnaces. Aug. 8.

17,601. E. Edwards.—From H. Wachwitz. An improved process for coating aluminium with other metals. Aug. 8.

17,623. A. Phillips. An improved form of metal purifier. Aug. 10.

17,680. W. P. Thompson.—From T. G. Orwig. New or improved hard metal or alloy, and process of manufacturing the same. Aug. 10.

17,839. H. Brewer. Improvements in and relating to the treatment of zinc ores or ore residues in the production of zinc chloride, sodium sulphate, and other products. Aug. 12.

17,864. L. R. Scammell. Improvements in the treatment of sulphide ores. Aug. 12. Date applied for July 13, 1896, being date of application in Australia.

17,941. B. Thomas and J. W. Thomas. Improvements in connection with the elimination of arsenic from metallic copper. Aug. 13.

18,006. J. Swinburne. Improvements in coating metals with aluminium and its alloys. Aug. 11.

18,013. R. Thomson. Improvements in treating ores of precious metals and in apparatus therefor. Aug. 14.

18,081. C. P. Sherck, J. L. Rutter, and S. Weiss. An improved process and means for converting pig iron into malleable iron or steel. Complete Specification. Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

9052. J. C. Butterfield. Treatment of blue stone and other sulphurised ores. Aug. 12.

15,141. A. Shedlock. Apparatus for separating and concentrating ores and other materials in the pulverised or granular state. Aug. 5.

17,618. W. T. Leyshon. Additions to machinery for coating metals. July 29.

17,901. W. J. May. Ferro-sodium fluxes. Aug. 12.

17,932. Davies Bros. and Co., Lim., E. A. Davies, and S. T. Thomas. Preparing metal sheets for the purpose of galvanising them or otherwise coating them with metal or metallic alloy. Aug. 19.

21,575. H. Partin. A new alloy of aluminium. July 29.

1896.

13,187. B. Kleber. Process for the manufacture of weather-proof gypsum, stone, or bricks. Aug. 5.

11,479. A. F. Cothias. Manufacture of metallic alloys. Aug. 5.

14,957. C. James. An improved process for the reduction of argentiferous and auriferous copper ores, mattes, or compounds without loss of the copper, silver, or gold. Aug. 19.

15,159. C. James. Process for the extraction of copper from sulphuretted ores or compounds. Aug. 19.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

16,057. C. Kellner. Improvements in electrolytic apparatus. July 20.

16,091. A. Stevens and F. Puttaert. Improvement in electric batteries. July 21.

16,256. L. M. Bullier. Improvements in electric furnaces. July 22. Date applied for Dec. 28, 1895, being date of application in France.

16,257. L. M. Bullier. Improvements in electric furnaces. Filed July 22. Date applied for Jan. 27, 1896, being date of application in France. July 22.

16,268. W. Rowbotham. Improvements in electric batteries. July 22.

16,270. M. O. A. Garreau. Improvements in secondary electric batteries. July 22.

16,516. J. Vaughan-Sherrin and H. H. Sherrin. Improvements in accumulator batteries. July 25.

16,597. R. M. J. Heurtey and P. Germain. Improvements in and relating to primary batteries. July 27.

16,726. F. W. Schneider. Improvements in electrodes for secondary batteries. Complete Specification. July 28.

16,729. L. G. Attenborough and E. A. Sulman. Improvements in the manufacture of caustic soda and other alkaline hydrates and compounds by electrolysis. July 28.

16,852. G. Poore. Improvements in electrolysis. Complete Specification. July 29.

16,916. E. Strzelecky. Apparatus for obtaining oxygen and hydrogen from steam by electrolysis. July 30.

17,001. R. Pauli. Electrolytic manufacturing of cyanide of alkali. July 31.

17,161. S. Hammacher. The manufacture of an improved active material for the plates or electrodes of electric accumulators. Aug. 4.

17,346. F. F. E. Heyse and W. H. Akester. Improvements in or connected with secondary or storage batteries. Aug. 6.

17,698. The Cowper-Coles Galvanising Syndicate, Lim., and S. O. Cowper-Coles. Improvements in means or apparatus for effecting the electro-deposition of zinc or other metals upon tubes or other circular or analogous objects. Aug. 8.

17,671. L. Hoepfner. An improved method for obtaining porous metals by electrolysis. Aug. 10.

17,879. V. M. Cornely and L. C. H. Dautel. Improvements relating to electric batteries. Aug. 12.

18,016. M. M. Brophy and J. D. F. Andrews. Improvements in electric accumulators or secondary batteries. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,024. E. Andreoli and G. Andreoli. Electrolytic production of amalgams, and their utilisation. Aug. 12.

16,692. A. Patrick. See Class IX.

17,505. C. Hoepfner. Electrodes. Aug. 5.

17,525. C. Kellner. Electrolytical manufacture of bleaching liquid. Aug. 19.

17,655. B. M. Drake and J. M. Gorham. Secondary batteries. July 29.

22,505. F. Dannert, H. Windolff, and J. Zacharias. Active material for electric accumulators. July 29.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

16,128. C. H. Simpson and F. H. Tielke Allan. An improved process for making soap and caustic soda. July 21.

16,129. C. H. Simpson and F. H. T. Allan. An improved process for the purification of spent lyes. July 21.

16,746. W. F. Haywood. Improvements in process and apparatus to be used in the manufacture of soap. Complete Specification. July 28.

16,766. J. Merz. Improvements in or relating to the extraction of fats, oils, resins, sulphur colours, tanning materials, and the like by means of volatile solvents and apparatus therefor. Complete Specification. July 28.

17,118. F. U. Klever. Improvements in lubricants. Aug. 1.

17,379. C. Schmidt. Improvements in processes for producing chemical combinations from raw wool fat. Complete Specification. Aug. 6.

17,446. E. Weldon. Improved harness soap. Aug. 7.

17,548. J. H. Hunter. An improvement in the process or method of purifying and separating butter, fatty, oily, or other substances. Aug. 8.

17,815. J. E. T. Woods and H. B. McKenna. Improvements in the manufacture or conversion of certain hydrocarbon oils for the production of a fluid oil suitable as a solvent for resinous gums and for medicinal purposes. Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,239. J. Holmes, H. E. Tankard, and W. Sealie. A new or improved method of and apparatus for removing fatty matters from the effluent waters of wool-washing machines and the like. Aug. 5.

1896.

15,050. G. C. Dymond.—From G. F. Metzger. Separating oil from its volatile solvent. Aug. 19.

15,597. G. C. Dymond.—From G. F. Metzger. Process and apparatus for separating naphtha or other volatile solvent from oil. Aug. 19.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

16,276. A. Gutensohn. Improvements in the manufacture of oxide of lead, and means used therefor. July 22.

16,857. J. Danby. A non-conducting and protective composition specially adapted for covering the surfaces of metallic structures, but applicable also to other structures, to prevent radiation of heat. July 29.

17,031. A. M. Clark.—From W. Hampe and C. Schnabel. Improvements in the manufacture of zinc pigments. July 31.

17,078. H. W. Aird and C. E. Felch. Improvements in paint and in the method of producing and applying same. Aug. 1.

17,799. E. T. Dumble. Improvements in process for hardening bituminous substances. Complete Specification. Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,839. A. Pullrook. New or improved compound applicable for rendering articles waterproof or air-tight, or as a cement or varnish, or for other similar purposes. Aug. 12.

17,871. W. L. Gunn. Improvements in compositions for protecting ships' bottoms against fouling, preserving wood, and shielding submarine electric cables from penetration by torpedo worms. Aug. 5.

21,717. W. Walters and W. T. Nichols. An improved patent-leather dressing. Aug. 5.

1896.

8981. S. Ganelin. Production of a substitute for white lead and of other oxy-salts of lead from lead sulphate and lead chloride. July 29.

15,689. J. W. Steiger and P. D. McArthur. Stick sealing-wax. Aug. 19.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

16,420. E. S. Cook. An improved process for treating raw hide for use in the construction of pneumatic tyres. July 24.

16,600. E. Avellis and E. Koster. An improved process for preparing chrome-dressed leather for dyeing purposes. Complete Specification. July 27.

16,764. J. Blunck. Improvements in the process of tanning hides, skins, or the like. Complete Specification. July 28.

17,370. E. E. E. Martens. A new or improved process for the preparation of liquid glue for joiners, upholsterers, and the like. Complete Specification. Aug. 6.

17,420. R. Widemann. A new or improved process of treating leather. Complete Specification. Aug. 6.

COMPLETE SPECIFICATION ACCEPTED.

1896.

13,281. W. L. Wise.—From Knoll and Co. Manufacture or production of an albumen-tanning compound. Aug. 12.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

16,861. R. Tugener. Apparatus for turning faecal matter into manure and for disinfecting water-closets. July 29.

17,151. C. Fell. The natural fertiliser. Aug. 4.

17,883. E. van De Griendt. Treatment of moss-litter manure for obtaining products therefrom. Aug. 12.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

16,009. W. Field. Improvements in extracting sugar from molasses by means of barium hydroxy-sulphide and recovering the same from the resulting by-products. July 20.

16,065. A. Glaser. Improvements in vacuum-apparatus for use in the manufacture of caramels and the like. July 20.

16,340. S. W. Wilkinson. Improvements in the manufacture of sulphocarbonates of starch, dextrin, and sugars. July 23.

16,411. W. Feld. Improvements in extracting sugar from molasses by means of barium hydroxy-sulphide and recovering the latter. July 24.

17,054. J. F. Williams. Improved method of and apparatus for boiling sugar, glucose, and jam. Aug. 1.

17,195. J. A. Link. Improvements in and relating to adhesive compounds. Complete Specification. Aug. 4.

17,536. E. J. Mills. Improvements in formation and preparation of soluble colloids of the gelatine class. Aug. 8.

18,138. C. F. Kastengren. An improved method of purifying molasses, syrup, or other solution of sugar by means of animal charcoal. Complete Specification. Aug. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

5953. C. F. Kastengren. Method of purifying molasses, syrup, or other solution of sugar. July 29.

15,485. A. Rohrbach. A new or improved process for purifying centrifugally separated substances. Aug. 19.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

16,229. H. Koch. A new or improved process in or relating to the preparation of yeast. July 22.

16,663. A. Fox. The brewers' wort sample cooler. July 28.

16,671. J. Dunn. Improvements in treating barley for alimentary purposes, including brewing and distilling. July 28.

17,183. A. Lippke. Process for the preservation of beer. Complete Specification. Aug. 4.

17,246. L. Prochazka. An improved process and apparatus for mashing and brewing. Complete Specification. Aug. 4.

17,316. C. J. Gerry. See Class XVIII. A.

COMPLETE SPECIFICATION ACCEPTED.

1895.

19,171. N. Anderson. Apparatus for blending or mixing spirits. Aug. 19.

XVIII.—FOODS, SANITATION, ETC., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

16,016. A. Backhaus. An improved treatment of the milk of cows or other domesticated animals to render it suitable as food for infants and children. July 29.

17,316. C. J. Gerry. Improvements in the treatment or preparation of tea, coffee, cocoa, sweetmeats, aerated waters, wines, spirituous liquors, or other beverages or articles of food or diet. Aug. 5.

17,611. F. Rebling. A new or improved process for producing blood-forming and nourishing means. Aug. 8.

17,658. W. Junge. Improvements relating to the preservation of beer, milk, water, meat, fruit, and other substances, and to apparatus therefor. Aug. 10.

17,720. H. M. Amos. Improvements in fruit evaporators. Aug. 11.

18,803. A. Maefadyen and R. T. Hewlett. An improved apparatus for pasteurising or sterilising milk or other fluids. Aug. 15.

B.—Sanitation.

16,034. E. W. Ives. Improvements in apparatus for the treatment of sewage and other liquids. Complete Specification. July 20.

16,078. J. Royston. An improved mode of treating night soil. July 21.

16,280. W. D. Scott-Monerieff. Improvements in or relating to the treatment of sewage and apparatus therefor. July 23.

17,526. C. H. Fitzmaurice and E. Mann. Improved means for softening water and apparatus therefor. Aug. 7.

C.—Disinfectants.

17,380. S. E. Gunion.—From J. W. Hill. Improved gases or vapours for disinfecting and for destroying germs and insects, and apparatus for producing such gases or vapours. Aug. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1895.

15,255. S. Griffin. Improvements in means for preserving food. July 29.

18,043. A. Ernecke. Apparatus for preserving food and the like. Aug. 5.

23,505. W. P. van Wyk. Manufacture or preparation of cocoa or chocolate powder. Aug. 12.

1896.

12,523. T. F. Garrett and W. M. Spouse. Consolidated soups and vegetable juices. Aug. 5.

14,196. G. C. Dymond.—From G. H. Walker, G. E. Gordon, and J. H. Waterhouse. Treatment of milk for the purpose of suiting it to individual indigestions. Aug. 5.

14,581. C. L. Bachelier. Process of preserving organic substances, more particularly applicable for elementary substances. Aug. 5.

B.—Sanitation.

1895.

16,401. J. J. Hartnett. Apparatus for disinfecting and purifying air. July 29.

18,093. B. W. Slater and The Native Guano Co., Lim. Treatment and purification of sewage and impure water. July 29.

C.—Disinfectants.

1895.

18,229. E. Burton. Disinfectant and cleansing and purifying compound. Aug. 5.

XIX.—PAPER, PASTEBOARD, ETC.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,503. W. Brothers. Process or treatment of waste materials obtained in the manufacture of ammonium compounds to produce a substance suitable for use as a paper filling in the manufacture of paper. July 29.

19,008. J. S. Rigby. Application and utilisation of the residual liquors produced in the manufacture of vegetable parchment paper. July 29.

1896.

7234. The British Xylonite Co., Lim., and S. W. Brooke. Manufacture of xylonite, celluloid, and similar compounds of nitro-cellulose. July 29.

9914. L. Capazza. Manufacture of stylographic paper. Aug. 5.

15,519. G. L. T. Hartmann. Apparatus for the manufacture of millboard, pasteboard, or the like. Aug. 19.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

16,047. J. C. Mewburn.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. Improvements in mono alkyl-ethers of pyrocatechin and in the production of such ethers. Complete Specification. July 20.

16,162. J. C. Mewburn.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. A new perfume and process for the manufacture of the same. Complete Specification. July 21.

16,239. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improvements in the manufacture of vanillin. July 22.

16,860. H. Higgins. Methods for causing the separation of caseinogen or casein from separated milk and its preservation in a dry state. July 29.

17,177. J. J. A. Trillat. Improvements in the production of vapours of formic aldehyde and in apparatus therefor. Filed Aug. 4. Date applied for Jan. 3, 1896, being date of application in France.

17,401. C. Fahlberg. Improvements in the manufacture of saccharine or compounds thereof, or mixtures containing the same, and in the production and treatment of materials for use therein. Complete Specification. Aug. 6.

18,035. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Improved manufacture of oxy-camphor. Aug. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,762. C. D. Abel.—From The Fabriques de Produits Chimiques de Thann et de Mulhouse. Manufacture of artificial musk. July 29.

18,297. J. C. Richardson. Manufacture of artificial camphor and its treatment. Aug. 5.

24,615. M. Woolf. The preparation and production of essences or extracts from vegetables. Aug. 12.

1896.

3998. A. J. Boulton.—From G. Barthel. Process and apparatus for the preparation of aldehydes. Aug. 5.

XXI.—PHOTOGRAPHY.

APPLICATIONS.

18,036. B. Acres. Improvements in the manufacture of films for photographic purposes. Aug. 14.

18,131. J. A. Michel-Dansac and L. Chassagne. Means for reproducing the colours in photography, suitable also for dyeing and printing. Complete Specification. Aug. 15.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

16,038. E. Kubin. Improvements in or relating to the manufacture of explosives. July 20.

16,858. H. Maxim. Improvements in the manufacture of pyroxylin smokeless explosives and in apparatus therefor. July 29.

16,859. H. Maxim. Improvements in nitro-compounds whereby their chemical stability is increased. July 29.

17,204. M. Bielefeldt. Process for the manufacture of explosives containing saltpetre. Complete Specification. Aug. 4.

17,307. C. E. Biebel. Improvements in the manufacture of nitro-glycerine explosives. Aug. 5.

18,034. M. Bielefeldt. Improved manufacture of explosives. Aug. 14.

18,078. B. Willecox.—From The Action Gesellschaft Dynamit Nobel. An improved explosive or blasting composition. Complete Specification. Aug. 14.

18,142. H. S. Maxim. Improvements in the manufacture of smokeless explosives. Aug. 15.

COMPLETE SPECIFICATION ACCEPTED.

1895.

17,535. P. R. J. Willis.—From W. C. Peyton. Apparatus for making gunpowder. July 29.

XXIII.—ANALYTICAL CHEMISTRY.

APPLICATION.

17,897. W. P. Thompson.—From A. Legrand. An improved testing carafe or bottle for indicating the richness in cream, of milk. Aug. 12.

PATENTS UNCLASSIFIABLE.

APPLICATION.

17,717. F. J. Jones and G. W. Jones. A chemical compound. Aug. 11.

COMPLETE SPECIFICATION ACCEPTED.

1896.

7793. C. Stahlschmidt. Manufacture of a new product from sugar, brown iron ore, and chloride of sodium. Aug. 12.



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MONUMENT TO LAVOISIER.

For the Lavoisier Monument International Fund, set on foot two years ago by the Academy of Sciences at the instance of M. Berthelot, nearly 2,000*l.* has now been collected, and it is hoped that a worthy monument will be ready for inauguration in May 1900. Alsace has contributed about 100*l.*, Germany 160*l.*, England 130*l.*, and Austria-Hungary 100*l.* The French Minister of Public Instruction will give 240*l.*, and the city of Paris 400*l.*—*Daily News*.

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 Wright, A. C., 1/o Leeds; Royal Institution Chemical Laboratory, Lond Street, Hull.

CHANGE OF ADDRESS REQUIRED.

Jürgensen, Dr. R., 1/o Weinberge, Prague, Austria.

Death.

Birch, R. W. Peregrine, M. Inst. C.E., at Foyers, Loch Ness, N.B., August 30.

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SESSION 1896-97.

November 2nd:—

"The Pure Culture of Bacteria for Inoculating Soils for Leguminous Plants."
 Arthur Caldecott. "The Smelting and Refining of Cyanide Bullion."

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Extracting Moisture from Peat and such like Materials, and Apparatus therefor, An Improved Method of. O. Rose, London. Eng. Pat. 14,533, July 31, 1895.

THE invention consists in treating the peat or other similar material in a closed chamber fitted with shafts carrying suitably-shaped blades to masticate and disintegrate it, whilst air under pressure is forced through the apparatus. The moisture is thereby forced through strainers of canvas or other suitable material into a vessel below, which may, if desired, be connected with an exhaust pump.—O. H.

Drying and Absorbing Apparatus [Swinging Plates or Shelves], Impts. in. F. W. Saatzmann, Driffield, Yorks. Eng. Pat. 15,565, Aug. 19, 1895.

THE apparatus is principally intended for drying moist sticky substances the drying of which in ordinary machines presents difficulties; but it may also be used for drying other materials, and also for absorbing gases by solid matters. It consists of a column provided with a number of horizontal shelves, each shelf being formed of a number of plates mounted on separate axes in such a manner that they can be turned separately by means of a key fitting on the exterior end of each axis, or all together by means of suitable mechanism, to allow the materials thereon to fall on to the next lower shelf. A space is left, alternately at the right- and left-hand side of each set of plates, so that the hot air or gas which enters at the bottom can pass upwards in a zig-zag manner over each shelf in succession to the outlet at the top. The material is spread over the top shelf, and is caused to descend from shelf to shelf to the outlet at the bottom by tilting the shelves in succession.—R. S.

The Production of High Vacua, Impts. in Apparatus for; [Exhausting Incandescent Electric Lamps]. A. Barr, Glasgow, and W. Stroud, Leeds. Eng. Pat. 13,188, July 9, 1895.

THE principle of the invention consists in "the combination of a rotating drum, partially submerged in mercury or other liquid, and containing passages of a somewhat spiral or helical form, which drum during its rotation effects a transference of gas from a chamber placed in communication with the vessel or vessels to be exhausted to a chamber placed in communication with a pump producing a partial vacuum, these two chambers being sealed one from the other by the liquid used in the apparatus."—O. H.

Mixing and Agitating Machinery for dealing with Liquids and the like, Impts. in. E. A. Brotherton, Leeds, and F. G. Holmes, Leeds. Eng. Pat. 16,804, Sept. 9, 1895.

THIS invention relates to the mixing of liquids, which may contain more or less solids, in a boiler, tank, or vessel of any description; and consists of arrangements whereby two opposite currents are simultaneously drawn, one from the top, the other from the bottom, churned in an intermediate chamber, and delivered through discharging arms.—R. S.

Evaporators, Impts. in and relating to. J. Foster, Pollokshields, N.B. Eng. Pat. 18,218, Sept. 30, 1895.

THIS invention relates to evaporating and concentrating vessels, especially to multiple-effect apparatus. The steam chamber is provided with two sets of vertical tubes, an outer ring of tubes of large diameter extending for about two-thirds of the circumference of the vessel, and acting as circulating tubes, and the ordinary tubes of smaller diameter connecting the top and bottom plates. The top plate is curved from the centre downwards to the sides, where it dips into a half channel or well, into which the top ends of the larger tubes open. The bottom cover of the evaporator curves downwards towards one side, leading the precipitated material to a settling pipe and pump of special form, whilst the liquid flows from the vertical tube through a branch pipe to an automatic feeding closely trapped chamber. This contains a vessel mounted on a central vertical spindle, and when it is filled to a determinate amount, the weight depresses a spiral spring, upon which it rests, and allows the liquid to flow past a valve-shaped disc. When the vessel rises, the valve is shut off again. The discharged liquid therefrom is drawn by the vacuum into the next evaporating vessel of the series.—R. S.

Evaporating Liquids [Water-Tube Principle], Generating Steam, &c.; Impts. in Apparatus for. P. C. Hewitt, New York, U.S.A. Eng. Pat. 20,126, Oct. 29, 1895.

THIS invention is to facilitate the evaporation of liquids by accelerating their circulation, and by securing a more effective contact of the liquid and heating surface by bringing more liquid in contact with such heating surface, and also by the rapid circulation of the vapour formed from the liquid. Two vertical sets of tubes are employed—highly heated ones up which the liquid passes, and one or more return tubes, which are protected so as not to be so highly heated, down which the liquid passes. At the upper end of these tubes is a special separating chamber, into which the liquid which has passed up the hot tubes discharges itself through stationary tangential nozzles, whereby a rapid rotary motion is caused in this chamber, the heavier portions of the liquid going towards the wall, passing over on inwardly projecting flange thereon, and escaping through a discharge tube. The remainder of the liquid passes down the return tube or tubes, the rotary motion thereof being arrested by wings or vanes, while the vapour escapes through a central outlet.—R. S.

Overflow Pipes of Distillation and Absorption Columns [Clearing Overflow Pipes from Incrustation], Impts. in or connected with the. H. Hirtel, Leipzig-Plagwitz, Germany. Eng. Pat. 9557, May 5, 1896.

IN order to prevent the choking or fouling of the overflow pipes of distilling and absorption columns, the patentee introduces through the vertical series of pipes, a spindle provided with scrapers to revolve or oscillate in each separate pipe. The spindle passes through a socket or projection on each plate or dish, to form a bearing, whilst an inverted cup fitted to the spindle, below the scraper, overhangs each socket to form a liquid lute or joint for the gas or vapour.—O. H.

Sulphurous Acid and other Gases or Fumes, Method of and Apparatus for Washing and Compressing. E. Porák, Kienberg, Bohemia. Eng. Pat. 12,643, June 9, 1896.

THE claim is for "A method of washing and compressing sulphurous and other gases or fumes, supplied by a sulphur burner or other gas generator, and which consists in sucking the said gases or fumes from the supply pipe by a jet apparatus adapted to force them into a liquid contained in a closed receptacle, and maintaining a continual circulation of the said liquid through the said jet apparatus and receptacle by means of a pump."—E. S.

Aërating Liquids, Improved Apparatus for, especially applicable to Fermenting Tuns and Indigo Vats. F. Grumbacher, Berlin. Eng. Pat. 13,386, June 17, 1896.

"A FERMENTATION and aëration apparatus for the manufacture of yeast, indigo, &c., characterised by the arrange-

ment of a circulation tube provided with an air-conducting tube, the upper end of which circulation tube is provided with a distributing plate and a cap, in such a manner that by the introduction of air in the air-conducting tube, air bubbles are caused in the lower part of the circulation tube and thereby a continuous circulation and aëration of the yeast or indigo fluid, is caused, for the object of bringing about a continuous intimate mixture of the same with the air."—J. L. B.

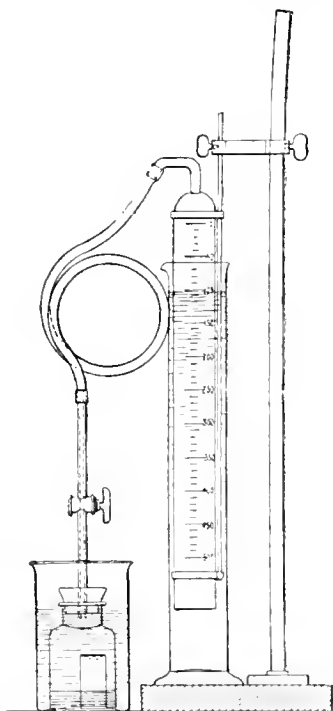
II.—FUEL, GAS, AND LIGHT.

Gas-purifying Material [Oxide], Revivification of. W. Leybold. J. f. Gasbeleuchtung, 1896, **39**, 500—502.

In the revivification of foud iron oxide it is advisable to have the oxide slightly moist, as then the revivification proceeds regularly, and there is less fear of firing than with the dry oxide. It is best to spread the material in layers about 16 to 20 ins. deep.

The author recommends the estimation of the sulphuretted hydrogen evolved when the material is treated with hydrochloric acid as the best means of determining the progress of the revivification. If a determination is made immediately after removal of the material from the purifier and this volume taken as 100, the relative volumes of sulphuretted hydrogen found in subsequent trials, represent the proportion remaining unrevivified.

The estimations can conveniently be made in the apparatus, of which a sketch is given. About 25 grms. of the oxide are quickly weighed (to 0.01 grm.) into the small glass, which is then introduced into the flask containing about 50 c.c. of commercial hydrochloric acid mixed with 50 c.c. of water. The cork is introduced into the bottle and the latter



placed in a beaker of cold water. When the temperature is pretty constant, the eudiometer is raised or lowered till the water-levels inside and out are the same, and then read off. The glass containing the oxide is then upset by slightly shaking the bottle, and when evolution of gas has ceased, the water-levels are readjusted and the gas volume again read off. Care must be taken that the oxide is thoroughly moistened with the acid, and in taking the samples these must be taken from low down in the layer of material, as on the surface the revivification takes place very rapidly.

The following is an example of many determinations:—

	1st Day.	2nd Day.	3rd Day.	4th Day.
Number of times material was turned over.	..	Twice	Twice	..
25 grms. of material yielded c.c. of sulphuretted hydrogen.	243.5	40.6	3.5	0

From samples taken from the surface no sulphuretted hydrogen was evolved after the first day. If it is not wished to follow the progress of the revivification, but merely to determine whether it is complete or nearly so, the usual Bunte burette may be employed in place of the larger one figured.

The progress of the revivification can also be determined, though less conveniently, by determining the percentage of oxygen in samples of air drawn from the centre of the mass. In the same samples as above, the following results were obtained:—

————	1st Day.	2nd Day.	3rd Day.	
Percentage of oxygen ...	0.4	0.5	4.0	
<hr/>				
————	4th Day.	5th Day.	6th Day.	7th Day.
Percentage of oxygen ...	16.0	19.6	20.0	20.4

—L. T. T.

Petroleum, Estimation of the Content of Burning Oil by the Distillation Test. R. Zoloziecki. Chem. Zeit. **20**, [67], 645.

See under XXIII., page 679.

Monazite Sand [Rare Earths], Analysis of; Estimation of Thoria. C. Glaser. Chem. Zeit. 1896, **20**, [63], 612.

See under XXIII., page 675.

Fuel, Determination of Heat of Combustion of. W. Hempel. Zeits. f. angew. Chem. 1896, **12**, 350.

See under XXIII., page 673.

Illuminating Oil, Export of, from Batoum. Melbourne J. of Commerce, 1896.

See under Trade Rep., page 685.

PATENTS.

Water-Gas, Improved Process and Apparatus [Directly connected Generator and Coking Chamber] for Producing. A. J. Boulton, London. From C. Dellwik, Stockholm. Eng. Pat. 13,764, July 18, 1895.

A PROCESS for the manufacture of water-gas from bituminous coal, &c., the characteristic feature of which, is, that the generator and coking chamber are in free and direct communication with each other, and that the generator-gas is burned in a combustion chamber arranged as part of the generator, the heat produced by the combustion causing a dry distillation in the coking chamber, and the products of distillation obtained during the same period being at the same time also burned in the same combustion chamber. The combustion chamber (the upper part of which is filled with loosely piled brick or a checker-work of refractory material intended to retain or store up the heat) is above the generator, and surrounds the coking chamber. This coking chamber is wider at the bottom than the top, and is completely open at the bottom to the generator. The generator being in the first instance filled with coke, and the coking chamber with bituminous coal, the latter becomes coked, and falls into the generator as the fuel in the generator becomes used up, fresh bituminous coal being fed into the coking chamber from time to time. Thus, after the start of the apparatus, only bituminous coal is necessary.

In an alternative form of apparatus, the coking chamber is built on the slant, and the combustion chamber is placed under it.—L. T. T.

Gas, Combustible, Impts. in Apparatus for the Production of [Automatic Oil-Gas Producer]. H. Howell, London. Eng. Pat. 14,469, July 30, 1895.

This patent is for an automatic oil-gas producer. The oil-gas holder is so connected with valves in the pipes conducting the oil to the retort that as the holder fills, the supply of oil is gradually reduced, and *vice versa*.—L. T. T.

Ammonium Carbonate and Acid Ammonium Carbonate, The Manufacture of, from certain Waste or By-Products [Waste Kiln and Blast-Furnace Gases], and Apparatus for Use in such Manufacture. H. R. Lewis, London. Eng. Pat. 14,618, Aug. 1, 1895.

See under VII., page 652.

Gas from Petroleum or other Oil or the like, Impts. in and Apparatus [Vertical Retorts in Pairs] for the Manufacture of. W. Fonlis, Glasgow. Eng. Pat. 15,048, Aug. 9, 1895.

In this process two vertical retorts are used, and the oil is introduced into the first by means of a pipe with a small nozzle, which passes through the top of the retort and terminates about the middle thereof, just over a horizontal plate, so placed that the oil impinging on the said plate is sprayed and becomes vaporised without coming in contact with the hot sides of the retort. The thus partially gasified material passes into the second retort, where gasification is completed. The retorts are surrounded by heating chambers so arranged that the heating may be evenly and easily regulated and controlled.—L. T. T.

Carburetted Water-Gas [Mixture of Coal- and Water-Gas], Impts. in Apparatus for the Manufacture of. The Economical Gas Apparatus Construction Co., Ltd., London, and L. L. Merrifield, Franklin, Massachusetts, U.S.A. Eng. Pat. 15,659, Aug. 20, 1895.

This patent relates to an apparatus in which, in the manufacture of carburetted water-gas, soft or bituminous coal and Canadian, Russian, or other heavy oils can be used without wasting the coal-gas from the soft coal. The principal novelty claimed, beyond special arrangements of

valves, &c., is in the form of the generator. This consists practically of an ordinary generator A^1 with, above it and in direct and free connection with it, a retort B^2 . A^1 is filled with coke, and B^2 with soft coal. In the first blow-up, the heated gases from A^1 pass through the annular spaces S round B^2 , heating it and causing the coal-gas to be generated. This latter passes downwards into the generator and so away with the generator products. The coal in B^2 is thus coked and is ready to fall into A^1 and replace the coke originally therein as the latter is consumed. Fresh coal is fed into B^2 by the hopper Q , in small quantities, after each blow-up.—L. T. T.

Furnaces for Burning Petroleum and Hydrogen, Impts. in or relating to. A. J. Boulton, London. From C. Dusaulx, Suresnes, France. Eng. Pat. 16,713, Sept. 6, 1895.

The furnace is designed so that two concentric petroleum flames, one within the other, shall impinge upon a horizontal metal plate, which is thereby raised to incandescence, and upon which soot deposits. The heat of this combined flame, by conduction of the metal plate and by reason of the contiguity of a water receptacle, generates steam, which, in contact with the incandescent plate and the soot thereon, is decomposed into its elements. The latter instantly recombine, forming an intensely hot flame. The outer petroleum flame is fed with oil by means of a cane or rattan dipping into an oil receptacle and passing through an annular tube. The inner flame is fed from an upper and exterior oil tank by means of a tube passing upwards within the annular tube and having a regulating cock. Its upper or burner end is pointed, and is higher than the outer burner. The latter is surrounded by a truncated cone to induce a draught of air thereto. The inner flame is surrounded by an inverted truncated cone for the same reason, having side openings to allow of the entry of steam from a small annular water-chamber outside.—R. S.

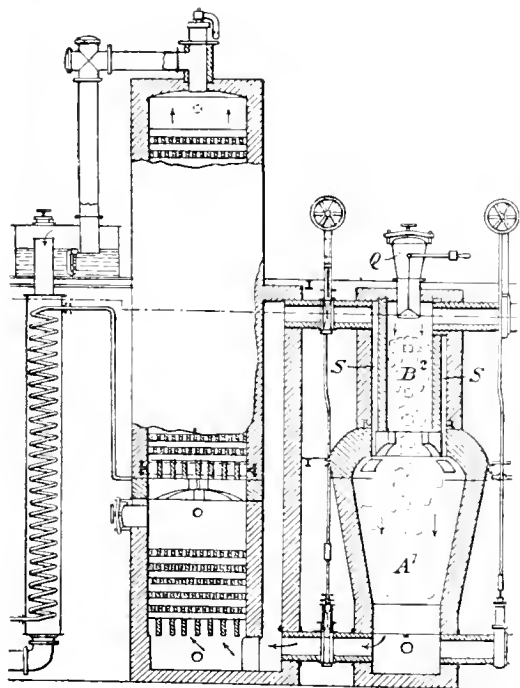
Steam, or a Mixture of Steam and Air, Impts. in or relating to the Economical Production of, for Use in Gas Producers. L. Mond, Northwich, Cheshire. Eng. Pat. 16,781, Sept. 7, 1895.

In his process for obtaining ammonia by the partial combustion of fuel containing nitrogen, with a mixture of air and steam (this Journal, 1886, 235—236; and 1896, 529), the patentee proposed to utilise the heat of this combustion to generate a part of the steam required, and to employ the generated gas from which the ammonia, tar, and steam had been separated, for driving gas-motors.

He now proposes to utilise the waste heat of the exhaust gases of these engines to further heat and load with moisture the mixture of air and steam to be used for the partial combustion of the fuel. This is carried out by alternately passing downwards, through towers or cylinders loosely filled with refractory material, the waste exhaust gases from the engines, and when the refractory material is rendered sufficiently hot, allowing water to pass over it and leading off the steam so formed. Whilst the water is passing downwards and the steam being generated, a current of air may also be admitted at the bottom of the towers and the mixture of air and steam be led off near the top of the chambers.—L. T. T.

Peat Charcoal, An Improved Method of Producing, and Apparatus therefor. O. Rose, Brixton, Surrey. Eng. Pat. 17,568, Sept. 20, 1895.

The peat to be made into charcoal is preferably dried, as described in Eng. Pat. 14,533, 1895, and is then charged into a set of retorts, being passed through each in succession. The retorts are arranged in two horizontal rows of two each. Each retort is the same in length, but the diameters decrease in order from the first, the hottest one, to the last. Within each retort is a hollow shaft about half its diameter, having on its periphery a worm-screw thread, either continuous or broken, and on each side alternately of the thread, and at about every third part of a convolution thereon, is fixed a wedge-shaped projection or blade. The shafts are rotated in the desired direction by ordinary spur gearing. Each retort is provided with a separate outlet for gases or vapours, leading to exhausters



and condensers, whereby the volatile products can be collected, and the process carried on under reduced pressure. The retorts are so fired that the flames from one circulate and do duty under and around the next, and so on to the chimney flue. The first retort being heated to about 900° or 1,000° F., the process is started, the retorts being about half-full of peat. The action of the rotating shafts and worm-screw and blades thereon, results in driving the contents of the first retort towards one end, and forcing it upwards into the second retort, along which it passes to the opposite end. It is next forced through a side opening into the third retort, from which, after passing to its opposite end, it falls into the last retort, and, after travelling to the opposite end, is discharged. The product is afterwards made, if desired, into briquettes.—R. S.

"Spraying" Liquids [Liquid Fuel] under Pressure, Impts. in Apparatus for. L. Rusden and R. Eccles, both of Newcastle-upon-Tyne. Eng. Pat. 17,938, Sept. 25, 1895.

The apparatus consists of:—

Spraying Device.—A central liquid-oil chamber receiving oil under pressure, with an annular steam or gas chamber surrounding it. The oil is caused to have a centrifugal motion by the device adopted. The steam or oil-gas is discharged through an annular "mitre"-shaped orifice surrounding the nozzle, the quantity being regulated by a "mitre"-shaped plug, which can be opened or closed by an external hand-wheel.

Automatic Valve.—This adjusts and keeps uniform the pressure on the liquid fuel delivered to the spraying device.

Gas and Oil Separator.—Where the oil passes through a heating coil, so as to generate gas to be used instead of steam in the spraying device, the oil and gas are separated by passing them together into a vertical cylinder furnished with a "float" which in its normal position opens a valve to allow the gas only to pass "onwards," while the oil flows out through the lower end. Both then pass to the sprayer by way of a hinge connection piece, so that the burner can be readily withdrawn from the furnace when necessary.

Accumulator.—The oil, before passing to the sprayer, enters a receiver which forms an air vessel or elastic accumulator, the pressure on the liquid fuel being kept uniform by means of the valve above.—R. S.

Liquid Fuel, An Apparatus for Projecting it intimately mixed with Air and Steam, in a State to be Burnt for Heating Steam Boilers and for other Purposes. C. J. Fox, King's Cross Road, London. Eng. Pat. 18,248, Sept. 30, 1895.

"A LIQUID fuel projector is employed, in which the central air passage is surrounded by an annulus from which liquid fuel issues, this again being surrounded by an annulus supplied with steam, which issues as a tubular jet, and carries forward with it, as a compound combustible jet, the liquid fuel and air."—R. S.

Cyanides and other Compounds, Improved Process for the Extraction of, from Illuminating and other Gases. F. Livesey, London. Eng. Pat. 18,334, Oct. 1, 1895.

The apparatus employed consists of a close cylinder, provided with perforated rotating discs in combination with pockets, which at each revolution of the shaft carrying the discs, dip into a suitable liquid for absorbing the compounds to be removed, and deliver it in thin films as they rise, which descending films of liquid intercept the passage of the gases, these being led through the perforated discs.—E. S.

Coke Ovens, Impts. in Horizontal. A. Hüssener, Essen a Ruhr, Prussia. Eng. Pat. 6999, March 31, 1896.

This invention relates to horizontal coke ovens having horizontal heating channels, and worked for the extraction of the by-products, the improvements consisting in the arrangement of the heating channels or flues and of the partition walls between each two coking chambers, and, where heated air is used, the arrangement of channels for heating it. Each oven chamber has two separate heating-channel systems, one on the right, the other on the left, and each consisting of a sole channel through which the heating-

gases pass, and from which they ascend to the highest of a series of four zig-zag communicating horizontal wall channels, the lowest of which is a waste-heat connecting channel leading to a common waste-heat collecting channel. The partition wall between each pair of oven chambers consists of a central massive wall, taking the whole pressure of the superstructure and of the oven arch, with projections on each side for supporting thin slabs serving as the side wall of the oven chamber, and leaving spaces between itself and the central wall forming the heating channels. Where heated air is employed, the waste-heat collecting channels have air channels arranged between them in the lower part of the foundation of the oven, extending at one end through the front wall to the open air, and communicating at the other end with pipes for leading the heated air to the gas supply entering the heating channels.—R. S.

Gas-enriching Apparatus, Impts. in. G. G. Schroeder, Washington, D.C., U.S.A. Eng. Pat. 7226, April 2, 1896.

This consists of a carburettor, with two compartments, the one containing the oil for carburetting, the other filled with sponge saturated with any suitable purifying liquid. The gas to be carburetted is introduced into the oil compartment through a "vertically swinging gas-supply pipe" which ends in a hemispherical deflecting plate with a float attached. This ensures that the gas always passes through the same thickness of carburetting oil, and also actuates a valve on the oil supply, and so keeps the level of the oil constant.—L. T. T.

Gas, Lighting and Heating, Impts. in Apparatus for Making. J. Sibley, Westerham, Kent. Eng. Pat. 9922, May 9, 1896.

A MODIFICATION of an oil-gas plant intended for country houses and small installations.—L. T. T.

Scrubber Washers for removing Impurities from Gas, Impts. in. H. Kirkham, London. Eng. Pat. 10,822, May 19, 1896.

IN some scrubbers, drums or wheels comprising metal discs having between them, material to afford additional scrubbing surface, are caused to rotate in closed tanks having in their lower parts water or liquor, in passing through which the scrubbing surfaces are wetted preparatory to the gas flowing in contact with such surfaces. It is proposed in such scrubbers to enclose the said material in specially constructed and easily removable cages or baskets fitting between the said discs. The material may thus be more easily renewed.—L. T. T.

Hoods, Mantles, or Gratings for Incandescent Gas-Lights. W. L. Voelker, Elizabeth, New Jersey, U.S.A. Eng. Pat. 13,256, June 16, 1896.

THE object of this invention is to make the filament of which the mantle is composed of such tensile strength that it can be easily handled by ordinary weaving or braiding machinery. The filament is formed in the usual manner, as by combining the incandescing oxide with a viscous material, and is then, when sufficiently dry, covered with a thin cotton braid; or it may be by right- and left-hand spiral winding; or strands of cotton yarn or other combustible fibres may be placed along the filament, and the cover afterwards run on spirally.—R. S.

Acetylene Gas-Generator and Container, A New and Improved. F. S. Thorn and C. Hoddle, both of London. Eng. Pat. 3142, Feb. 12, 1896.

The generator consists of a bell-gasometer having the carbide in a perforated vessel, fastened to and depending from the dome of the bell. If excess of acetylene accumulates in the generator, the bell is raised and the carbide simultaneously removed from the water.—L. T. T.

Acetylene Gas, Improved Process and Apparatus for Purifying [Scrubbing with Alkaline and Acid Solutions]. E. F. J. C. Pauweraerts, Brussels. Eng. Pat. 11,706, May 29, 1896.

This purifying process consists: "First, in cooling the acetylene gas, and in absorbing the impurities thereof by

means of a suitable absorbing agent, such as caustic lime or lime hydrate saturated with sulphate of iron and mixed with sawdust. Secondly, in passing the gas through water which has been acidulated with 50 per cent. of hydrochloric, nitric, acetic, citric, or salicylic acid for the purpose of removing the ammonia from the gas. Thirdly, in removing the acidity of the gas by means of a suitable absorbent, such as caustic soda or potash; and, fourthly, in drying the gas in a suitable material, such as sawdust, bran, or other absorbent material."

It is claimed that the gas so purified is improved in illuminating power, free from smokiness, and may safely be liquefied in an ordinary compression pump.—L. T. T.

Acetylene Gas, Apparatus [Two Connected Vertical Chambers] for the Generation of. E. F. J. C. Bauweraerts, Brussels. Eng. Pat. 11,708, May 29, 1896.

This consists of two vertical chambers communicating at top and bottom, the bottom connecting pipe having a tap or valve in it. The carbide is placed in a pail having grooved perforations; the water is placed in the other vertical chamber, and is admitted by the valve in the communicating pipe.—L. T. T.

Acetylene Gas [Generator], Impts. in the Manufacture or Production of, and in Apparatus therefor. H. A. Derooy, jun., Paris. Eng. Pat. 12,683, June 9, 1896.

This apparatus consists of two or more chambers containing the carbide in perforated pails or other suitable removable vessels, and so arranged that as one chamber becomes exhausted, the water is intended to pass on to the second.—L. T. T.

Hoods or Mantles for Incandescence Gas-Lights, Process of Manufacturing. W. L. Voelker, Elizabeth, New Jersey, U.S.A. Eng. Pat. 13,255, June 16, 1896.

The hoods are partially dried and then put into a furnace which is hotter than that of the flame to which they will be subjected when in use. The required temperature of the furnace is about 3,500° to 4,000° F. By rapidly heating the mantles to this temperature, they are not distorted in shape, and when in use on burners the flame has no perceptible destructive action thereon. The hoods are preferably heated in batches of from 25 to 30 in a gas furnace, such as one used for melting platinum, which is only just large enough to take the batch.—R. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Aluminium Chloride, Action of, on Benzene containing Thiophene. E. Boedtker. Comptes rend. 1896, 123, 310—311.

In preparing cumene by Friedel and Crafts' reaction from the so-called "crystallisable benzene" of commerce, the author has always observed a considerable disengagement of hydrogen sulphide; this he attributes to the presence of thiophene, which he always finds to be present in such benzene. When the benzene is heated with aluminium chloride, hydrogen sulphide and hydrogen chloride are disengaged, and if the product be washed with water and the benzene removed by distillation, a brown fluorescent liquid is obtained, which boils above 300°. This substance contains traces of sulphur, but it does not give the thiophene reaction. The author believes it to contain both the benzene and thiophene nuclei.—A. K. M.

Petroleum Products, Influence of Sunlight and Air on. Capacity of Petroleum for Absorbing Atmospheric Constituents. R. A. Ostrejko. Trudy bak. otd. imp. russk. techn. obschtsch. 1896, 10, [6], 1.

In the continuation of his researches (this Journal, 1896, 26 and 345), the author found that crude solar oil distillate under the same conditions, absorbed the air in the eudiometer tube in 12 days, and deepened in colour from 3 to 2 mm. on the colorimeter scale in 40 days, whereas refined

distillates required in one case 14, and in another 41 days for the absorption of the air, the colour changing from 33 to 7 mm. and from 58 to 6½ mm. respectively: the acidity was about double.

The experiments were also extended to the absorptive capacity of petroleum for carbon dioxide, nitrogen, oxygen, hydrogen, and nitrogen monoxide. At the end of 9 hours' exposure in the dark, nitrogen monoxide, carbon dioxide, and oxygen were found to have decreased in volume, but the converse was noticed with nitrogen and hydrogen, and the same results were obtained by a further 32½ hours' exposure in the dark. On the admission of light, absorption proceeded in all cases, the following times being required for completion: nitrous oxide, 3½ hours; carbon dioxide, 4 hours; oxygen, 8 hours; nitrogen, 2 days (1 hour longer than air); hydrogen, 4 days. This faculty of petroleum for absorbing gases may exert an influence on its composition; e.g., oxygen may be absorbed from underground- or rain-water by contact, and thus form petroleum acids, and it may be that other chemical substances are communicated to the oil in a similar manner, the probability of which discounts the value of hypotheses on the origin of petroleum based on its chemical composition.—C. S.

Ammoniacal Gas Liquors, Desulphurising. Chevalet. Rev. Chim. industr. 7, [79], 203.

The presence of sulphur in the crude ammoniacal liquor from gasworks is prejudicial to the quality of the nitrate and chloride of ammonium manufactured therefrom, causing, in the former case, nitrites—undesirable in powder on account of their hygroscopicity—and, in the latter, thiocyanate of ammonium, which, on account of its decomposability by the electric current, unfits the ammonium chloride for telegraphic purposes. The sulphur may, however, be readily and cheaply removed by allowing the liquor to pass slowly through a scrubber containing iron turnings oxidised in moist air (instead of the ordinary wood shavings), the iron oxide combining with the sulphur in the liquor. The operation may be rendered continuous by passing a current of air through the scrubber to oxidise and regenerate the sulphide of iron. To prevent loss of ammonia by this aeration, a small scrubber containing wood shavings moistened with water is connected with the apparatus.

The effluent liquor is clear, and has lost all trace of sulphur. When treated with lime, the ammonia obtained is purer than that from crude liquor, and does not smell of gas; and when distilled with sodium carbonate, the concentrated liquors are free from thiocyanates, which remain in combination with sodium in the residual liquid.—C. S.

Ketopentamethylene [Wood Tar], Condensation with Aldehydes. D. Vorländer and K. Hohohm. Ber. 1896, 29, 1836.

See under XXIV., page 682.

Phenol, Methods for the Quantitative Estimation of. G. Frerichs. Apoth. Zeit. 1896, 11, 415.

See under XXIII., page 680.

Petroleum, Determination of Sulphur in. Aufrecht. Pharm. Zeit. 1896, 41, 469.

See under XXIII., page 680.

Paraffin in Petroleum, Estimation by Zulozicki's Method. K. W. Charitshkow. Trudy bak. otd. imp. russk. techn. obschtsch. 1896, 11, 204.

See under XXIII., page 680.

Petroleum, Application of the Acid Test. Trudy bak. otd. imp. russk. techn. obschtsch. 1896, 11, 181.

See under XXIII., page 678.

Materials for Denaturing Spirit. Chem. Zeit. 1896, 533.

See under Trade Rep., page 685.

PATENTS.

Mixing and Agitating Machinery for dealing with Liquids and the like, Impts. in. E. A. Brotherton and F. G. Holmes, Leeds. Eng. Pat. 16,801, Sept. 9, 1893.

See under I., page 641.

Waste Materials obtained in the Manufacture of Ammonium Compounds: Improved Process or Treatment of, to Produce a Substance for Use as a Paper Filling in the Manufacture of Paper. W. Brothers, Rawtenstall, Lancaster. Eng. Pat. 18,503, Oct. 3, 1893.

See under XIX., page 668.

IV.—COLOURING MATTERS AND DYES.

Benzylated Parafuchsin. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1896, 251—259.

THE influence of benzyl groups on the colours of the substitution derivatives of parafuchsin, is less than that of methyl groups.

The compounds which are produced when the dehydrating agent employed for the preparation of the leuco compounds is sulphuric acid, differ in colour from those prepared by the use of alcoholic hydrochloric acid or zinc chloride.—E. B.

Safranines, Constitution of. O. Fischer. Ber. 29, 1870—1873.

COMMENTING ON Nietzki's last paper (this Journal, 1896, 537), the author points out that the sole argument in support of the azonium formula is the strong basicity especially of the acetyl safranines. It has, however, been shown by Fischer and Hepp that the supposed strong basicity of this class of compounds is delusive, the similarity in colour of the salts and bases, and the solubility in water of certain safranine bases, appearing to support this view. The author has decomposed with dilute sodium carbonate the hydrochlorides of acetylposafranine, diacetylphenosafranine, and acetylrosinduline. The last-named salt, which is yellow, is directly decomposed by sodium carbonate solution, the base separating as a violet-red precipitate, which becomes crystalline and bronzy on standing. In the case of acetylposafranine hydrochloride, the addition of soda-lye in strong solutions gives evidence of decomposition by the change of colour, but even with weak solutions (1:1,000) and also with sodium carbonate decomposition takes place, and may be demonstrated by extracting the base with ether. It is, however, not clear why certain salts of the safranines, especially the carbonates, are not at once decomposed. Possibly it is an inherent property of the *p*-quinone group, or it may be that the phenazine molecule has acquired pyridine properties owing to the attachment of a phenyl group to a nitrogen. The following facts support the *p*-quinonoid formula for the safranines:—1. Their formation from the indamines. 2. Their easy conversion into anilides, &c., similar to the conversion of *p*-quinone into quinone anilide. 3. Aposafranine contains no hydroxyl. 4. Safranin only contains one hydroxyl. 5. Aposafranine is a weak base. 6. No free amino group can be detected in the salt of aposafranine. 7. The formation of an inner anhydride between the ammonium hydroxide and an amino group in the meta position according to Nietzki's view, is improbable.—T. A. L.

Phenazine, Formation of. O. Fischer. Ber. 29, 1873—1876.

THE method employed by the author and O. Heiler (Ber. 26, 383; this Journal, 1893, 751) for obtaining phenazine by heating *o*-amidodiphenylamine with lead oxide has been applied for the production of other azine derivatives. By reducing *o*-nitrophenyltoluidine (Schiff, Ber. 23, 1842; this Journal, 1890, 931) with alcoholic ammonium sulphide under pressure at 120° C., *o*-amidophenyl-*p*-tolylamine is obtained, which crystallises from petroleum ether in plates melting at 76—77° C. When distilled over red-hot lead oxide, *p*-tolylphenazine is formed, which melts at 117° C.,

identical with the product obtained by condensing pyro-catechin with *o*-tolylene diamine (Ber. 19, 726). By oxidising diamidodiphenylamine—



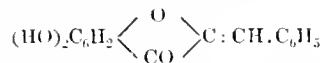
Nietzki and Bauer (Ber. 28, 2979) obtained the *p*-amido-phenazine of Fischer and Hepp, but could not obtain it from the isomeric compound (4.2.1)(NH₂)₂.C₆H₃.NH.C₆H₄. Nietzki concluded from this that a diphenylamine in which one nucleus was unsubstituted, or only substituted in the meta position, could not give an indamine or an azine. The author, however, finds that the lead oxide method easily gives amidophenazine, melting at 274° C. (F. and H., 265° C.). In the same manner, dinitro-*p*-methoxydiphenylamine (from bromodinitrobenzene and *p*-anisidine), melting at 141° C., after reduction to diamido-*p*-methoxydiphenylamine, melting at 119° C., gives, on heating with lead oxide, *p*-amidomethoxyphenazine—



melting at 217° C., which is the methyl ether of the amido-oxyphenazine, melting at 268° C., obtained by Nietzki and Simon (Ber. 28, 2975).—T. A. L.

Chloracetylpyrogallol, Action of Benzaldehyde on. L. Kesselkaul and St. v. Kostanecki. Ber. 29, 1886—1891.

IN a paper on the preparation of flavone derivatives, Friedländer and Rüdert (Ber. 29, 878) have described a compound as 3,4-dihydroxyflavone, which they obtained by the action of benzaldehyde on chloracetylpyrogallol. In view of Kostanecki and Tambor's work (Ber. 29, 237), this conclusion was open to objection, and the compound obtained is an oxindogenide of the formula—



This substance, benzalanhydroglyceogallol, which the authors have prepared, crystallises in golden-yellow plates melting at 221° C. It is not an oxyflavone, since it gives orange shades on an alumina mordant, and dissolves in concentrated sulphuric acid with a deep orange colour, whilst all known oxyxanthones and oxyflavones dissolve with a pure yellow colour, giving occasionally fluorescent solutions. The diacetyl derivative and the diethyl ether of the compound have been prepared, the former (colourless needles) melting at 201° C., and the latter (yellow needles) at 115° C. The product has also been obtained by the action of benzaldehyde on anhydroglyceogallol. Since the oxindogenides like the indogenides are coloured, it would appear that the chromogen of indigo is—



of which the synthesis has been undertaken. This substance contains an open α -naphthoquinone ring, a fact which may have some bearing on the colouring properties of indigo.

—T. A. L.

Quercetin [Dye-stuff] in the Outer Skins of the Bulb of the Onion (Allium Cepa). A. G. Perkin and J. J. Hummel. Proc. Chem. Soc. 1896, [168], 144—148.

LEITCH (Farben und Färbekunde, 1825, 1, 431) has described the dyeing properties of these skins. The colouring matter was obtained by the authors in the form of glistening yellow needles of the formula C₁₅H₁₀O₇, which yielded compounds with mineral acids; the sulphuric acid compound C₁₅H₁₀O₇.H₂SO₄ was analysed. On acetylation, a compound, C₁₅H₁₀O₇.(C₂H₃O)₅, forming colourless needles, melting point 190—191°, was obtained, and by decomposition with fused alkali, phloroglucin and protocatechuic acid formed the principal products. With mordants it dyed shades similar to those given by quercetin, the colouring matter of quercitron bark. It was thus proved to be identical with this substance.

Comparative dyeing experiments showed that the colouring matter of onion skins was quite equal to that of such well-known dyestuffs as old fustic and quercitron bark.

Sicilian Sumach, The Colouring Matter of, Rhus Coriaria. A. G. Perkin and G. Y. Allen. Proc. Chem. Soc. 1896, [168], 157.

SUMACH, which consists of the dried and powdered leaves of the genus *Rhus*, especially *R. coriaria* (Sicilian), and *R. cotinus* (Venetian sumach), is used in tanning, and also in dyeing and calico printing, on account of the tannin matter it contains, which according to Lowe is gallotannic acid (Fresenius, Zeit. anal. Chem. 12, 128). According also to Chevreul, it contains a yellow colouring matter (Watts' Diet. Chem. 1874, 5, 614). Lowe (Zeit. anal. Chem. 12, 127), who examined the different varieties of sumach, stated that they contain quercetin and quercitrin, but this is certainly incorrect as regards Sicilian sumach.

The colouring matter, $C_{15}H_{10}O_8$, forms glistening yellow needles, having dyeing properties similar to those of quercetin and fisetin, but is distinguished from these by its colour reactions with dilute alkalis. Reactions show it to be identical with *myricetin*, the colouring matter of *Myrica nagi*. Sicilian sumach also contains some quantity of free gallic acid.

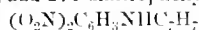
PATENTS.

New Diamido Bases, Derivatives of Azimidobenzene and of Azo [Cotton] Dyes from these. Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst-on-the-Maine, Germany. Eng. Pat. 17,639, Sept. 21, 1895.

THE bases employed are obtained from the products formed by the action of 2,4-dinitrochlorobenzene on aniline or *o*-toluidine, yielding 2,4-dinitrodiphenylamine—



melting at 156° C., and 2,4-dinitrophenyl-*o*-tolylamine—



of which the correct melting point is 123° C. On reduction with an alkaline reducing agent in alcoholic solution, only the nitro group adjacent to the imido group is reduced, yielding respectively nitro-amidodiphenylamine (dark red needles and plates from alcohol), melting at 117° C., and the corresponding tolylamine derivative, melting at 121° C. Both these substances, when treated with nitrous acid, yield azimidobenzene derivatives, melting at 167° C. and 115° C. respectively. On nitration in sulphuric acid solution, corresponding dinitro compounds are obtained, melting at 190° C. and 201° C. Finally, these substances, on reduction, are converted into diamido bases which melt at 153° C. and 155° C., and, after conversion into their tetrazo derivatives, can be combined in the usual manner with amines, phenols, and their derivatives. For instance, one molecular proportion of the tetrazo compound can be combined either with two similar or different molecular proportions of a dyestuff component yielding yellow, red, violet, or orange dyestuffs. If, however, the tetrazo compounds be first combined with α -naphthylamine, its 1,3' or 1,2' sulphonie acids, or with such derivatives capable, after combination, of further diazotisation, then on treatment with nitrous acid, diazo compounds are obtained which, when combined with the usual components, yield blue and violet to black dyestuffs. The second diazotisation can be performed on the fibre. By combining the tetrazotised diamido bases with dihydroxynaphthalene mono- or disulphonie acid or with an amidonaphthol mono- or disulphonie acid, products are obtained, which will combine with one or two molecular proportions of a diazotised amine or its sulphonie acid. Different products are obtained according as to whether the combinations are carried out in an alkaline solution or in presence of acetic acid. The colouring matters obtained according to this invention are said to be fast to light and soap, and are suitable for dyeing evenly, not only un mordanted cotton, but also mixed goods, such as half wool and half silk. —T. A. L.

New Mordant-dyeing Colouring Matters [Yellow], The Manufacture and Production of. B. Willeox, London. From "The Badische Anilin und Soda Fabrik," Ludwigshafen, Germany. Eng. Pat. 17,660, Sept. 21, 1895.

THESE colouring matters are obtained by oxidising aromatic hydroxycarboxylic acids in sulphuric acid solution, either by means of a persulphate or by an electric current (see also Eng. Pat. 17,260, 1895; this Journal, 1896, 588). About 10 kilos. of symmetrical *m*-dihydroxybenzoic acid are dissolved in 200 kilos. of cold sulphuric acid of 95 per cent., and 15 kilos. of ammonium persulphate are added to the solution, the temperature being kept below 50° C. After 12 hours' agitation, the melt is stirred into 1,000 litres of water, and the colouring matter is filtered off, being kept for use in the form of a paste. According to the electrolytic process, 10 kilos. of the dihydroxybenzoic acid dissolved in 40 kilos. of 63 per cent. sulphuric acid are placed in the electrolytic cell containing the positive electrode. The negative electrode, separated by a suitable diaphragm, is immersed in sulphuric acid. An electric current of 20 amperes per sq. dec. of anode surface at about 8 volts, is passed through the solution, which is kept constantly agitated and at about 25° C. When the reaction is complete, the melt is poured into water and worked up as above. The resulting product is identical, and gives strong, fast yellow shades on wool mordanted with chrome or alumina. Cotton mordanted with alumina is also dyed yellow. The colouring matter, which is scarcely soluble in water even on boiling, forms a yellow or greenish-yellow paste which dries to a greenish-yellow powder soluble in and crystallisable from alcohol or glacial acetic acid. The following acids can also be employed for the purpose of this invention: salicylic acid, *m*- and *p*-hydroxybenzoic acid, cresotic acid, symmetrical *m*-dihydroxybenzoic ethyl ether or anilide, gallic acid, gallic ethyl ether, gallamic acid, gallanilide, tannin, protocatechuic acid, β -resoreylic acid, or the like. —T. A. L.

Sulpho Acid which may be Employed in the Production of Colouring Matters, Impts. in the Manufacture of. I. Levinstein and Levinstein, Ltd., Manchester. Eng. Pat. 20,548, Oct. 31, 1895.

By heating dihydroxynaphthalene sulphonie acid G (Eng. Pat. 9642 of 1889; this Journal, 1890, 609) with aniline and aniline hydrochloride or with toluidine and toluidine hydrochloride, one hydroxyl group is replaced, and there results phenyl- or tolylamidonaphthol sulphonie acid. For instance, 26 kilos. of the sodium salt of dihydroxynaphthalene sulphonie acid G, 25 kilos. of aniline hydrochloride, and 100 kilos. of aniline, are heated to 160° C. for 2—3 hours. The melt having been made alkaline, the excess of aniline is driven off, and the filtered solution is run into water acidulated with hydrochloric acid. The phenylamidonaphthol sulphonie acid separates out as a grey precipitate, and, after filtering and washing, may be used directly for the production of azo dyestuffs. A colouring matter dyeing unmordanted cotton olive-brown, is obtained by combining tetrazotised dianisidine with salicylic acid and aniline, diazotising the product so obtained, and combining this with an alkaline solution of phenylamidonaphthol sulphonie acid. —T. A. L.

Substantive Cotton Dyestuffs from Benzidine Sulpho-Acids, Manufacture of. H. Inray, London. From F. Petersen and Co., Schweizerhalle, Bâle, Switzerland. Eng. Pat. 13,713, June 22, 1896.

THE benzidine sulphonie acids of Griess (Ber. 14, 200), when combined with γ -amidonaphthol sulphonie acid, yield products which, after diazotisation and combination with various components, give valuable colouring matters, which in some cases are considerably stronger than the corresponding derivatives obtained from the non-sulphonated benzidine base. The diazotisation and development can also take place on the fibre by dyeing the fabric with the colouring matter obtained from the tetrazotised benzidine sulphonie acid and γ -amidonaphthol sulphonie acid. The two sulphonie acids of Griess produce very similar effects, but slightly bluer shades are obtained from the more soluble acid. A blue-black colouring matter for cotton fast to

light and washing, is formed by combining the tetrazo compound from one of the Griess sulphonic acids, corresponding to 10 kilos. of nitrite with an alkaline solution of 34 kilos. of 7-amidonaphthol sulphonic acid. The new intermediate compound, after diazotisation, is combined with 23 kilos. of *m*-phenylenediamine, when it forms a black precipitate. The dyestuff is readily soluble in water, but insoluble in alcohol. It dissolves in sulphuric acid to a bluish-green solution, which gives a black precipitate on dilution. The reddish-brown aqueous solution gives a reddish-brown precipitate with hydrochloric acid, and a brown precipitate with caustic soda.—T. A. L.

New Disazo, Trisazo, and Polyazo [Blue and Black] Colouring Matters, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 13,744, June 22, 1896.

By combining diazo compounds of the general formula $(1.N:N.C_6H_4.COX)$ (in which X may be hydrogen, a hydroxyl, an alkoxy, an amido, alkyl, or alkyl-amido group), with the 1.1'.3.3', 1.1'.4.3', or 1.4'.3.2' amidonaphthol disulphonic acids, products are obtained, which, although of little value as colouring matters, can be employed for the production of disazo, trisazo, and polyazo dyestuffs. The diazo compounds are obtained from the *o*-, *m*-, and *p*-amidobenzaldehydes, the *o*-, *m*-, and *p*-amidobenzoic acids, their ethers and amides, and, after combination with one of the above-named acids, an azo colouring matter of the general formula $XOC.C_6H_4.N:N.C_{10}H_7(OH)(NH_2)(SO_3Na)_2$ is obtained. These products act as a dyestuff component in a diazo or tetrazo combination, and they may be employed in the various stages usual in such combinations. Since also they contain a CO group, they are capable of reacting with aromatic hydrazines, and the hydrazone azo-colouring matters thus obtained dye unmordanted cotton and wool heavy dark blue, black, and green shades. The specification contains a large number of examples, of which the following may be taken as typical. (1.) The product obtained by combining the diazo compound from 6.1 kilos. of *p*-amidobenzaldehyde with 16 kilos. of 1.1'.3.3' amidonaphthol disulphonic acid is combined in a solution made alkaline with sodium carbonate with the tetrazo-ditolyt obtained from 10.6 kilos. of toluidine. When the formation of the intermediate product is complete, a solution of 6.5 kilos. of *m*-tolenylenediamine is added and allowed to stand 12 hours, when the colouring matter is separated in the usual manner. It dyes unmordanted cotton black. (2.) The diazo compound from 6.1 kilos. of *p*-amidobenzaldehyde is combined with 16 kilos. of amidonaphthol sulphonic acid in acetic acid solution; when the combination is complete, 5.4 kilos. of phenylhydrazine are added and the whole is heated to 60–70° C. for two hours, when the red colour of the solution gradually changes to blue. After making alkaline with sodium carbonate and cooling, the tetrazo solution from 9.2 kilos. of benzidine is run in. The formation of the intermediate compound is complete in about two hours, when it is mixed with a solution of 16 kilos. of 1.1'.3.3'-amidonaphthol sulphonic acid, made alkaline with sodium carbonate. After standing a considerable time, the whole is heated, and the colouring matter is salted out, filter-pressed, and dried. It dyes unmordanted cotton blue.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Woollen Goods, Use of Ammonia in Washing. Textile Colorist, 1896, 18, 207.

IN using ammonia for washing woollen goods after fulling, part of the diluted ammonia is added at the beginning to loosen the dirt, and part when most of the dirt and lather have been washed out; this second addition assists the removal of the soap. Some ammonia may also be added to the solution of fuller's earth used for the final washing. The strength of the ammonia used, varies with the different shades, i.e., light shades require weaker ammonia. Reds, especially those dyed with Brazil wood, madder, or cochineal, will not stand washing with ammonia. Care should be

taken that the material, whilst wet with ammonia, does not come into contact with any metallic parts of machinery, &c., as this would occasion dark stains on the pieces.—A. S.

Woollen Goods, Waterproofing of. Textile Colorist, 1896, 18, 206.

THE two principal methods of waterproofing woollen goods are:—

1. Treating the goods upon the washing machine with a solution of aluminium acetate, prepared by making a solution of 3 kilos. of alum and 3 kilos. of lead acetate in 100 to 200 litres of water, allowing to settle, and then drawing off the clear solution of the aluminium acetate.
2. Steep 100 parts of glue (preferably animal glue) in cold water until it has absorbed twice its weight thereof, pour off the excess of water, and heat the glue to boiling. Stir into the boiling glue 5 parts of tannin and 2 parts of silicate of soda, and then add 100 parts of alum dissolved in 100 parts of boiling water. When the ingredients are thoroughly mixed together, allow to cool. Boil 1 kilo. of the gelatinous mass thus obtained, for 3 hours with 10 to 12 kilos. of water, replacing the water which evaporates. Cool down to 80° C., pour into a sizing machine, and pass the goods through. Dry at about 55° C., and finally press upon the cylinder at 50° C.—A. S.

PATENTS.

Removing Tar, Pitch, Oil, Grease, and Similar Matter from Wool, Fur, and the like: An Improved Method of and Apparatus for. S. W. Wilkinson and The Grove Company, Ltd., London. Eng. Pat. 16,143, Aug. 28, 1895.

THE grease, tar, &c., derived from natural or other sources, is extracted by means of a suitable volatile solvent, the most effective being benzol boiling below 100° C. or carbon bisulphide. The felt is placed in a closed vessel which is capable of withstanding a certain amount of pressure, and which can be heated by means of a steam jacket or hot-water coil. This is connected by means of a distributing pipe with a suitable vessel, in which the solvent is heated and volatilised. The felt is permeated by the hot solvent, which subsequently condenses and is siphoned back into the boiler. The solvent remaining in the fibres of the felt after the extraction is complete, is removed by heating the extractor, condensing the vapours, and returning the liquid to the boiler, suitable communicating pipes, with cocks, valves, or the like, being provided for the purpose.

—C. A. M.

Effluent Waters of Wool-washing Machines and the like, New or Improved Method of and Apparatus for Removing Fatty Matters from the. J. Holmes, Bradford; H. E. Tankard and W. Scaife, Laisterdyke. Eng. Pat. 18,239, Sept. 30, 1895.

THE effluent from the washing machine is run into a tank or tanks containing perforated pipes, through which an air blast is driven by means of a fan, blower, or pump. The froth or foam thus produced consists chiefly of the fatty matters. It is collected, preferably, by means of an endless travelling band of wire gauze or other suitable material, whence it is removed by a revolving roller and scraper, and delivered into a suitable receptacle.—C. A. M.

Mineral-Oil Stains, Improved Process for Removing [with Aniline Oil or Phenol], from Vegetable Fabrics. J. Y. Johnson, London. From S. Wallach and Co. and E. Schweitzer, Müllhausen, Alsace. Eng. Pat. 24,643, Dec. 23, 1895.

THIS patent is based on the property possessed by certain substances—such as aniline, crude aniline oil, phenol, and others; also resin oil, Turkey-red oil, and the like—of removing from vegetable fibres the mineral oil stains acquired in the process of weaving. The best results are obtained by using small quantities of aniline, aniline oil, or phenol, which will readily dissolve in a solution of any kind of soap. Cotton fabric may either be steeped in a solution of 6 litres of aniline or aniline oil, 100 litres of water, and 4 to 5 kilos. of soap before being transferred to the bucking

tub, or the pieces of fabric may be placed in the bucking tub or lye-boiler, and the lye with the aniline or other solvent, introduced. From 10 to 15 litres of aniline, or from 6 to 7 litres of phenol, will generally suffice for 2,000 kilos. of material. It is claimed that material thus treated acquires far less yellow tinge in the process of steaming than do fabrics bleached by the present method, and that the firmness or strength of the fibre is not diminished.

—C. A. M.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Chlorine Baths [Cotton Bleaching], The Addition of Acid to. Leipziger Färber Zeit. 45, 248.

In order to increase the effectiveness of a bleaching-powder solution, an addition of hydrochloric or sulphuric acid is frequently made. Lunge recommends for this purpose, the use of acetic or other organic acid, *e.g.*, lactic or formic acid. The expense is not great, since, after the first addition, very small further quantities are necessary, the acid being regenerated during the bleaching process. When acetic acid is used, hypochlorous acid and calcium acetate are at first formed; the former during bleaching is converted into hydrochloric acid, which does not remain in the free state, but at once acts upon the calcium acetate, forming calcium chloride and liberating acetic acid. When this process is adopted, the customary "souring" after treatment with bleaching powder can be omitted, thus obviating the risk of tendering the fibre through the action of a mineral acid. Acetic acid may, however, be applied subsequently to the bleaching-powder solution instead of in the same bath, or the goods may be worked in water acidulated with acetic acid and the clear bleaching-powder solution gradually added. When alkali remains in the material from the "ley boil," or when hard water is employed, sulphuric acid may be used in just sufficient quantity to effect neutralisation, the liberation of hypochlorous acid being effected as before by the weaker organic acid.

—R. B. B.

Starch, The Oxidation of [for Cotton Finishing].

O Schmerber. Bull. Soc. Ind. Mulhouse, 1896, 238—241.

With a view to effect the oxidation of starch by purely chemical means, the author instituted a series of experiments with various oxidising agents, namely, bleaching powder, chloric acid, magnesium dioxide, chromic acid, and potassium permanganate. The last of these was found to give the best result. The method eventually adopted, consists in placing in a vat of 1,000 to 1,500 litres capacity, 100 kilos. of starch and 100 litres of water, stirring to get the starch well into suspension, and then adding a solution of 500 grms. of potassium permanganate in 20 litres of warm water. The mixture becomes successively red-violet, pale brown, and dark brown in colour. It is left for 24 hours, and 4–5 litres of hydrochloric acid, diluted with 20 times as much water, are then added to it. The mixture is stirred whilst the acid is introduced, and at intervals afterwards, until the starch is obtained in a colourless condition. The product is then washed by decantation to remove the acid and manganous chloride, and is dried.

The starch thus oxidised, gives a paste which is more liquid and transparent than that which is obtained from the same starch in its ordinary state. On standing, the paste becomes opaque, but it reassumes its transparency when heated. It is considered probable that oxidised starch will find useful application in the processes of finishing and printing cotton fabrics.—E. B.

Starch, The Oxidation of. E. Dolfus and F. Scheurer.

Bull. Soc. Ind. Mulhouse, 1896, 241—245.

A REPORT on the paper (see preceding abstract) of Schmerber. The authors have repeated the experiments described by that chemist, and find that the starch, treated in the way he recommends, yields a paste, or, rather, a solution which is more liquid and transparent than that yielded by un-oxidised starch. The product appears to be closely related to soluble starch.

Schmerber was led to undertake this study by the results obtained by Siemens and Halske in exposing starch to the action of oxidising agents (prepared by the electrolysis of a solution of sodium and magnesium chlorides).

In connection with the subject, the following references to accounts published by previous investigators are made:—

Persoz (Traité de l'Impression, t. 1, 289).

Hernite (this Journal, 1893, 168). Starch which has been treated by the method alluded to, is stated to be characterised by its remarkable degree of whiteness.

Leitner (Zeits. f. angew. Chem. 1890, 546) mentions the fact that the course of the action of potassium permanganate on starch could be followed by testing with iodine solution, as is done in the process of converting starch into diastase, the colorations obtained with iodine at successive stages of such action with potassium permanganate being blue, violet, violet-red, and reddish-brown. At the next and final stage of oxidation, no coloration is produced. The products are gummy substances which are differentiated from dextrans by their acid reaction and by their yielding precipitates with basic lead acetate and barium hydroxide. On boiling, they expel carbon dioxide from carbonates, and they slightly reduce Fehling's solution.

O. N. Witt and Siemens (this Journal, 1896, 366) also make use of potassium permanganate to effect the purification of starch.

Asbóth (Chem. Zeit. 1892) used hydrogen dioxide and ammonia, and obtained by their action on starch paste, a solution from which soluble starch (termed by Asbóth, amyloextrin) was precipitated by the addition of alcohol, its amount approaching 80 per cent. of the total product.

It is, finally, pointed out that during the past two or three years the weavers in Alsace have made considerable use of sodium dioxide to render their sizes more liquid.

—E. B.

Paranitraniline Red on Cotton Cloth. R. Wieland.

Leipziger Färber- u. Zeugdrucker Zeit. 45, 321—326, 345—346. (See also this Journal, 1896, 111 and 112.)

A PROCESS for producing *p*-nitraniline red on cotton cloth on the large scale is described in detail. The half-bleached goods are padded with a solution of β -naphthol prepared as follows:—

β -naphthol (pure)	2700 kilos.
Sodium hydrate solution, 22° B.	3450 litres.
Turkey-red oil (sodium salt)	8100 "

the whole made up to 180 litres.

The goods should pass twice through this bath, and the pressure of the rollers should be so regulated that the cloth shall take up its own weight of liquor. After padding, the goods must be thoroughly dried in a hot-flue, which may be heated up to 70° C., taking care to avoid creases or folds in the cloth during the drying, as such parts would be of a lighter colour than the rest of the cloth. The turning-in of the edges, to which satens are particularly liable, may be prevented by adding 1 litre of a 10 per cent. tragacanth solution to every 10 litres of naphthol solution.

The trough in which the goods are developed should be as small as possible, the sides sloping downwards. It is provided with three small wooden rollers to guide the cloth through the developing bath, and a pair of squeezing rollers to remove the surplus liquor. The cloth then travels a few yards before being washed, so as to allow the diazo solution to combine with the naphthol. The goods then enter a washing machine, through which they pass continuously and in open width, and must subsequently be well washed in the chain form on a "dolley." A slight soaping with 2 grms. of soap to the litre at 60° C. for, say, 10 minutes imparts to the red a bluish tint.

The diazo solution is prepared as follows:—4.8 kilos. of paranitraniline and 2.45 kilos. of sodium nitrite are made into a paste with 300 c.c. of methylated alcohol and 5 litres of water, using wooden vessels for the purpose. This paste is gradually introduced into a mixture of 9.75 litres of hydrochloric acid of 20° B. and 150 litres of water cooled to —3° C., and after about 10 minutes, the whole is made up to 180 litres.

In a separate vessel are dissolved 8.8 kilos. of sodium hydrate in 50 litres of water and 30 litres of acetic acid of 40 per cent. The solution, which should show a feebly acid reaction, is then made up to 180 litres.

For making up the developing bath, at first, take of—

Diazo solution	1 part.
Acetate „	1 „
Water.....	2 parts.

For subsequent additions, however, three parts of diazo solution and one part of acetate are mixed in a tub placed above the developing trough, and allowed to flow into the latter as required, whilst the cloth is passing through at the rate of about 20 metres per minute.—I. S.

Indigo Vats, Calcium Lactate in. Textile Colorist, 1896, 18, 204.

THE glucose in the indigo vat is first converted into lactic acid by the action of lactic ferment, and the lactic acid is then further acted on by the butyric bacilli with formation of butyric acid, carbon dioxide, and hydrogen. Thus the addition of calcium lactate at the beginning of the operation hastens the action of the vat, as it can be immediately acted on by the butyric bacilli to furnish the hydrogen necessary for reduction. It was found that the proportion of 1 lb. of calcium lactate to 10 or 20 galls. of new vat liquor gave good results.—A. S.

Indigo-dyed Yarn, A New Cause of Unevenness in. Eulenthaler, Leipziger Färber Zeit. 45, 245.

IN the author's dye-works the water for dyeing purposes is taken from a reservoir of 800 cb. m. capacity, and since on the average only about 35 cb. m. are drawn off daily, the water tends to become stagnant. At certain seasons of the year there is found in the reservoir a species of moss from which bubbles of hydrogen are given off. During this period it was frequently noticed that the yarn dyed with indigo had an uneven, "striped" appearance, especially in the case of dark shades which had been dipped several times in the vat and often allowed to lie in the wet state overnight. Since the moss adheres tenaciously to the yarn, and unevenness is shown in the portions of the yarn to which it adheres, the explanation must be sought in the reduction of indigotine brought about by the nascent hydrogen produced during the development of the vegetable growth.—R. B. B.

Silk, Absorption of Dilute Acids by. J. Walker and J. R. Appleyard. Proc. Chem. Soc. 1896, [168], 147.

WHEN silk is dyed with picric acid a real equilibrium is attained which is independent of the original distribution of the materials.

When other solvents than water are used the rate and amount of dyeing with picric acid seem to be connected with the dissociative power of the solvent. Silk will not take up picric acid from benzene or from carbon tetrachloride, but does so readily from alcohol, less readily from ether and acetone. The ratio of the final concentrations of aqueous and alcoholic solutions of picric acid required to dye silk to a given standard, was found to be approximately the ratio of the solubilities of picric acid in water and in alcohol.

A comparison of the extents to which the various acids are absorbed by silk shows that the acids fall into two classes—the aromatic acids where the absorption is great, and the non-aromatic acids where the absorption is relatively small. In each class there is a rough parallelism between the strength of the acids and the amount absorbed. The addition of calcium benzoate to a solution of benzoic acid greatly diminishes the strength of the acid, and the absorption also is thereby much diminished.

If dyeing were a pure chemical addition of the dye to the fibre, the theory of mass-action predicts that the equilibrium concentration of the dye-bath should be constant at any given temperature, independently of the quantities of material taken. This is not known to be the case for actual dyeing, but it was experimentally verified by "dyeing" Diphenylamine brown with picric acid from aqueous solution.

Bichromate, Recovery of, from Spent Aniline Black Liquors. Beltzer. Leipziger Färber- u. Zeugdrucke Zeit. 45, 342.

THE spent chrome liquors, which contain the chromium in the form of its soluble salts (sulphates, chlorides, &c.), are allowed to settle, the clear liquor is decanted and heated, and the chromium precipitated with the calculated quantity of lime, chalk, or an alkali. The precipitate is collected on a filter, mixed with the calculated quantity of an alkali to form a neutral chromate, dried, and roasted in a special furnace. The melt is dissolved in water, converted into the bichromate by the addition of hydrochloric or sulphuric acid, and made up to the required strength again.—I. S.

Aniline Poisoning. Leipziger Färber- u. Zeugdrucker Zeit. 45, 346.

See under XVIII. B., page 667.

PATENTS.

Dyeing, Washing, and Rinsing Apparatus for Textile Goods, Impts. in. H. Schirp, Barmen, Germany. Eng. Pat. 12,500, June 8, 1896.

THE liquor is taken from and returned to a special reservoir, and by means of a pump is caused to circulate through the dyeing vessel. In the interior of the latter are a number of cones perforated around the apex, and the liquor passing through these perforations is evenly distributed throughout the material. The chief feature of the invention is the insertion in the pipes, which connect the two vessels with the pump, of reversible valves which, when turned through 180°, cause the liquor to circulate in the opposite direction, so that it may be either forced or drawn by suction through the material, and thus, it is claimed, thorough penetration and even dyeing are ensured.—R. B. B.

Colours with Silk-like Gloss, Improved Process and Apparatus for the Production of, on Vegetable Fibres and Textile Fabrics; also on Wool, India-Rubber, Leather, Wood, Metal, and other Substances. E. Heberlein, Wattwil, St. Gallen, Switzerland. Eng. Pat. 13,198, June 15, 1896.

TO produce colours with a silk-like gloss the material is dyed in a cold bath containing collodion together with an alcoholic solution of a basic or phthalein dyestuff. The collodion acts as a mordant, replacing the tannin and tartar emetic of the ordinary process. Direct-dyeing colouring matters may also be employed, but in this case the dye-bath must be heated. Dyeing takes place in a closed vessel partially filled with the solution, through which the yarn or fabric is guided by means of rollers, and the material then passes through a drying chamber. It is claimed for the process that: (1) the threads are strengthened and their weight increased; (2) the colours are more brilliant than when dyed with tannin mordant; (3) the colours are faster, especially to chlorine; and (4) the fibres are stiffened, and fabrics thus treated are rendered waterproof. If softness be required, an addition to the dye-bath of 5–10 per cent. of olive oil must be made.—R. B. B.

Aërating Liquids, Improved Apparatus for, especially applicable to Fermenting Tuns and Indigo Vats. F. Grambacher, Berlin. Eng. Pat. 13,386, June 17, 1896.

See under I., page 641.

VII.—ACIDS, ALKALIS, AND SALTS.

Carbonic Acid, Manufacture and Uses of, in Germany. U.S. Consular Reports, Aug. 1896, 756.

USES.—The industrial uses of carbonic acid may be classified under three general groups—(1) for aërating mineral waters, beer, sparkling wines, and other effervescent beverages; (2) for making various carbonates and other products, such as salicylic acid, in chemical manufacture; and (3) for the manufacture of artificial ice and the cooling of refrigerators and cold-storage chambers.

The consumption of carbonic acid for all these purposes is estimated to have doubled in this country during the past 10 years, and its production has rather more than kept pace with its steadily increasing use. Complete statistics for the past two years are not available, but in 1891, 23 firms produced 6,600,000 lb. of liquid carbonic acid, and in 1892 the exports of that material amounted to 2,053,360 lb. There are now 28 firms and syndicates engaged in the manufacture, with a steadily increasing output, and the business seems to be active and prosperous.

When produced artificially, carbonic acid gas is usually tainted by impurities, so that the gas used for making pure chemicals and for aerating mineral waters, beer, wines, &c. is now generally obtained in Germany from the decomposition of magnesite, or still more from natural carbonic acid springs, which exist abundantly in the Lower Rhine region, between Mayence and Cologne. Many of the springs have been known for centuries, but their importance as sources of carbonic acid dates from only a few years ago, when the process of condensing the gas into liquid form was perfected, and it became thereby a cheap and convenient commercial product.

1. *Natural Carbonic Acid.*—There are, in the Lower Rhine country, hundreds of springs—including such well-known sources as the Apollinaris, Selters, Kronthal, Ems, and Nauheim springs—which yield waters more or less overcharged with carbonic acid gas. Where the gas is in excess, it escapes in the ebullition of the fountain, which, being securely inclosed, the surplus gas is collected and either condensed into liquid dioxide or used directly for impregnating natural mineral waters which have other valuable qualities, but are deficient in effervescence. Where, as is often the case, the water is impure or wanting in medicinal qualities, it is run to waste, and the spring utilised only for its carbonic acid gas.

From the time when the manufacture of liquid carbon dioxide became an established industry, the supply of gas from natural springs became inadequate, and recourse was had to artificial borings. The first artesian well for this purpose was sunk at Burgbrohl, a few miles westward from the Rhine, below Coblenz, in 1883, and was only 5½ ins. in diameter. At a depth of 171 ft., a vein was reached, from which spouted up a stream, 25 ft. in height, that yielded 108 galls. of water per minute and 375 galls. of dry carbonic acid gas. It continued to flow at this rate until 1891, a period of eight years, during which time there was condensed from the gas of that single well 1,394,800 lb. of liquid carbonic acid. Its yield was regular and constant until 1891, when a similar well was bored, still deeper, at a distance of 130 ft. from the original one. This tapped the same source of supply, and from that time the older well declined somewhat in its yield, but it is still in use. Since then other wells have been bored at various points in the surrounding region, notably at Hönningen and Linz, near Coblenz, and within the past few weeks a remarkable one has been opened at Herste, near Driburg, in the north-eastern part of Westphalia.

It was noticed some time ago that gases which would extinguish a lighted match or candle were rising from holes and crevices in the ground, and that the small pools of water thereabouts were frequently in ebullition. Boring was accordingly begun, and at a depth of 25 ft. the outflow of gas became so profuse that the workmen were in danger of suffocation. Means were adopted to divert this outflow, and the boring proceeded until, at a depth of 438 ft., there was an explosion. Bore dust, pebbles, &c. were blown out to a height of 70 ft., accompanied by a stream of gas so powerful that the roar of its escape could be heard at a long distance. Thus far the well had been quite dry, and work was continued under great difficulties, until, at a depth of 485 ft., a vein of water was struck, which rushed out as finely-atomised spray to a height of nearly 100 ft., yielding 88 galls. of water per minute. The well has since been cased with an iron pipe, which conducts the outflow into a large reservoir, where the water separates by gravity from the gas, which is then forced into compressors and condensed to liquid carbonic acid. One measure of liquid contains 430 measures of gas.

This well is interesting as an illustration of the fact that, as usual, the strata through which it was bored have no apparent relation to the gas which it yields. The conclusion is inevitable that the carbonic acid is developed at a great depth, and wholly independently of the overlying geological strata, through which it escapes to the surface.

The present market price of liquid carbonic acid condensed from natural gas, and supplied by the above method, is 11 cents per kilo., equal to 5 cents per American lb. From this general rate there is granted a discount of something more than half a cent. per kilo. to customers whose orders aggregate more than 500 kilos. (1,102 lb.) within a calendar year. This discount is 2½ cents per kilo. to consumers of 1,000 kilos., and 4 cents per kilo. to consumers of 5,000 kilos. or more per year. It will thus be seen that large purchasers, who buy for their own use or for export more than 5 tons of acid from the same syndicate within a year, can obtain it for a minimum price of about 7 cents per kilo. (3.17 cents per lb.). Rates like these for carbonic acid of warranted purity naturally control the market, and have contributed largely to the greatly increased use of this material during the past 10 years.

The use of carbonic acid in connection with beer is as follows:—The thing desired was a latent and easily controlled force which, without injuring the quality of the beer, should lift it from the storage cask in the cellar to the faucets above, where it is drawn for consumption. For this purpose the flask containing the liquid dioxide is connected with a reservoir which is provided with a manometer and adjustable pipes to convey the gas into the cask or casks in which the beer is kept on draught. These connections being adjusted, a small quantity of acid is let into the reservoir, where it expands at once into gas with development of cold. When the manometer shows a pressure of 2 atmospheres, the supply of acid is shut off, and the generated gas, passing through the pipe into the cask, acts as a steady, automatic power to force the beer up to where it is drawn for use. Air used in this manner requires to be condensed by mechanical power, and, moreover, ferments and otherwise injures the beer. Carbonic acid, on the other hand, not only furnishes spontaneously any required degree of pressure, but adds an important element to the beer itself, supplying any deficiency in effervescence, preserves the beer fresh and sparkling, and enables the contents of each cask to be used, unimpaired in quality, down to the last half pint.

2. *Artificial Mineral Waters.*—For fortifying and recharging natural mineral waters which are deficient in carbonic acid, the natural dioxide gas is usually employed directly at the spring, without condensation to liquid form, and for this purpose it is superior to gas prepared by any artificial method. But for the manufacture of soda and other artificial waters that are made from ordinary or distilled water, the liquid dioxide condensed from natural gas has one defect, *viz.*, it contains a small percentage of atmospheric air, which, when present, prevents the perfect combination of the carbonic acid gas with the water, and inclines the gas to escape too readily when the bottle containing the aerated water is opened. For this sole reason, the principal maker of artificial soda and other sparkling waters in Frankfurt uses carbonic acid gas made by treating magnesite with pure sulphuric acid.

Hydrobromic Acid, Concentrated; Note on. Chas. T. Tyrer. Pharm. J. 1896, 94.

The author states that, owing to the complaint that the concentrated acid of sp. gr. 1.275 has a smell of sulphurous acid, a careful examination of the acid was made, but no sulphur compounds could be detected. A sample of the acid of sp. gr. 1.640 was re-distilled until colourless. It was free from sulphurous acid and bromine, though smelling remarkably like the former. Hydrobromic acid of sp. gr. 1.25 and upwards, attacks glass rapidly, and the silica when once dissolved does not separate out readily on dilution, but only on neutralising the acid. The author concludes that a sp. gr. of 1.25 is the highest concentration possible for a really reliable acid; acids of higher specific gravity rapidly change colour, and contain silica.—A. S.

Hypophosphorous Acid, Note on. Chas. T. Tyrer. Pharm. J. 1896, 94.

THE author considers the method of preparing this acid from its calcium salt (Lunan, "Year Book of Pharmacy," 1888, 21; Cooley's "Cyclopedia," 2, 1273) unsatisfactory, as calcium sulphate or oxalate (according to the acid used as precipitant) dissolves, and gradually separates out.

As potassium tartrate is slightly soluble in dilute alcohol, the same objection arises with the U.S.P. method, which consists in decomposing the potassium salt with tartaric acid and separating the potassium tartrate with alcohol.

He prefers the method of preparation from the barium salt by careful precipitation with sulphuric acid in dilute solution. The acid prepared in this way dissolves a small quantity of BaSO_4 , but nothing separates out, even on long standing; this acid also, when of sp. gr. 1.137, contains 30 per cent. of real hypophosphorous acid.

Concentrated hypophosphorous acid attacks glass and porcelain much more readily than concentrated phosphoric acid, and the separation which sometimes occurs on neutralisation is due to silica.—A. S.

Ammoniacal Gas Liquor, Desulphurising. Chevalet. Rev. Chim. industr. 7, [79], 203.

See under III., page 645.

Calcium Acetate, Analysis of Commercial. E. Barillot. Rev. Chim. industr. 7, [79], 197.

See under XXIII., page 680.

Sulphur Trust, Sicilian; Anticipated Results of. U.S. Consular Reports, Aug. 1896, 773.

See under Trade Rep., page 683.

PATENTS.

Production of Bleach and other Products, Improved Means for Treating Sodium Chloride for the. L. Blackwell, Stoke Newington Common, Middlesex. Eng. Pat. 14,122, July 24, 1895.

"EFFION," a liquid resulting from the distillation of animal matters, is mixed with a stated proportion of sodium chloride, "and a solution of 'cupion' and chlorine is, it is alleged, formed by the absorption of the latter by the former. This solution is then poured off, leaving," it is stated, "the sodium remaining in the vessel." The effion solution of chlorine is heated, and the chlorine evolved may be passed over slaked lime to obtain bleaching powder. Carbonic acid may be passed into the mixture of cupion and salt "to liberate chlorine," it is said, and "obtain sodium carbonate."—E. S.

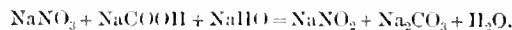
Ammonium Carbonate and Acid Ammonium Carbonate, The Manufacture of from certain Waste or By-Products [Waste Kiln and Blast-Furnace Gases], and Apparatus for Use in such Manufacture. H. R. Lewis, London. Eng. Pat. 14,618, Aug. 1, 1895.

THE waste gases from kilns, blast furnaces, or the like, after passage through water or other cleansing liquid, are forced, with the gases produced in the distillation of gas-liquor, with steam into suitable condensers, where crystalline ammonium salts are formed. A "continuous still" is preferably used in distilling the gas-liquor, to prevent the formation of a solution of ammonium carbonate as a distillate, which is liable to decompose. The residual gases are washed to prevent waste of ammonia. The ammonium salts obtained are exposed to a current of air to remove any sulphide; or they are washed with a little water and dried, thus insuring that any ammonium carbamate present is converted into carbonate, according to the equation $\text{CO}(\text{NH}_2)_2(\text{ONH}_4) + \text{H}_2\text{O} = (\text{NH}_4)_2\text{CO}_3$, and this carbonate is converted into the more stable bicarbonate by contact with carbonic acid in presence of moisture, or by passing air or other gas over it, in the latter case with evolution of ammonia, which is collected.—E. S.

Formates and Nitrites, Impts. in the Preparation or Manufacture of. M. Goldschmidt, Charlottenburg, Germany. Eng. Pat. 17,066, Sept. 12, 1895.

It is known that a formate is produced when carbonic oxide gas is passed over soda (or preferably soda lime) heated to about 230° C., and the inventor finds that the reaction is greatly facilitated by conducting the process under pressure.

To prepare a nitrite, a mixture of a nitrate and formate is heated to fusion. With sodium salts and free alkali, the reaction is represented by the equation—



Instead of first preparing a formate and then using the formate to obtain a nitrite, the latter may be obtained in a single process, by simply passing carbonic oxide over a mixture of a nitrate and corresponding hydroxide, according to the following equation, in which "M" may be sodium or other suitable metal:—



The mixture exposed to the action of the gas is first heated gently until it will absorb no more CO; the gas is then withdrawn, and the temperature raised to the point of incipient fusion of the mixture, under which conditions, the transformation into nitrite takes place quantitatively.—E. S.

Cyanides and other Compounds, Improved Process for the Extraction of, from Illuminating and other Gases. F. Livesey, London. Eng. Pat. 18,334, Oct. 1, 1895.

See under II., page 644.

Sulphurous Acid and other Gases or Fumes, Method of and Apparatus for Washing and Compressing. E. Porak, Riebnberg, Bohemia. Eng. Pat. 12,613, June 9, 1896.

See under 1., page 641.

VIII.—GLASS, POTTERY, ENAMELS.

Coloured Pictures, Writing, or the like [Indestructible] on Glass, Porcelain, Enamel, or Sheet Iron; Impts. in or appertaining to the Process for the Production of. F. Albrecht, Liverpool. From W. Kuapp, Hamburg, Germany. Eng. Pat. 2,4283, Dec. 18, 1895.

THE present process is intended as an improvement on Eng. Pat. 13,838 of 1893, and is carried out as follows:—25—35 grms. of pure caustic soda or potash are melted together with 25—35 grms. of lime, 7—13 grms. of sulphate of soda, 3—7 grms. of sulphate of magnesia, and 125—1,000 grms. of water-glass of 38 per cent. "The solution is thoroughly mixed, and may, if desired, be allowed to stand long enough to clear." It is used for printing any device on bottles or other objects of glass, porcelain or enamel, from a rubber plate in relief. The imprint on the bottle is covered with any suitable coloured powder, or powders for the production of several colours, and the bottle with its device is heated to as high a temperature as is feasible. An indestructible label is said to be thus produced.—B. B.

PATENT.

Coating [Insulating] for the Interior of Metal Vessels, Improved. C. F. Hohenberg, Wittstock-in-the-Mark, Germany. Eng. Pat. 12,163, June 3, 1896.

THE surface of the vessel is coated three times with a paste of "permanent white" (BaSO_4) and albumin prepared in the cold, the mixture being coagulated by heat after each addition. The object is to protect, by insulating the metal surface, any articles of food, &c. that may be placed in such vessels from metallic contamination through oxidation; and the composition is stated to be specially useful in the case of aluminium ware.—F. H. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Brickwork constructed in Frosty Weather, Durability of. Thonind. Zeit. 1896, 20, 222.

In a series of experiments carried out at Riga it was found that—

1. Brickwork constructed in cold weather, using ordinary mortar prepared with warm water, proved very unsatisfactory in point of resisting power; nor was any improvement effected by dissolving in the water $\frac{1}{2}$ per cent. of calcium chloride.

2. Excellent results were obtained when the mortar was produced with warm water containing in solution $1\frac{3}{4}$ per cent. of common salt.

3. The addition of freshly slaked lime to ordinary mortar, resulted in a satisfactory degree of durability; but still better results were obtained by the exclusive use of freshly slaked lime, especially when employed in conjunction with calcium chloride.

4. An admixture of Portland cement with common mortar increased its resisting power to frost.

5. The best results were obtained with a mixture of Portland cement and 5 parts of sand.—H. T. P.

Fireproof Materials [Building], Estimation of Alkalis in. C. Reinhardt. Stahl u. Eisen, 1896, 16, 448.

See under XXIII., page 675.

Mortar, The Analysis of. W. J. Dibdin and R. Grimwood. Analyst, 1896, 197—204.

See under XXIII., page 675.

PATENTS.

Portland Cement, Pigments, and the like: Impts. [Modified Apparatus] in the Manufacture of Finely Pulverised Substances for Use in the Production of. A. Patrick, Glasgow. Eng. Pat. 16,962, Sept. 11, 1895.

THE present patent relates to a device intended to improve the apparatus described in Eng. Pat. 21,292 of 1893. The essential difference consists in the use of a revolving cylindrical sieve with an air blast.—B. B.

Wood, Impts. in the Treatment of [Preserving and Stopping Shrinkage]. A. de Sainte-Marie and A. A. Hoffmann. Eng. Pat. 20,246, Oct. 26, 1895.

THE design of the patented process is to permit "of rapidly stopping the shrinkage which wood slowly undergoes when drying in the air." This result is said to be attained by immersing the wood in a liquid such as solutions of calcium or magnesium chloride, acetates or nitrates of the alkalis, and heavy mineral oils, and raising the temperature of the bath to 100° C. or higher. After treatment for a length of time depending upon the thickness of the boards or blocks, the wood is removed and the salt with which its outer portions are impregnated is removed by washing. Wood may be treated in the manner described in an open vessel or under pressure.—B. B.

Weatherproof Gypsum, Stone or Bricks; Process for the Manufacture of. P. Kleber, Saarbrücken, Germany. Eng. Pat. 13,187, June 15, 1896.

"TEN parts of sifted ashes, potash, and other alkaline carbonates are mixed in the dry state with 1 part of a mixture consisting of 80 parts of gypsum and 20 parts of hydraulic lime." The product is kneaded with "saturated gypsum water acidulated with 5 per cent. of sulphuric acid," and is moulded into bricks, which are dipped into "a saturated solution of alum or other alumina or alum earth which has been acidulated with one-third of sulphuric acid." The resulting blocks are dried, and are said not to effloresce or disintegrate by the action of weather.—B. B.

Peat and other Lignous Substances for Producing Paving Blocks, Slabs, Tiles, Slates, Conduits, and Fuel; New or Improved Process for. R. F. Strong, London. Eng. Pat. 13,649, June 20, 1896.

Dry peat, sawdust, or similar material is ground and mixed with 20—30 per cent. of lime or magnesia, and the mixture is treated with 10 per cent. of pyroligneous acid. The product is pressed into blocks, cooled by a fan, and is then ready for use as paving, either in block form or in powder, applied in the manner adopted for asphalt. For fuel, 1—2 per cent. of lime may be used and 5 per cent. of pyroligneous acid; or a peat coke may be made by adding to the mass, before compression, 3—5 per cent. of silicate of soda in aqueous solution, pressing, and coking.—B. B.

X.—METALLURGY.

Metals (Non-Ferrous), Annual Report on Progress in the Extraction of. C. Schnabel. Chem. Zeit. 1896, 20, 595—599.

Zinc.—In treating zinc ores electrolytically, the main endeavour has been to obtain solid metal, free from slime. So far, however, the process has not been successfully applied to the extraction of zinc from rich ores, although it is used to recover the metal as a by-product from pyrites and argentiferous galena or blende. For the treatment of burnt pyrites, the processes of Höpfner (who converts the zinc into, and electrolyses, the chloride) and v. Kittler are used. For the other ores named, the methods of Ashcroft, Höpfner, Siemens and Halske, and Pape are available; the two former use chloride solutions, the two latter sulphates. The Ashcroft process is in use at Newcastle (N.S.W.) in connection with Broken Hill ore. The ore is roasted and leached with ferric chloride, which gives zinc chloride and ferric hydroxide; on electrolysis of this a compact zinc is deposited, and the solution is regenerated. The residue, containing less than one-third of the original zinc, is smelted for argentiferous lead in blast furnaces, the ferric oxide assisting as a flux for silica. In electrolysis, iron anodes are first used, so that ferrous chloride may be formed, and then carbon anodes are substituted, in order that the liberated chlorine may peroxidise the iron salt. Between the electrodes there is a canvas partition, to prevent the access of iron solution to the cathode, and the zinc liquors are circulated first through the cathode compartment, and then, when nearly freed from zinc, through the iron and carbon anode compartments successively; they are finally returned to the ore-leaching vats. By maintaining a rapid circulation and a higher level of liquid in the cathode chamber than in that containing the anodes, the ferrous liquor is excluded from the former, and the zinc is therefore practically free from co-deposited iron. The metal is re-melted. The electrodes in each bath are placed parallel, but the baths themselves are coupled up in series. The current strength used is 50—55 ampères per sq. m. at 1.1 volt pressure in the baths with iron anodes, and 2.7 volts in the others; and the expenditure of coal under the boilers is equal to from 3 to 4 parts by weight for 1 part of zinc recovered. The chief cost in this process is in the consumption of anode iron, which amounts to 67 parts by weight per 100 parts of zinc. The electrolytic refining of zinc containing lead is practised at Ilseburg; but the extraction of zinc from alloys of zinc, lead, and silver at Hoboken (Antwerp) is diminishing in favour, the distillation of the zinc from the alloy, followed by the separation of the silver and lead, having been found more advantageous. The market for zinc salts is very limited; but the sulphate is made at Julius-hütte, and Sophienhütte (Goslar), by leaching roasted mixtures of galena, blende, and pyrites in rotating iron drums. The conversion of zinc sulphate into oxide has not yet been economically effected.

In the dry way it is well known that blast furnaces yield only a pulverulent deposit of zinc. Biewend's process (Chem. Zeit. 1895, 19, 1357; this Journal, 1895, 663), which consists in heating blende with metallic iron in the blast furnace, tapping out the iron sulphide with the slag, and passing the zinc-bearing gases through a condenser filled with glowing coal, is not likely therefore to yield the metal in a satisfactory

condition. In this process the sulphide of iron is roasted to oxide, and the latter is reduced to the metallic state for use again. No large-scale experiments have as yet been instituted. Lynen's condensing plant, in which several zinc retorts are connected with a single condensing chamber, cooled to 415–550 °C. by means of air-circulating pipes, and with a layer of liquid zinc upon the floor, has not yet come into use. Steger (Preuss. Ministerial Zeits., 1894, 163) substitutes magnesia for clay in the manufacture of retorts, producing vessels which have a higher thermal conductivity and less permeability to zinc vapour. These Frankei retorts, as they are termed, are under trial in Silesia, and the original difficulty, introduced by the susceptibility of the magnesia to changes of temperature, is said to have been successfully met.

Gold.—The Siemens-Halske electrolytic process for the recovery of gold from cyanide liquors is in use by the Rand Central Ore Reduction Co. at Johannesburg, and thereby 70 per cent. of the precious metal in the ore is recovered. The electrolytic separation of gold and silver has been successfully practised at Pittsburgh and St. Louis, U.S.A., and at Pinos Altos in Mexico, and more recently at the Deutsch. Gold- u. Silb.-Schmelzanstalt, Frankfurt-on-Maine.

Silver.—The Rössler-Edelmann process for the desilvering of lead by zinc containing aluminium, followed by electrolysis of the resulting zinc-lead silver alloy has been given up in Lantental in favour of the old process, and is but little employed in Ilobohen. The zinc skimmings of the Parkes process are now distilled in the United States in petroleum-fired retorts. The treatment of argentiferous and auriferous anode slimes, consists usually in obtaining the precious metals in alloy with lead. Where this cannot be done, the slimes are treated in the wet way, and are either—(1) stirred with silver sulphate solution, which causes the copper to dissolve and precipitate an equivalent of silver; or (2) they are digested with dilute sulphuric acid in the presence of air, to oxidise and dissolve copper; or (3) they are boiled with strong sulphuric acid, which dissolves both silver and copper, and leaves the gold untouched; or (4) the slimes are cast into anode plates and treated by electrolysis.

Nickel.—In separating the copper and nickel from rich mattes obtained from the Bessemer converter, the Orford Copper Co. (U.S.A.) remelts the matte in blast furnaces with sodium sulphate and carbon. The resulting sodium sulphide unites with copper and iron sulphides to form a matte that retains but little nickel, the greater portion of that element concentrating in a second matte which, being heavier, is found below the former. Emmens' process of separating copper from nickel mattes by chloridising-roasting is not suitable for material containing much copper, as the extraction of the copper is then incomplete; for example, at Youngwood, U.S.A., a matte containing 20 per cent. of Cu. failed to give up the whole of that amount. Basse and Selve (Chem. Zeit., 1892, 16, 1725) patented a process for electrolysing nickel salts, consisting in adding organic compounds (tartaric or citric acids, glycerin, or dextrose) to maintain the oxides in solution, and then an excess of caustic alkali, electrolysing the bath with a current of 0.3–1.0 ampère per sq. dm. In this way, iron, cobalt, and zinc were deposited at the cathode, whilst the nickel remained dissolved, or partly precipitated as hydroxide, according to the concentration of the bath. Ammonium carbonate was afterwards added to the bath, in quantity sufficient to carbonate the whole of the caustic alkali, and the nickel was then obtained on the cathode by electrolysis.

Copper.—In the roasting of ores in districts where wages are high, furnaces with mechanical stirring are rapidly superseding those which require hand labour; in the United States, besides rotating cylinders with continuous feed, the O'Hara-Brown, the Pearce, the Keller-Gaylord, and the Brown horse-shoe furnaces are largely employed. The electrolytic refining of copper is now greatly facilitated by the use of compressed air, according to the systems of C. and H. Borchers, and Siemens and Halske. The air is introduced under pressure through

lead pipes, terminating in glass jets near the bottom of the vat; by this means arsenic and iron are both precipitated (as arseniate of iron), the liquid is circulated, and the current density may be safely increased from 30–50 to 100 ampères per sq. m. When the electrolyte is saturated with bismuth and antimony, taken up from the anode, it must be removed, and treated with copper oxide or basic copper salts in a separate vessel, a current of air being meanwhile passed through the liquid. After filtration and acidification the liquid is used again. The Hayden process has not been extended in the United States, and the process of Smith and Randolph has but a limited application. In all three processes the raw copper plates must necessarily be of equal thickness, which necessitates costly preparation by rolling and cutting to size; but even then there are irregularities in the plates for which allowance cannot be made. The advantage of the processes consists in the rapidity of the solution and the moderate thickness of the plates, entailing only a comparatively small locking up of capital. In Baltimore, Hayden's process is in use, and by it plates 6.44 mm. thick are treated in 12 days with a current of 160 ampères per sq. m. The three processes have not been used in Europe.

Aluminium.—Bucherer, of Cleveland (Chem. Zeit., 1892, 16, 1764; see also this Journal, 1893, 272), and the Aluminium Industrie Gesellschaft Neuhausen (Chem. Zeit., 1893, 17, 1006) electrolyse aluminium sulphide, either (in the latter process) alone or in a bath of alkaline or alkaline earth chlorides or fluorides, the electrolyte being heated either by the current or by external firing. For an externally-fired bath of the sulphide in sodium or potassium chloride, a current pressure of 2½–3 volts suffices, whilst for the electric heating of the mixture by the electrolysing current, 5 volts are required. The bath is of cast or wrought iron lined with carbon, and the upper part of the vessel is filled with reducing gases. Owing to the comparatively low temperature which suffices for the purpose, neither the carbon anode nor the lining is attacked by the sulphur set free, and the aluminium produced is exceptionally pure. The chief obstacle so far to the use of the process is the high cost of the aluminium sulphide.—W. G. M.

Fibrous Wrought Iron and Crystalline Low Carbon. The Conditions which Cause. W. F. Durpe. J. Franklin Inst., 1896, 142, 110–148.

The difference of structure of wrought iron and ingot iron is not due to the former containing a smaller percentage of carbon, for in many samples the reverse holds good, but to the existence in wrought iron of interstitial slag. Wrought iron of truly fibrous structure may, without suffering molecular alteration, yield a crystalline fracture when subjected to a sudden tensile strain (a jerk), or to a sudden compressive strain (a jar). The appearance of a crystalline fracture is due to the rupture of the material of the test piece in, approximately, a single plane, whereas the same metal ruptured so as to allow the interlocking laminae to slide over each other before severance, exhibits a fibrous fracture. The formation of blowholes in steel ingots probably arises from the entanglement of air in the metal as it is poured into the ingot mould, the distribution of the air thus entangled, being similar to that observed when water flows from a trompe into a receiver already containing water. The more viscous the liquid the more persistent the retention of the bubbles. Water vapour thus entangled in molten steel would yield hydrogen, which gas is actually found in the blowholes of steel ingots. The mean composition of gases from this source is given by Müller as H, 79 per cent., N, 19 per cent., CO, 2 per cent.; the same authority also states that the average pressure was 120 lb. per sq. in. The author calculates that when an ingot containing an average number of blowholes is rolled into a bar, a disruptive stress (due to the reduction of the areas of the cylinders generated by the extension of the blowholes), of 132.7 lb. per sq. in. may be produced. In unfavourable cases this internal stress may rise to as much as 49,545 lb. per sq. in., i.e., to a point above the elastic limit of soft steel. He dissents from the idea that the greater strength of Whitworth "fluid compressed steel" is due to the elimination of blowholes, holding rather that it is to be

ascribed to the forcing of the molecules of the metal into more intimate contact, as in forging. Internal fracture of ingots may occur in reheating, if that operation be rapidly performed, for the expansion of the exterior may set up stresses sufficient to determine rupture of the central portions. The persistence of such cavities in the finished forging causes mechanical weakness, and flaws of this kind are difficult to detect. It is suggested that irregular variation of the electrical resistance of a given bar, tested at different points on its length, might be a means of diagnosis.

—B. B.

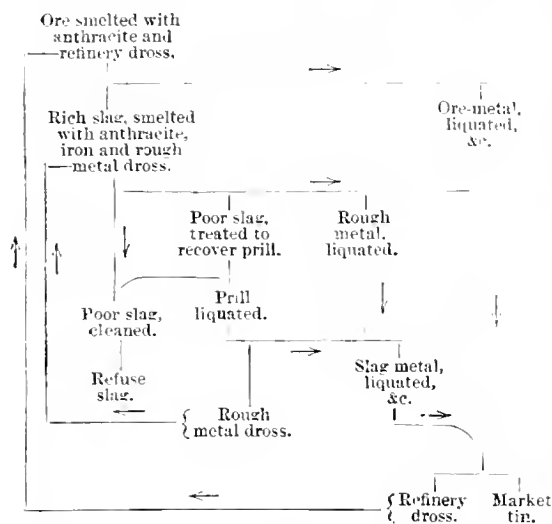
Tin Smelting at Pulo Brani, Singapore. J. McKillop and T. F. Ellis. *Proc. Inst. C.E.* **75**, 60—77.

Tin smelting in the Malay Peninsula has been until recently carried out in a primitive manner by the Chinese. The enactment of regulations for the preservation of forests threatens the Chinese tin smelter with extinction, especially in the face of the fact that European companies are building modern anthracite-smelting works in the district. The present paper contains a full description of one of these works and the process conducted therein, recently started near Singapore. The ore is assayed by the cyanide process, and its value is determined by the appearance and hardness of the button in addition to its actual weight. Great attention is paid to the preparation of the ore before smelting, as it is easier to produce tin of good quality by eliminating the impurities from the ore than by smelting and refining the metal. The chief impurities are mispickel, copper pyrites, and iron pyrites. Wolfram is never entirely absent and causes loss of tin by increasing the richness of the slags. Arsenic, sulphur, or copper render the tin useless, and if an ore contain either of the first two, it is roasted once at least. When roasted, it is sluiced and sorted into three kinds, which are treated in different ways according to their composition.

The metallurgical processes are considered in four parts, viz.:—(A) Smelting ore, with the production of rich slag and ore metal; (B) Smelting rich slag, with the production of poor slag and rough metal; (C) Treatment of poor slag containing tin as prill; and (D) Refining the metal products of A, B, and C.

The scheme of smelting is shown by the following diagram.

DIAGRAM SHOWING THE PROCESSES OF SMELTING.



The recovery of the prill used to be effected by crushing and washing, as practised in Cornwall, but this method is now abandoned and the slag is re-melted to allow the metal to sink and thus separate. The liquation method is employed for refining. The consumption of iron added to the slag charges is 4.7 per cent. of the tin obtained. Welsh anthracite is the best reducing agent but is expensive

at Singapore and it has been found that coal of good quality may replace it. The amount of anthracite required is 17.0 per cent. of the ore but 10.0 per cent. more than this figure must be used if other coal be employed. The coal first tried was Australian, but this has been replaced first by Japanese coal and latterly by that from the Labuan and Tonkin coal-fields. In connection with the smelting a regenerative furnace of the Siemens type was tried, but it proved unsuccessful owing to the impossibility of keeping the chambers free from tin.—A. W.

Alloys of Iron and Antimony. The Density of and the Mean Specific Heat between 0° and 100°. J. Laborde. *Comptes rend.* **123**, (1896) [4], 227.

The alloys were made by melting pure crystallized antimony in a brasqued crucible with iron wire cut into small pieces. When the iron had melted, the alloy was well mixed by agitating the crucible, and poured out into an ingot mould where it cooled rapidly. In the following table, the calculated specific heat is based upon the values obtained for the particular metals used, viz., 0.1136 for the iron and 0.0509 for the antimony.

No. of Alloy.	Iron Per Cent.	Density at 0°.	Specific Heat.	
			Found.	Calculated.
1	18.48	7.211	0.0639	0.0625
2	25.69	7.912	0.0688	0.0670
3	35.42	8.300	0.0753	0.0731
4	39.20	8.071	0.0779	0.0754
5	43.12	8.298	0.0737	0.0778
6	55.02	8.159	0.0869	0.0854
7	61.20	8.120	0.0903	0.0892
8	81.20	7.800	0.1028	0.1019

Almost all the densities are equal to or greater than that of the heavier constituent, iron, showing that a considerable contraction had occurred. At first, the density rapidly increases with the percentage of iron, then it diminishes, but more slowly; the density of the alloy No. 4 is abnormal.

The specific heat in each case exceeds the calculated value, the differences being for the most part greater than the errors of experiment; alloy No. 4 shows the greatest divergence. The composition of this alloy is nearly Fe_3Sb_4 (38 per cent. Fe).

The results in general, accord with the observations of M. Weiss, who showed that the magnetic properties of these alloys increases rapidly when the proportion of iron either exceeds or falls below that corresponding to the alloy Fe_3Sb_4 .—L. A.

Aluminium, Silver, Gold, Copper, and Platinum; Melting Points of. S. W. Holman, R. R. Lawrence, and L. Barr. *Techn. Quarterly*, 1896, **9**, 24—39.

THE metals used in this investigation were extremely pure with the exception of the platinum in which there was $\frac{1}{2}$ per cent. or more of impurity. The melting points were calculated from the measurement of the thermal electromotive force of a couple consisting of one wire of platinum and one of a 10 per cent. rhodo-platinum alloy. One junction was placed in the melting or solidifying metal, the other being surrounded by ice. The battery employed consisted of two Samson-Leclanché cells, and the E.M.F. was measured in microvolts by the Poggendorff null method. For the temperatures required to be known for the equation the authors chose zero and the melting points of sulphur and of pure gold, the recent work of Holborn and Wien being taken as provisionally correct in the case of the latter. The following melting points were obtained in this way:—Aluminium, 660°; silver, 970°; gold, 1072°; copper, 1095°; platinum, 1760°.—C. A. M.

Gold-Arsenic Works at Bovisa, Italy. Eng. and Mining J., Aug. 29, 1896, 201.

THE works at Bovisa (Milan, Italy) belonging to the Società Anonima Ingegneri L. Vogel, are among the most complete of their kind in Europe. The principal

object of the company is the production of mineral superphosphate. The phosphates, amounting to about 75,000 tons yearly, are mostly imported from South Carolina, and about the same quantity of sulphuric acid is produced on the premises for converting the phosphates into superphosphates.

For the production of sulphuric acid about 25 tons per day of iron pyrites are burnt in *Etagen-Oefen*. Of these 25 tons, 15 tons come from the mines of Agordo (Udine), containing from 2 to 3 per cent. of copper, which is saved after roasting by lixiviation. The remaining 10 tons come from the Cuni mine, in the neighbourhood of Mount Rosa.

Worked for free gold since the time of the Romans, this mine constantly gave good returns up to the beginning of this century, when the ore having suddenly become very refractory, the mine was shut down.

In 1887 the mine was leased by the Societa Anonima L. Vogel. The problem was very complex, and the only way to make the concern pay was to utilise all that the ore contained—sulphur, arsenic, and gold. The plan which has been carried out ever since is as follows:—

The ore containing enough iron pyrites to burn by itself in the *Etagen-Oefen* is sorted out and sent to the works at Bovisa (distance, 5 miles by waggon and 65 miles by railroad); the poorer ore is to be treated at the mine with cyanide.

The ore going to Bovisa contains an average of 34 per cent. of sulphur, 10 to 12 per cent. of arsenic, 0.6 to 0.7 oz. of gold, and 2.5 oz. of silver per ton. This ore is subjected to a first roasting in *Etagen-Oefen*, where it is freed from the sulphur and arsenic. Attached to the roasting furnace are two series of large leaden canals through which the sulphurous and arsenious acids are made to pass. The sulphurous acid then goes to the lead chambers to be converted into sulphuric acid; the arsenious acid condenses in the canals in the form of a reddish-white slime.

These slimes are taken out from time to time, dried, in order to be subsequently subjected to a last sublimation so as to obtain a white commercial product 99 per cent. pure. So far no difficulty was met with, but as soon as they began the sublimation in a kind of *Muffel-Ofen* troubles began. The slimes were found to contain some free sulphuric acid and some very fine particles of oxide of iron. Owing to the presence of these two substances it was found impossible to obtain by sublimation a pure product; the arsenious acid obtained had a faint reddish tint; its purity was never more than 90 per cent.; it was not entirely soluble. It was evident that, before trying sublimation, it was absolutely necessary to get rid of the free sulphuric acid present. They devised a large agitator, in which the slimes were agitated with water, which was siphoned off after letting the slimes settle, and the operation was repeated three or four times. This treatment, although long, tedious, and expensive, did not give the wished-for results, although a considerable improvement was shown in the sublimation of the slimes thus treated. After trying a few more schemes unsuccessfully, they at last devised a method which was the simplest of all. They built a large rectangular vat of bricks with a false bottom, and a quartz filter on its top, covered with perforated sheets of lead. The slimes coming from the labyrinth are thrown into this vat, and spread evenly all over the filter; then water is allowed to percolate slowly through the mass; the free sulphuric acid present being thus carried out through the false bottom, and recovered by pumping it back to the lead chambers.

The slimes thus washed gave the most satisfactory results, and one single sublimation gave a most beautifully white product containing 98 to 99 per cent. of pure arsenious acid. It is well known that in England and even at Freiberg two sublimations are necessary to arrive at a commercial product.

Before this industry arose the arsenious acid used in Italy was all shipped from England, but in a year's time they were able to supply all demands in Italy, amounting to about 400 tons a year. The greater part of this product is used in glass manufactures and in tanning leather. The product is sold in Italy at 28 frs. per 100 kilos. (about

3.3 c. per lb.). In this manner the sulphur and the arsenic of the ore is well disposed of.

Attention was then turned to the recovery of the gold contained in the roasted pyrites. This product still contains 1.5 to 2 per cent. of sulphur and about 0.5 per cent. of arsenic; in order to eliminate these substances—injurious to the subsequent operation of chlorination—the roasted pyrites undergoes a second thorough roasting in another *Etagen-Oefen* quite similar to the first one, but provided with a fire-place, where a lively fire is made in order to drive out the last traces of sulphur and arsenic. The pyrites thus dead roasted is cooled and then charged into large wooden rectangular vats, lined with lead, and holding 10 tons each. These tanks are provided with a false bottom, covered with a quartz filter, upon which the mass rests. A weak solution of chloride of lime, together with a weak solution of sulphuric acid, is allowed to percolate slowly through the mass, dissolving and carrying with it the gold, the clear solutions passing through the false bottom to the precipitating tanks. One vat of 10 tons is completely lixiviated and washed out in 3 days.

The extraction of the gold in bullion ranges between 85 and 87 per cent. No attempt is made to save the silver, as it would hardly pay the expenses of extraction. In this manner a mine which, owing to the very refractory nature of the ore, was almost worthless 10 years ago, is now giving a very good profit.—W. G. M.

Gold and Other Metals, Double Sulphides of, or the Action at a red heat of Sulphur upon Gold when Alloyed with other Metals. J. S. MacLaurin, University College, Auckland, New Zealand. Proc. Chem. Soc. 1896, [168], 149.

It is shown that when alloyed with silver, lead, copper, or iron, gold is readily converted into a sulphide by the action of sulphur vapour on the melted alloys. Analyses of the compounds so prepared are given which prove that the gold sulphide has the formula, Au₂S.

Gold and Silver, The relative Weights of dissolved, by Potassium Cyanide solutions from Alloys of these Metals. J. S. MacLaurin. Proc. Chem. Soc. 1896, [168], 149.

The author finds that gold and silver are dissolved by solution of potassium cyanide from an alloy of these metals in the proportions by weight in which they exist in it. He shows that this is the ratio of their atomic volumes.

Tungsten. R. Helmbacker. Eng. and Mining J., Aug. 15, 1896, 153—154.

TUNGSTEN occurs associated with tin ores in the Erzgebirge, especially in the Zinnwald Mines, north of Teplitz. The tin ore and its associated minerals occur (1) in veins in the older granite rock of the district; (2) finely disseminated through the rock between these veins; and (3) in lodes crossing through both the older and the more recent granites. From these mines an average of about 43 tons is annually obtained, which goes chiefly to Germany and to a large tungsten steel works in Styria, at an average price of about 30 florins per 100 kilos.

There are three varieties of the separated ore in the market. 1. A hand-picked ore. 2. A granular ore, wet-crushed and then dressed. 3. A sandy ore which has been subjected to the same treatment. Average analyses show:—

	1.	2.	3.
WO ₃	76.5	75.6	60.1
FeO.....	10.3	9.8	8.1
MnO.....	12.2	12.6	9.6
CaO.....	1.1	0.4	0.9
MgO.....	trace	trace	trace
SiO ₂	trace	3.6	8.4
Residue (rock, gangue) .....	..	..	13.1

The assay of tungstic acid in the wolfram is conducted by heating 3—5 grms. of the ground ore to 110°, fusing in platinum with sodium carbonate, thoroughly

extracting with water, and filtering. Bases are determined in the residue by the usual methods. The filtrate is acidified with hydrochloric acid and boiled, and the precipitate formed, is weighed, after filtration and drying. Any silica is removed by treatment with hydrofluoric acid and any stannic oxide is reduced to metal by fusion with potassium cyanide, and the separated metal dissolved and determined. From these data the amount of pure tungstic anhydride is easily derived.—J. T. D.

Alloys [Al, Ni, Mo, W, and U], New Method for the Preparation of. H. Moissan. *Comptes rend.* 122, 1302—1303.

THE method is based on the powerful affinity of aluminium for oxygen. A mixture of the oxide to be reduced and aluminium filings, is projected into a bath of melted aluminium. The heat which is disengaged by the combustion of a portion of the aluminium by the oxygen of the air is so great that the oxides of the most refractory metals are reduced, whilst the metal itself dissolving in the aluminium, gradually raises the melting point of the alloy. In this way alloys of aluminium with nickel, molybdenum, tungsten, uranium, and titanium have been obtained. In certain cases the heat given out during the reaction is so great that occasionally alloys containing 75 per cent. of tungsten have been maintained in the liquid condition. The reaction is sometimes explosive.

These alloys enable us to introduce the refractory metals, of which the fusing point is higher than the temperature of our ordinary furnaces, into any other metal possessing even a higher melting-point. For example, by introducing metallic chromium into melted copper an alloy containing not more than 0.5 per cent. of chromium is obtained; but melted copper dissolves an alloy of aluminium and chromium in all proportions forming a mixed alloy, copper-chromium-aluminium. From this alloy the aluminium may easily be eliminated by covering the melted bath with a thin layer of copper oxide which dissolves in the copper and oxidises the aluminium to alumina which swims on the surface.

This process might be used for the introduction of tungsten or titanium into a bath of steel kept molten in a Siemens-Martin furnace. The excess of aluminium could then be burnt away or destroyed by the addition of oxide of iron.—J. S.

Platinum in New South Wales. Occurrence of.

Eng. and Mining J. 1896, 62, 126.

PLATINUM mixed with gold has recently been discovered near the newly formed townships of Fifield and Platina. The metals occur in crevices in the bed rock and in the dirt at the bottom, in the form of small, water-worn grains, and are obtained by puddling and washing. The gold is extracted by amalgamation with mercury, leaving behind the crude platinum. An analysis of the latter by the analyst to the mines department gave:—Platinum, 75.90 per cent.; iridium, 1.30 per cent.; rhodium, 1.30 per cent.; palladium, traces; osmiridium, 9.30 per cent.; iron, 10.15 per cent.; copper, 0.41 per cent.; lead, traces; siliceous matter, 1.22 per cent. The ratio of platinum to gold is from 3 to 1 up to 6 to 1.—A. S.

Vanadium, its Alloys and their Applications. M. K. Hélonis. *Bull de la Soc. d'Encouragement*, June, 1896, 904—908.

At a height of about 4,800 m. on the elevated plains of the great chain of the Andes an anthracite mine is worked, containing two parallel, inclined beds of vanadium-containing coal, from 2 to 3 m. thick, and 1,400 m. long. The beds are separated by calcareous deposits. This coal burns readily, leaving 2 per cent. of ash, or 20 kilos. per ton, having an amber colour, and yielding 14 to 25 per cent. of vanadium as tetroxide, a little zirconia, notable traces of platinum, besides about 16 kilos. per ton of silver. The author has devised a process whereby vanadic acid and vanadates may be obtained at small cost from this ash, and anticipates from this source the probability of technical applications, not only in relation to dyeing, but to metallurgy.

Vanadic acid is reduced by aluminium at a red heat by successive stages to V_2O_3 ; but reduction to metal requires a temperature of about $1,700^\circ \text{C}$., when the evolution of heat from the formation of the alloy is liable, without certain precautions, to give rise to violent explosions, the light given out being comparable to that of the electric arc. Alloys may be obtained containing from 1 to 40 per cent. of vanadium, out of which the aluminium may be dissolved, leaving the vanadium in powder or in brilliant scales, which latter are not attacked by HCl or alkalis, and scarcely by concentrated sulphuric acid, but dissolve in nitric acid with production of vanadic acid, and, when thrown on a red-hot plate they inflame with projection of brilliant sparks.

The author has observed that the Swedish iron, from the magnetic oxide of Mount Taberg, so remarkable for its ductility, contains vanadium; and also that certain slags from Staffordshire iron furnaces, producing very ductile iron, contain a considerable proportion of vanadic acid. For application in the metallurgy of iron, alloys of vanadium are obtained by reduction of the oxides by aluminium in powder, the alloys named being aluminium-vanadium, iron-aluminium-vanadium, iron-nickel vanadium, and iron-chromium-vanadium. Alloys of copper-aluminium-vanadium have also been obtained for experiments with bronze. There is a special alloy of V-Al, remarkable for its sonorous quality, applicable in making bells and certain musical instruments.

A specimen of dephosphorised steel, tested after being melted in a plumbago crucible, gave breaking charge, 96 kilos. per sq. mm.; elongation, 2.3 per cent. The same, similarly melted with 1 per cent. of vanadium, gave breaking charge, 109 kilos.; elongation, 7.53 per cent.; limit of elasticity, 78.7. A second experiment was made, a magnesia-lined crucible being used, and 0.5 per cent. of vanadium added, which gave on trial, breaking charge, 66 kilos.; elongation, 16 per cent. A third experiment, using a magnesia-lined crucible, but adding 1 per cent. of vanadium, gave an alloy having breaking charge, 97 kilos.; elongation, 14 per cent. The same forging, annealed, gave breaking charge, 71 kilos.; elongation, 20 per cent. This last specimen, though very soft, took a remarkably high temper. A specimen of soft iron, with resistance, 38—39 kilos., and elongation, 19 per cent., after fusion with iron-vanadium equal to 0.5 per cent. of vanadium, gave a bar forged without annealing, having breaking charge, 61.25 kilos., and elongation, 12 per cent., which, after annealing, became respectively 53 kilos. and 32 per cent. elongation. This last specimen showed very great malleability and ductility. An aluminium-bronze was also tested, containing 8 and 1 per cent. respectively of aluminium and vanadium, which gave breaking charge, 71 kilos.; elongation, 12.5 per cent.

Nickel oxide is reduced by aluminium powder, and nickel-aluminium alloys containing from 25 to 90 per cent. of nickel, have been obtained. Aluminium added to fused commercial nickel instantly reduces the oxide present with a strong reaction. Nickel, chromium, tungsten, and molybdenum are easily extracted from their alloys with aluminium, and nickel thus obtained becomes pyrophoric at over 100°C . Great care is necessary in preparing molybdenum-aluminium, since a mixture of molybdenum oxide and aluminium powder, when strongly heated, explodes with a report like a gun-shot and projection of the metal. Iron-molybdenum may be prepared without danger. An alloy containing 21 per cent. of molybdenum is described as being hard enough to scratch glass. Steel, melted with 0.5 per cent. of molybdenum, acquires extraordinary hardness. —E. S.

Manganese, Determination of, in Steel. Sources of Error in Volhard's and similar Methods. G. Auchy. *J. Amer. Chem. Soc.* 1896, 18, 498.

See under XXIII., page 677.

Copper, Crude, The Analysis of. F. Jean. *Ann. Chim.* 1896, 1, 185.

See under XXIII., page 677.

Mercury, General Method for the Estimation of. M. G. Deniges. Bull. Soc. Chim. de Paris, 1896, 15—16, 862.

See under XXIII., page 678.

Zinc in Russia. Chamber of Commerce J., Aug. 1896, 148.

See under Trade Rep., page 684.

PATENTS.

Compound Metal Sheets or Plates, Impts. in the Manufacture of, for Use in Making Silvered Copper Utensils and other Articles. O. Inray, London. From E. Martin, Paris. Eng. Pat. 11,763, June 17, 1895.

Pure copper, or a special alloy of 98 parts of copper, 1·9 of tin, and 0·1 of nickel is cast into ingots, which are slightly hammered while hot. The surface is then planed, coated with the double nitrate of silver and mercury, and finally with a plate of silver, which is fixed by pressure. It is then enclosed in a sheet of copper and secured with a thin copper hoop. The ingot thus prepared is heated to 700° or 800° C. and rapidly rolled into a bar, reheated, and rolled into a sheet. Instead of silver an alloy of silver and aluminium may be used.—J. H. C.

Volatilisation of Galena into White Compounds of Lead, and of Zinc into White Compounds of Zinc, the Making of Litharge, and the Smelting of Metals from their Ores or Slags; Impts. in the Process for. A. C. J. Charlier, Glasgow. Eng. Pat. 14,166, July 23, 1895.

See under XIII. A., page 662.

Metallic Sands and Pulverised Ores [in Blocks with dried Peat], Impt. in the Reduction of. A. A. Dickson, Toronto. Eng. Pat. 12,455, June 27, 1895.

Dried peat is disintegrated between rollers, intimately mixed with the metallic sand or pulverised ore in equal or other convenient proportions, and pressed into blocks, which are then ready for the reducing furnace, either with or without previous charring.—J. H. C.

Zinc-Bearing Ores, Impts. in the Treatment of, and Zinc-Bearing Products. E. A. Ashcroft, Broken Hill, Australia. Eng. Pat. 13,534, July 13, 1895.

This patent relates to the extraction of zinc from its roasted ores by leaching with a ferric salt solution, whereby the iron is replaced by zinc, and subjecting the solution to double electrolysis, by which the metallic zinc is deposited and the leaching solution regenerated, as described in a previous patent (this Journal, 1894, 957). The improvements refer, firstly, to the composition of the working solutions, which are now mixed with a sulphate or chloride of an alkali or magnesium; secondly, to the method of performing the double electrolysis; and thirdly, to the method of performing the leaching operation. The cycle of operations is now as follows:—Leaching, whereby iron is thrown out of solution and zinc substituted; circulation past the cathodes in the zinc electro-depositing plant, where the excess of zinc is taken out; circulation past the iron anodes, where ferrous salts are imparted to the solution; and circulation past the carbon anodes, where the ferrous salts are oxidised to ferric, and the solution thereby regenerated for further leaching. In place of the carbon anodes in the last operation, the oxidation may be effected by chlorine or any other suitable agent.—A. W.

Precious Metals [Gold and Silver], Extraction of, from their Ores and Compounds. Improved Process. W. H. James, London. Eng. Pat. 15,656, Aug. 20, 1895.

The improvement consists in the use of a solution of peroxide of hydrogen in conjunction with potassium cyanide as a solvent.—J. H. C.

Aluminium and Magnesium, Manufacture or Production of Granulated. W. L. Wise, London. From the Aluminium Industrie-Actien-Gesellschaft of Neuhausen. Eng. Pat. 15,959, Aug. 24, 1895.

The metals are heated to a temperature of about 100° C. below their melting points, and then crushed by grinding or stamping while still hot.—J. H. C.

Aluminium, Alloys of [Tungsten and Magnesium]. H. Partin, Paris. Eng. Pat. 21,575, Nov. 13, 1895.

To alloy aluminium with tungsten, a preliminary alloy is made to overcome the difference of their fusing points. It is prepared by first melting together copper, tin, and a little arseniate of potash, then powdering this material, fusing it with tungsten and antimony, and finally adding the metal so produced, to the fused aluminium, in the proportion of from 4 to 10 per cent., according to the tenacity or the sonorousness required. Magnesium may be used in a somewhat similar manner in place of the tungsten and antimony. Increased tenacity is conferred thus upon the aluminium.—A. W.

Metallic and other [Al, Mg, Ca, Sr, Ba, &c.] Compounds, Process for Producing, Decomposing, Converting, Transforming, and Reducing. H. S. Blackmore, Mount Vernon, U.S.A. Eng. Pat. 23,707, Dec. 10, 1895.

THE chief object of this invention is the economical production, from infusible or semi-fusible natural products, of purified chemical compounds or metals, and particularly of sulphides of such metals, as aluminium, magnesium, calcium, strontium, barium, &c., or the metals themselves. The following processes are claimed:—

Fluo-carbides are produced by exposing carbon and a metallic fluoride in a heated state to the action of a volatile element such as sulphur, tellurium, selenium, &c.

Compounds of carbon and fluorine with other elements are produced by passing the vapour of such elements over a mixture of carbon and metallic fluoride (such as lead fluoride) in a heated state.

Sulphur fluo-carbide is produced by passing the vapour of sulphur over a heated mixture of carbon and a metallic fluoride.

Silicon is eliminated from a molten bath or compound by exposing the same to the action of fluorine carbide or sulphur fluo-carbide.

Metallic oxides or infusible bodies to be transformed, are dissolved or suspended in the bath and similarly treated.

Aluminium or other sulphide is produced by exposing the molten or liquefied oxides to the action of carbon bisulphide vapour or of carbon and sulphur.

Cyanides are produced by suspending a metallic carbide in the bath, and exposing it to the action of nitrogen; alkaline cyanides are produced by suspending carbide of iron in a molten bath of alkali sulphide, and introducing nitrogen gas.

Alkali salts are produced from natural products, such as sodium chloride, by suspending alumina in a molten bath of the said natural product, and exposing it to the alternate action of steam and gaseous acid.

Alkali carbonate is similarly produced by using a bath of alkali chloride and subjecting the same to the action of super-heated steam and carbonic anhydride.

Ultramarine is produced by dissolving kaolin or felspar in the bath, and exposing it to the action of carbon bisulphide vapour.

Metals are reduced from their salts or combinations by dissolving them in the bath, and gradually exposing it to the action of highly heated or molten reducing agents.

Aluminium or other metals are produced by dissolving their compounds in the bath, and gradually introducing, in small streams, metallic iron or copper or other reducing agent in a highly heated or molten state, or by slowly commingling said compounds in a molten or dissolved state with a highly heated or molten reducing agent of greater specific gravity, or by exposing the molten or suspended oxides to the alternate action of a non-metallic carbide and a highly heated or molten reducing agent of greater specific gravity, or of a non-metallic carbide and a molten compound (such as potassium cyanide).

Aluminium is produced from bauxite by dissolving it in a molten bath, and heating it as above.

Alkali aluminate and hydrochloric acid are produced by exposing alumina dissolved or suspended in molten alkali chloride to the action of steam.

For any of the above processes a molten flux or bath consisting of a mixture of fluorides and sulphides of the alkali metals, potassium and sodium, may be employed, and the various reactions may be effected in any order.

—J. H. C.

Metallic Alloys, Impts. in the Manufacture of [Cu, Ni, Fe, Co, My, and Spelter]. C. Parnacott, London. Eng. Pat. 23,950, Dec. 13, 1895.

THE proportions are :—copper, 44 ; nickel, 20 ; spelter, 25 ; iron, 7 ; cobalt, 3 ; and magnesium, 1 part. The nickel is first melted and the magnesium added in minute charges, whilst stirring with plumbago rods, after which an equal quantity of copper is mixed in. In another crucible the remainder of the copper is melted with the iron and cobalt, and when properly fused this alloy is poured into the first mixture. The zinc is then added whilst stirring with a charred wooden rod. This alloy will resist oxidation, polish brilliantly and withstand the corroding action of hydrochloric acid in sea water and of all atmospheric influences.

—A. W.

Crucible Melting Furnaces, Impts. in. W. Kirkham, Sheffield. Eng. Pat. 1303, Jan. 18, 1896.

INSTEAD of the usual rectangular fire-brick chamber, a perforated metallic casing of oval form is placed over each fire-grate. This is constructed in segments, secured by straps and bolts to allow for expansion and contraction, and lined with special silica fire-bricks moulded in segments and so arranged and covered in as to form spaces for the circulation of air around such casing. Shutters and dampers are provided for the regulation of the air circulation while the furnace is at work, and for the exclusion of air when it is idle.—J. H. C.

Sulphuret of Aluminium, a Process for the Manufacture of Double Compounds of with other Metallic Sulphides. D. A. Peniakoff, Huy, Belgium. Eng. Pat. 7273, April 4, 1896.

ALUMINIUM free from moisture is mixed with metallic salts rich in oxygen (such as sulphates, phosphates, chromates, or manganates), and then treated with sulph-oxy-carbon or sulphuretted carbon vapours in tightly closed retorts heated to a suitable temperature.—J. H. C.

Smelting Fine Ores, Improved Method for Using Mine Dust [Bricks or Briquettes] of Iron from Calcining Kilns or Hearths. G. Fisher, Shotts. Eng. Pat. 8558, April 23, 1896.

THE dust or residue is pugged, ground, or mixed as in preparing clay for brick-making, alumina or other binding material being added when necessary. The plastic mixture is then formed into lumps and dried ; these, when necessary, are afterwards calcined.—J. H. C.

Annealing Sheet Metal, New or Improved Method of and Apparatus for. W. E. Harris, Ohio, U.S.A. By W. P. Thomson, Liverpool. Eng. Pat. 9552, May 5, 1896.

THE sheets, after annealing and cold rolling, are stacked in an annealing box, with interposed layers of copper filings and pulverised soapstone, and then annealed a second time. Powdered iron ore is in some instances added to the soapstone. Any convenient form of annealing furnace may be employed.—J. H. C.

Amalgamating Machines, Improved Process [Use of Kerosene] for Preventing the Sickening of Mercury in. J. T. Penny, Adelaide, and J. Dungey, South Melbourne, Australia. Eng. Pat. 12,519, June 8, 1896.

THE sickening of mercury is prevented by supplying kerosene in small quantities either to the material under treatment, or at short intervals, to the amalgamating plates and mercury in the machines when at work.—A. W.

Articles of Steel and Malleable Iron, Impts. in Annealing. W. H. Trengrove, Christchurch, New Zealand. Eng. Pat. 13,476, June 18, 1896.

THE articles are enveloped in asbestos before they are placed in the annealing furnace.—J. H. C.

Metallic Alloys [of Al, Cu, Sn, Zn, and Pb], Impts. in and in the Manufacture of. A. P. Cothias, Ivry-sur-Seine, France. Eng. Pat. 14,479, June 30, 1896.

THE improved alloys are composed of copper, tin, zinc, and aluminium, or lead, in the following proportions, or nearly so :—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Al .....	..	10	230	400	880
Cu	160	180	80	40	40
Sn	50	150	190	200	80
Zn	750	660	500	520	..
Pb	10	..	..	..	..
	1,000	1,000	1,000	1,000	1,000

Ocasionally small quantities of titanium, manganese, tungsten, and the like, in the form of salts, are added to increase the hardness. These alloys have considerable tensile resistance, and may be soldered and worked with the greatest facility.

In preparing the alloys, the desired quantities of copper and tin are first melted together and allowed to cool. The zinc is then added and the whole remelted. The mass is then allowed to cool until it is in a pasty condition, when the aluminium is added, after which the whole is heated to a very high temperature. One-tenth of one per cent. of ammonium chloride and a small quantity of phosphorus are added in the course of the last heating. The phosphorus may be employed in the form of a salt.—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

PATENTS.

Electrodes, Impts. in [Carbon Electrodes]. C. Hoepfner, Giessen, Germany. Eng. Pat. 17,505, Sept. 19, 1895.

THE electrodes consist of plates of artificial carbon, in which are embedded projecting pieces of retort or other natural resistant carbon, so as to increase the surface of the electrode, and protect the artificial carbon from the action of the current. The pieces of retort carbon may be fixed in the prepared plates, either before or after they are baked, and the surface of the ground plate may be coated with paraffin, so that the acting surface of the electrode is supplied by the projecting retort carbon alone. It is claimed that by this method of manufacture, plates of any desired size may be made, which have the resistant properties of retort carbon.—G. H. R.

Accumulators, Active Material for Electric [Organic Acid Paste]. F. Dannert, H. Windolf, and J. Zacharias, Berlin, Germany. Eng. Pat. 22,505, Nov. 25, 1895.

THE active material for the plates is prepared by mixing into a paste with a solution of formic acid (CH_2O_2) or tartaric acid ($\text{C}_4\text{H}_6\text{O}_6$) a powder composed of a mixture of a metal and its oxide (say lead oxide). To this paste may be added some jelly, glue, sugar, or substances convertible into sugar. This mixture is placed in the moist state in the electrode frames, and formed after drying.—G. H. R.

Carbon Anodes, Impts. in the Manufacture of, for Electrolytical Processes [Preserving Anodes by Wax or Grease]. P. Jensen, London. From H. Cappelen and D. Cappelen, Skien, Norway. Eng. Pat. 13,521, June 18, 1896.

TO prevent the destruction of the anodes, the carbon of which they are composed is dipped in molten paraffin wax,

or similar inert fatty substance, which enters the pores and solidifies on cooling. The carbon may be impregnated either before or after it has been shaped, and it is claimed that the treatment allows of the employment of inferior carbon and of higher current density.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Oleaginous Seeds (I'Sano, Mohamba, Wild Olive). Note on the Composition of. A. Hébert. Bull. Soc. Chim. (3). 15—16, [15], 935—941.

I'Sano or Unguoko.—These seeds are derived from a large tree of the Oleaceae family, growing in the French Congo territories. The fruit is a drupe of some 3 cm. in length, and encloses a brownish oval nut 2.7×2.4 cm., almost completely filled by the kernel, 37 per cent. of which is shell. The ground and dried seed contains 7.3 per cent. of moisture, and yields 60 per cent. of oil; the residue (oil-cake) contains 33.12 per cent. of total nitrogenous matters (= 5.3 per cent. N), 1.5 per cent. of sugars, 24.37 per cent. of soluble gums, 6.7 per cent. of cellulose, and 4.25 per cent. of ash (chiefly CO_2 , P_2O_5 , salts of Fe, Al, Mg, and K, with a small proportion of sulphates, chlorides, and salts of Ca and Na), and should make a suitable cattle food. The oil is liquid, even at -15°C ., reddish in colour, of insipid flavour, and fishy smell. It is viscous and very siccativ, has a sp. gr. of 0.973 at 23°C ., is but slightly soluble in 90° alcohol, and gives the following reactions:—

Thermal test with sulphuric acid + 117°C .

Nitric acid and mercury: Viscous reddish turgid mass.

Potassium hydrate (sp. gr. 1.34) in the cold: Yellowish-brown coloration.

Potassium hydrate (sp. gr. 1.34) in the warm: Soft, dark-brown soap.

Fuming nitric acid: Brown zone, followed by very energetic reaction, resulting in a carbonaceous mass.

Sulphuric acid: Black coloration, carbonised mass.

When treated with boiling water in presence of litharge, the oil becomes pasty after awhile.

The oil yields 80 per cent. of brown liquid fatty acids, which from the behaviour of their lead salts are unsaturated, and consist of oleic acid (15 per cent.) linoleic acid (75 per cent.), and 10 per cent. of a new solid white acid (named by the author isanic acid), turning directly to rose colour in contact with air; the bromine absorption is double that of oleic acid. The glycerin in the mother-liquor amounts to from 12 to 13 per cent.

It is considered that this oil might be advantageously extracted on an industrial scale, and employed for the same purposes as linseed oil.

Mohamba.—These seeds are very similar to those just described, and contain 8.6 per cent. of moisture when dried at 100°C ., but yield only 12 per cent. (of the shelled kernel) of oil. The oil-cake contains 19.5 per cent. of nitrogenous matter (= 3.12 per cent. N), 1.5 per cent. of sugars, 15.55 per cent. of cellulose, 43.33 per cent. of soluble gums, starch, &c., and 3.05 per cent. of ash (containing the same substances as I'Sano-seed), and forms a nutritive foodstuff.

The oil is liquid at -15°C ., yellow, fairly fluid, inodorous, insipid, only slightly soluble in 90° alcohol, and has a specific gravity of 0.915 at 23°C . The thermal test gives + 55°C .; the nitric acid and mercury reaction results in a yellow turgid mass, becoming pasty after awhile; in the cold, potassium hydrate gives a yellow coloration, and a soft brown soap in the warm; fuming nitric acid produced a brisk reaction, and sulphuric acid a deep brown coloration. Treatment with boiling water and litharge results in the formation of a solid paste. The fatty acid obtained amounts to 90 per cent. of brown, liquid, unsaturated acid, which, when recovered from its lead salt, deposits in time a white fatty acid, soluble in alkali, alcohol, and ether, crystallising from the latter in laminae, which melt at $34-35^\circ\text{C}$. This acid absorbs bromine to the same degree as oleic acid, and therefore seems to belong to the $\text{C}_{18}\text{H}_{32}\text{O}_2$ series, but does not correspond with any known acid; the quantity obtained was too small to permit

of thorough examination. The liquid acid answers to the bromine absorption and elaidin reactions for oleic acid. About 9 per cent. of glycerin is present in the mother-liquor from the saponification of the oil.

Wild Olive.—The seed is derived from a wild olive of the Simaruba variety, found native near Gatira (San Salvador Republic). The drupe is edible, of a sweet but astringent flavour, and contains a seed composed of large plano-convex cotyledons with short, superior radicle, rich in an oil which is used for making soap. The shell amounts to 61 per cent. of the whole seed. The oil-cake is fairly nitrogenous, very bitter in flavour, and contains no starch, but a large proportion of tannin and glucose. On extraction, the seed yields a solid yellow fat (quantity not stated) melting at 30°C ., which contains over 90 per cent. of solid white fatty acids, melting at $48^\circ-49^\circ\text{C}$., and consists of equal quantities of saturated and unsaturated acids. The former, as a whole, melted at $54^\circ-55^\circ$, but the melting points of the three fractions obtained by the acid of barium chloride were respectively $58^\circ-59^\circ$, 44° , and 38°C . The unsaturated (liquid) fatty acids in time deposited a solid white acid, melting at $44^\circ-45^\circ\text{C}$., and probably consisting of saturated acids.—C. S.

Isanic Acid: A New Unsaturated Fatty Acid. A. Hébert. Bull. Soc. Chim. 1896, 15—16, [15], 941—945.

This acid is obtained by fractional precipitation of the fatty acids in I'Sano seed oil (see previous abstract), and, when purified by recrystallisation from ether, consists of foliated crystals, melting at 41°C ., and readily soluble in strong alcohol, ether, chloroform, benzene, acetone, methyl alcohol, and petroleum spirit. With alkalis it forms crystallisable salts. It possesses a particular odour, which it imparts to the seed, and is extremely susceptible to change, turning rose-red on exposure to air, the tinge deepening in proportion as oxygen is absorbed. This colouring matter may be separated by dissolving the acid in ether. The potassium, ammonium, lead, barium, and silver salts are also very unstable, this peculiarity increasing the difficulty of analysing the acid. The mean percentage composition, derived from four analyses, is: carbon, 76.63; hydrogen, 9.30; oxygen, 14.07, which, together with the estimation of the bases in the silver (31.05) and barium (24.40) salts, appears to coincide most nearly with the formula $\text{C}_n\text{H}_{2n-8}\text{O}_2$, n being equal to 14—a view confirmed by the cryoscopic determination of the molecular weight (217). It was, however, found impossible to verify this by hydrogenation with hydrogen iodide (Arnaud's method), nothing but products of advanced decomposition, with traces of a liquid fatty acid, resulting. The authors sought to verify the general formula of their acid by treatment with bromine. The capacity of absorption corresponded appreciably to two molecules. The chlorinated and brominated compounds are unstable, decomposing with loss of the halogen acids.

The ammonium salt is soluble in water, recrystallising as naereous spangles, which turn rose, then blue, on exposure to air. The barium salt is a white powder, soluble in warm chloroform or alcohol, but separating out on cooling in the form of microscopic crystals, which also become rose-coloured in air; and the silver salt is very susceptible to light and air. The red colouring matter may be isolated by solution in sulphuric acid and reprecipitation by water. Experiments with a view to ascertaining whether the formation of this body affords an insight into the general system of the production of vegetable colours, are in progress.—C. S.

Solidifying Point of Mineral Oils. Alteration of. D. Holde. Mitt. Königl. techn. Versuchs. zu Berlin, 1896, 113—116.

The author has shown (Mitt. Königl. techn. Versuchs. 1895, 253; this Journal, 1896, 138) that certain dark mineral lubricating oils suffer a change in their solidifying points by previous heating. Thus, heating to 50°C . may cause an oil normally not solidifying at -15°C . to become gelatinous and non-mobile at that temperature. This observation has now been extended to numerous other samples, and appears to hold generally. Occasionally the

alteration takes place in the reverse direction—that is, a previously heated oil will solidify less readily than the same oil which has not been thus treated.—B. B.

Tung Oil (Chinese Wood Oil). W. H. Deering. Imp. Instit. Journal, Scient. and Tech. Research Dept., Aug. 1896, 303.

This is a glyceride oil giving on saponification 96½ per cent. of fatty acids, which, at ordinary temperatures, are hard and crystalline; it requires 1.18 per cent. of caustic potash for neutralisation and 19.12 per cent. for total saponification. The bromine absorption is 98 per cent. It is a golden-yellow, clear, viscous oil; when exposed to air in a thin film it dries to a white, opaque, solid film in 20 hours, raw linseed oil usually requiring 60 hours. Heated to 500° F., with or without oxides of lead and air stream, it jellified in about 10 minutes, the rapid change being probably due to polymerisation rather than to oxidation. Tung oil will probably be valuable in the manufacture of linoleum.—A. C. W.

Rapinic Acid. J. Zellner. Monatsh. f. Chem. 1896, 17, 309–313.

ACCORDING to Reimer and Will (Ber. 20, 2385), rapinic acid possesses the formula $C_{18}H_{34}O_2$, and is isomeric with ricinoleic acid.

The author, however, has carefully investigated the acid and its zinc salt with a view of obtaining further information regarding the supposed presence of the third oxygen atom, and has arrived at the conclusion that its formula ought to be $C_{18}H_{32}O_3$, or that only two oxygen atoms are present in the molecule; and that although it possesses the latter formula, it is not identical with oleic acid, as it does not exhibit the elaidin reaction.—J. S.

Rape-Seed Meal as an Adulterant of Mustard and Linseed Meals, &c., Test for. Pharm. Zeit. Russl. 1896, 35, 360.

See under XXIII., page 679.

Hübl Residues, Recovery of Iodine from. K. Dietrich. Pharm. Central-Bl., N.F., 1896, 17, 361.

See under XXIII., page 680.

Resin Oil in Fatty Oils, Detection of. P. Cornette. Ann. Pharm. 1896, 2, 240.

See under XXIII., page 680.

Soap in Egypt. Chamber of Commerce J., Aug. 1896, 147.

See under Trade Rep., page 684.

PATENTS.

Soap, Shave Dips, Hop Washes, and the like, Impts. in the Manufacture of [with Soluble Sulphur]. F. W. Saatmann, Driffield. Eng. Pat. 15,568, Aug. 19, 1895.

To obviate the formation of sulphides in the production of soluble sulphur in soaps and the like, the patentee mixes ground resin with about 30 per cent. of flowers of sulphur, heats the mixture to about 120° C., and distils the clear upper liquid at "a temperature exceeding 23° C." The resulting product is readily saponified, and the soap dip or wash so obtained contains the sulphur in a soluble form.

—C. A. M.

Effluent Waters of Wool-washing Machines, and the like, New or Improved Method of and Apparatus for Removing Fatty Matters from the. [Separation by Air-Blast Agitation.] J. Holmes, Bradford; H. E. Tankard and W. Seafie, Laisterdyke. Eng. Pat. 18,239, Sept. 30, 1895.

See under V., page 648.

Soaps and Saponaceous Compounds [Admixture with Boric Compounds], Impts. in the Manufacture of. J. Ascough, Stafford. Eng. Pat. 10,681, May 18, 1896.

The object of this invention is to increase the antiseptic properties of soaps by the addition of boron compounds in

such a manner that the tendency of the latter to dissociate is avoided. For hard soaps for household or toilet purposes, the following mixture is employed:—Boric acid in powder, 62 lb.; dry sodium carbonate, 27 lb.; boiling water, 44 lb.; tincal borate in powder, 5 lb. These are heated in the boiling pan and stirred until effervescence has nearly ceased; 2 lb. of this boron compound, while still hot and fluid, are stirred into each cwt. of the boiling soap, which is then allowed to set in the usual manner. For soap powders and similar compounds, the boron mixture is allowed to cool until more or less solid before being transferred to the grinding apparatus with the respective substances.

For mineral and polishing soaps the mixture consists of sodium carbonate, dry, 27 lb., and water (boiling), 41 lb.; or soda crystals, 71 lb., with boric acid in fine powder, 50 lb., and calcium borate in fine powder, 16 lb. These are combined in the boiling pan and added to the soap in the manner described above.—C. A. M.

Glycerin and Caustic Soda from Soap Lyes [Electrolysis] Impts. in the Production of. J. Glatz and O. Lugo, New York. Eng. Pat. 10,837, May 19, 1896.

The soap lye left in the manufacture of soap, containing free alkali, sodium or potassium hydrate, fatty glycerides, free glycerin, and some fatty acids, is subjected to the action of an electric current, the anode being composed of zinc or carbon, preferably the latter, retained in contact with the liquor under treatment, whilst the cathode is separated from the anode by a porous partition. It is claimed that in an apparatus constructed on this principle, the current decomposes the caustic soda in the lye, the liberated sodium being attracted to the cathode and immediately oxidised to sodium hydrate. The glycerin compounds are decomposed and the glycerin set free, whilst the albuminoid and colouring matters are rendered insoluble and are readily removed by filtration. The colour of the lye is changed from a dark-brown to a light straw colour. After the electrolytic treatment the insoluble matter is separated from the liquor and the latter distilled. The glycerin obtained is perfectly pure and free from discoloration, and can be used for all purposes in the arts. The caustic soda produced is practically pure, and can be used at once by the soap-maker, since by the above process it is possible to produce a solution of the required density.—C. A. M.

Soap or Cleansing Agent [Mixed with Sawdust], Improved. H. W. Wilson, Todmorden. Eng. Pat. 12,953, June 12, 1896.

In this patent, soap is mixed with sawdust in about equal proportions, the object being to give a certain amount of roughness which will not injure a smooth surface. A secondary advantage is that the soap will float.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(4.)—PIGMENTS, PAINTS.

PATENTS.

Paints and Pigments [Arsenic Trisulphide and Sulphur], Impts. in the Manufacture of. S. B. Schryver, London. Eng. Pat. 13,973, July 23, 1895.

THE basis of this paint consists of arsenic trisulphide mixed with sulphur. It is prepared by slaking 56 lb. of lime in 100 gallons of water, adding 160 lb. of sulphur, and boiling with wet steam till the liquid is nearly clear. The solution is decanted, 198 lb. of white arsenic added, and the whole again boiled until the pigment reaches its maximum of brightness, when it is allowed to cool, and hydrochloric acid is run in to faint acidity. Other pigments, such as Prussian blue, may be precipitated with the arsenic, if desired, so as to form a green. The material is claimed to be specially suitable for ships' bottoms, owing to the "anti-fouling" nature of the arsenic sulphide. For this purpose it may be suspended in boiled oil and petroleum spirit, and mixed with the oxides of iron and zinc together with lime and rosin.—F. H. L.

Volatilisation of Galena into White Compounds of Lead, and of Zinc into White Compounds of Zinc, the Making of Litharge, and the Smelting of Metals from their Ores or Slags; Impts. in the Process for. A. C. J. Charlier, Glasgow. Eng. Pat. 14,166, July 25, 1895.

This invention consists "in the use of gas under pressure in conjunction with heated air for the conversion of galena into white compounds of lead by volatilisation, likewise the same from zinc ores into white compounds of zinc; also the extraction of all kinds of metals, lead, zinc, iron, antimony, &c., either from their ores, slags, or residues." When working on lead the furnace is built of iron, water-jacketed half-way up. Half of the bottom is made to slope to a saucer-shaped receptacle placed in the other half, and the hot gas and air are led in midway, and just where the slope begins. By the use of gaseous fuel, the formation of slags in the furnace is avoided, and as the waste gases leave the apparatus still under pressure, fans, &c. are not required to drive the fume through the usual condensers. The basin serves to collect any metal that is not volatilised, whence it may be removed without stopping the operation.

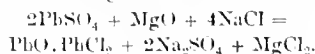
—F. H. L.

Protecting Ships' Bottoms against Fouling, Preserving Wood, and Shielding Submarine Electric Cables from Penetration by Tereido Worms; Impts. in Compositions for [Metallic Cresylates]. W. G. Gunn, Bristol. Eng. Pat. 17,871, Sept. 24, 1895.

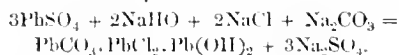
The essential point of this patent lies in the use of the "cresylate" of either mercury, lead, copper, iron, or zinc. 100 parts of cresol are heated between 80° and 120° C. with 120 parts of the oxide of one of the above metals, or a mixture of them, until a drop of the substance solidifies on cooling. If the composition is to be employed for preserving wood, the cresylate is dissolved in creosote oil, &c., but if a paint is required, it is ground into an ordinary linseed-oil vehicle.—F. H. L.

White Lead, Substitute for [Lead Oxychlorocarbonate], and of other Oxy-Salts of Lead from Lead Sulphate and Lead Chloride; Impts. in the Production of a. S. Ganelin, Philadelphia, U.S.A. Eng. Pat. 8981, April 28, 1896.

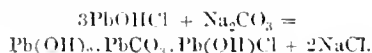
This specification describes various processes for preparing different oxy-salts of lead from the chloride or sulphate, one of which, the oxychlorocarbonate, is a new compound, and may be used as a substitute for white lead. (1.) On mixing the sulphate or chloride of lead with magnesia in presence of water, the basic salt $PbO \cdot PbSO_4$ or $PbO \cdot PbCl_2$ is definitely formed, irrespective of the proportions of the substances present. (2.) By treating lead sulphate with half its equivalent of a stronger base in presence of water and a salt of the desired radical, an oxy-salt of lead is produced in the following manner:—



(3.) By adding another salt containing a different acid, an oxy-lead compound may be obtained with two acids, e.g., the above-mentioned oxychlorocarbonate:—



The same body may also be prepared from the basic chloride as follows:—



—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Unhairing, Sweating and Liming Processes for: J. von Schroeder's Researches on. F. H. Haenlein. Dingler's Polyt. J. 1896, 301, 65—70 and 90—95.

For what is known concerning the rationale of "Unhairing," consult Villon (*Traité pratique de la fabrication des cuirs et du travail des peaux*) and Eitner (*Der Gerber*,

1875, 3; 1877, 49; 1880, 111; 1881, 51; 1888, 159, 198; 1891, 13; 1892, 65, 223.) Compare also this Journal, 1890, 461 and 549.

A brown- and black-haired ox-hide was washed, cleansed from adhering flesh, &c., trimmed, and cut up into squares of 10 cm. side. These were immersed in successively stronger salt solutions until they no longer absorbed salt from saturated brine, and were finally preserved in brine to which access of air was prevented. When a square was required for an experiment it was restored to its original condition by 2—3 days' washing in running water. The brown-haired squares were, on the average, somewhat heavier than the black-haired.

As a sweating pit, an ordinary moist chamber, such as is used by the bacteriologist, served, and in this the pieces of hide were laid on dishes, hair side up; the temperature was kept at 16° C. Signs of putrefaction were noted after three days, and after five days one of the pieces could be easily unhaired by a horn spatula. Thus this period may be considered the normal time for unhairing at 16° C., and this is consonant with practice. The epidermis was to a great extent removable as a whole, so that the hair retained its normal condition—a fact emphasising the epidermoid character of the hair.

A second piece of hide was removed from the chamber after six days, and was easily unhaired by the spatula, with the exception of the usual "ground hairs," which, though easily removed by forceps, were too short to be caught by the spatula; there is thus no real difference between "ground hairs" and other hairs, as has been stated. A third piece of hide was unhaired after 8½ days, without any damage to the grain; but a fourth piece, which remained in the chamber for a month, suffered materially. It was found that a piece of hide from which the salt had not been washed could not be properly unhaired until after a sojourn of five months in the chamber, illustrating the retardation of the sweating process effected by salt.

Experiments on the influence of the proportion of lime used and of the addition of stale or partially stale lime-liquor to the limes, on unhairing by this process, were carried out by immersing the hide pieces, freed from salt, in diverse liquors, varying from pure water and water containing the common proportion of lime (6 kilos. of caustic lime per cubic metre of water), to a magma of 300 grms. of quick-lime in a litre of water. In some cases, liquor which had been already used in a tanyard was added, and in every case the proportion of ground hide to unhairing liquor was 1:4·8. In the result it was found that within wide limits the proportion of lime has no influence on the unhairing process, and that immersion in water cannot be substituted for sweating. The influence of the proportion of lime in the plumping of hide, was not considered in these experiments. When the salt was left in the hides it had no appreciable influence on their unhairing by lime.

The detailed experiments lead to the inference that the liming process is not dependent for its depilatory action on the presence of bacteria, and is effective by virtue of alkalinity alone. This result contradicts Villon's conclusion (*loc. cit.*).—A. G. B.

Tannin and Colouring Matter contained in the Bark of Myrica nagi. A. G. Perkin and J. J. Hummel. Proc. Chem. Soc. 1896, [168], 145.

Myrica nagi is an evergreen tree, belonging to the Myricaceæ occurring in the sub-tropical Himalayas, in the Khasia Mountains, the Malay Islands, and Japan. The bark, which is used as a tanning agent, and occasionally for medicinal purposes, was found to contain a yellow colouring matter. This formed yellow needles, closely resembling quercetin, having the formula $C_{15}H_{10}O_8$. In strong solutions of alkali it dissolves with an orange colour, which, on dilution and exposure to air, becomes first green, then deep blue, and finally red-violet. It dyes shades which, in their general character, closely resemble those produced by quercetin and fisetin. With fused alkali it yields *phloroglucol* and *gallic acid*. This is probably a tetrabromo derivative of the colouring matter, but, on account of its somewhat peculiar properties, it will require further

examination. The results of this investigation show that this colouring matter, for which the name *myricetin* is proposed, is most probably a hydroxyquercetin. Its colour reactions with dilute alkali are probably due to the oxidation of the pyrogallol nucleus it contains. The amount of colouring matter, isolated by the method described, varied from 0.23 to 0.27 per cent., and the amount of tannin it contained, according to H. R. Procter, 27.30 per cent.

Quebracho Colorado, The Colouring Matter of. A. G. Perkin and O. Gunnell. *Proc. Chem. Soc.* 1896, [168], 158.

The wood of *Quebracho colorado* constitutes the tanning matter "quebracho," which is suitable for the production of Morocco leather, and, moreover, in conjunction with alum, it gives the leather a bright yellow shade, instead of the darker colours prepared in the ordinary way. Jern (Bull. Soc. Chim. 33, 6) found it to contain a tannin differing from those of oak bark and chestnut wood. According to Arnaudon (Watts' Dict. Chem. 8, 1732), it contains a yellow colouring matter.

The colouring matter, $C_{15}H_{10}O_6$, forms glistening yellow needles, dyeing shades similar to those of quercetin, and yielding compounds with mineral acids. Its dyeing properties were identical with those of fisetin, $C_{15}H_{10}O_6$, the colouring matter of young fustic (*Rhus cotinus*), and there could be little doubt that it was fisetin.

A second substance, $C_{14}H_{10}O_{10}$, forming minute prisms, was also isolated, and was found to be *ellagic acid*, and further, the presence of a considerable quantity of *gallic acid* was detected, these latter being, no doubt, chiefly formed during the isolation of the fisetin from the quebracho.

Leather Refuse, The [Mauurial] Value of. J. B. Lindsey.
J. Amer. Chem. Soc. 1896, **18**, 565.

See under XV., page 663.

PATENTS.

Degreasing Leather, Impts. in the Method of and Machines for. E. W. Wright and W. Monk, both of Nottingham. Eng. Pat. 10,752, May 19, 1896.

ACCORDING to this new method, the skins to be treated are immersed in a "warm liquid volatile solvent," the nature of which is not further specified, and means are provided for the constant agitation of either the skins, or the solvent, or both, throughout the treatment. After about one hour's treatment with the solvent, the latter is run off, and the skins are dried by allowing hot air to pass over and between them, the vaporised solvent being condensed by suitable means. The extracted grease is recovered by evaporation of the solvent.

The machinery described, principally concerns (1) the treatment of the air, which is used over and over again, whether for agitation of the solvent or for evaporation of the solvent still adherent to the drying skins, and (2) the keeping apart of the skins during treatment.—E. R. B.

Chrome-dressed Leather, Process [Steaming at 100° C.]
for Hardening. K. Möller, Brackwede, Germany. Eng.
Pat. 11,695, May 29, 1896.

THE inventor hardens chrome-dressed leather, so as to render it suitable for boot soles, &c., by subjecting it for varying lengths of time, in the presence of water, to a temperature of about 100° C.—E. R. B.

XV.—MANURES. Etc

Leather Refuse, The [Manurial] Value of. J. B. Lindsey.
J. Amer. Chem. Soc. 1896, 18, 565—575.

THE experiments here described show that dissolved leather, prepared by heating finely ground sole leather with sulphuric acid and neutralising the mixture with chalk, is a source of nitrogen which is as available for plant food as is the average animal matter used for fertilising purposes.

The percentage of nitrogen in the dissolved leather used by the author was 0.97. If the quantity of nitrogen obtained by the experimental crops from sodium nitrate be called 100, then that obtained from dissolved leather was 70. Wagner gives the following relative values of nitrogenous manures:—

Sodium nitrate	100
Ammonium sulphate	90
Dried blood, ground horn, and green plants	70
Ground bone, ground fish, and flesh	60
Stable manure	45
Ground wool	30
Ground leather	20

—A. G. B.

Mixed Fertilisers, A Method for Separating the "Insoluble" Phosphoric Acid derived from Bones and the like, and from Rock Phosphates respectively, contained in. A. P. Bryant. J. Amer. Chem. Soc. 1896, **18**, 491.

See under XLIII., page 678.

Nitrates, Reduction of, by Bacteria, and consequent Loss of Nitrogen. E. H. Richards and G. W. Rolfe. Techn. Quarterly, 1896, **9**, 40.

See under XVIII. B., page 667.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar-Cane, Occurrence of Amines in the Juice of.

J. L. Beeson. J. Amer. Chem. Soc. 1896, **18**, 743—744.

THE presence of amines in the products of the sugar beet has long been known, but their occurrence in the juices of the sugar-cane has not been recognised prior to the present sugar season. By the action of heat on the precipitate obtained by the addition of lime-water to cane-juice, the author has obtained a product having the general properties of an amine, but he has not been able to establish its identity.—A. K. M.

Sugar, Inversion of, by Salts. J. H. Long. J. Amer. Chem. Soc. 1896, **18**, 693—717. (See also this Journal, 1896, 550.)

In the experiments described in this paper, the solutions employed, contained 20 per cent. of cane-sugar and varying amounts of each of the salts, the inversion being carried out at a constant temperature of 85° C. The rotation of the solutions was determined at intervals, and the rate of inversion thus ascertained. With some of the salts the velocity coefficient K was practically constant, with others it increases with the time, and with others again it decreases. These results may be roughly tabulated as follows:—

These results may be roughly tabulated as follows :—

Potash alum	K constant.
Ferrous sulphate	K increases slowly.
Ammonium ferrous sulphate	" "
Zinc sulphate	" "
Cadmium chloride	" "
Manganous sulphate	K increases rapidly.
" chloride	" "
Lead nitrate	" "
Ferrous chloride	K decreases rapidly.
" bromide	" "
" iodide	" "

—A, K, M.

Sugars, Transformation of, by Lead Hydroxide. C. A. Lobry de Bruyn and A. von Eckenstein. Rec. trav. Chim. des Pays-Bas. 1896, **15**, 92.

LEAD hydroxide reacts on sugars in a manner analogous to that of the hydroxides of potassium and sodium, by inducing molecular re-arrangement. Glucose yields mannose, but no fructose. The latter sugar undergoes alteration on treatment with lead hydroxide, but, contrary to the effect produced by the alkalis, neither glucose nor mannose results. It is supposed that in the course of the mutual transformation of glucose, fructose, and mannose by the action of alkalis, another non-acid body of greater reducing power is formed, but its nature is not yet elucidated. Like the alkalis, lead hydroxide acts on the reducing bodies

(lactose and maltose), forming galactose and glucose. From these researches the authors disagree with Svoboda's opinion that lead acetate decomposes sugars, finding that decomposition, with the formation of lactic acid, ensues only after the prolonged reaction of caustic alkali.—C. S.

Sugars, New Hydrazones of the [*Separation of Sugars*]. A. von Eckenstein and C. A. Lobry de Bruyn. Rec. trav. Chim. des Pays-Bas. 1896, 15, 97.

See under XXIII., page 679.

Mannose, Sorbose, and Galactose, Ammonia Derivatives of. Lobry de Bruyn and F. van Leeat. Rec. trav. Chim. des Pays-Bas. 1896, 15, 81.

See under XXIV., page 683.

Starch, The Oxidation of. E. Dollfus and F. Scheurer. Bull. Soc. Ind. Mulhouse, 1896, 241—245.

See under VI., page 649.

Starch, The Oxidation of. O. Schmerber. Bull. Soc. Ind. Mulhouse, 1896, 238—241.

See under VI., page 649.

PATENT.

Molasses, An Impd. Method [Boiling with Sulphites] of Purifying. C. F. Kastengren, Stockholm, Sweden. Eng. Pat. 5953, March 17, 1896.

MOLASSES are boiled, under pressure, with the sulphite of an alkali or calcium, which may or may not contain sulphurous acid in excess.—J. L. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Moulds which appear to Partake of the Nature both of Yeasts and Moulds. A. Jorgensen. Centralblatt für Bakteriöl. 1896, 42.

THE author has observed the occurrence of denarium-like moulds in beer, and that they produce an unpleasant smell and turbidity. He recommends that a careful note be made of their occurrence when examining air, water, or beer.

This mould forms at first the usual white mycelium, but later gives rise to oidium-like bodies, which sooner or later bud. After some time the growth separates into yeast-like cells, and the liquid acquires an unpleasant smell, and is turbid.—A. L. S.

Pure Yeasts and their Nutrition. H. Seyffert. Zeits. ges. Brauw. 1896, 19, 318.

A PURE yeast which had been successfully used for pitching during two years, gradually lost its admirable "breaking" properties, and, although still perfectly pure, assumed a foreign flavour, rendering rejection necessary. After prolonged attempts to find a suitable yeast from a large number of cultures, the author came to the conclusion that the source of failure lay in the nutrient media employed rather than in the yeasts or methods of culture, and a series of ash analyses revealed a paucity of lime both in the wort and in the yeast used in the brewery, due to the low percentage (1.39 CaO per 100,000) of lime in the water used. Yeast from external sources soon became poor in lime when used in this wort, but recovered when lime was added to the goods.

Experiments were made with fermentations in wort with 20 grms. of added gypsum per hectolitre, as well as in worts made from water, with half that amount of added gypsum, and in worts from barleys steeped in waters with and without such addition. In the result the presence of gypsum was found beneficial, not only in the nutrition of the yeast, but also in steeping and malting, by preparing the ground for a normal development of the organism. When a wort poor in lime was still further deprived of that constituent by dialysis, a boiling fermentation resulted. A number of media otherwise unsuitable for yeast culture may be rendered available, at least for the normal development of various races of yeast, by the employment of lime.

—C. S.

Yeast, Fermenting Power and Activity of. E. Duclaux. Ann. de l'Inst. Pasteur. 1896, 119—127 and 177—189.

THE term fermenting power, was introduced by Pasteur to indicate the ratio between the amount of sugar fermented and the amount of yeast employed in the fermentation. This ratio must not be confused with the fermenting activity which is the measure of the rapidity of the fermentation.

The element of time does not enter into the definition of fermenting power; this factor corresponds to the idea of mechanical work, a certain amount of work being necessary to transform a definite weight of sugar; it is not a characteristic of any one yeast, but varies with the conditions of experiment. A condition which profoundly affects its value, is the presence or absence of oxygen; as this varies between maximum limits, the fermenting power varies between such great ratios as 4 and 200.

The idea of fermenting power stated in simple terms, is, that the sugar transformed by a given weight of yeast is greater, as the amount of oxygen is less. In contact with air the greater part of the sugar is used up by being converted into carbon dioxide and water; only a small part is transformed into alcohol. On the other hand, if the supply of oxygen be deficient, an interior combustion of the sugar is set up, and a greater yield of alcohol is obtained. Thus the fermenting power depends both on the *quality* and the *quantity* of the reaction.

The ratio of fermenting activity is one which is more readily understood; it is equal to the fermenting power in a unit of time; thus the amount of sugar that will be transformed in a time T, by an amount of yeast L, is $Q = ALT$, A being the activity. If fermentation be started with a small quantity of yeast, increase of yeast will take place and the quantity L will be an amount intermediate between the amount of yeast sown and the amount existing in the solution at the end of the experiment. The author considers it to be about $\frac{1}{3}$ of this latter amount (Microbiologie, 419).

Besides the quantity of sugar (Q) which has been fermented, a further portion has been employed in the growth of the yeast; this amount is almost equal to the amount of yeast (L) and may be denoted by the expression ML where M nearly equals unity.

The whole weight of sugar used is:— $S = ML + ALT$. The fermenting power is the ratio $S : L = P$; hence $P = M + AT$. This expression resembles that expressing uniform motion in dynamics, P being comparable to space traversed, and A to velocity. Fermenting power is therefore a more complex quantity than fermenting activity, and involves a consideration of time. Duclaux further interprets this equation by considering the two latter terms separately; M is the amount of sugar completely burnt to carbon dioxide and water and AT the amount fermented and producing alcohol, carbon dioxide, succinic acid and glycerin. The first he calls the constructive amount and the second the maintaining one.

Turning to Pasteur's experiments (Études sur la Bière, chap. 6), and considering 24 hours as the unit of time; then under aerobic conditions, $P = M + A = 4$; under suitable conditions M might have a value 2 then we should have a value for $A = 2$. Under anaerobic conditions we have $P = M + 90A$, when taking the same value for M, we get $A = 1.9$. The two values of A are very close.

These two extreme cases show that when the fermentation is very rapid, that is, T is very small, only the first term (M) of the above equation is of importance, whereas when the fermentation is slow, it is only necessary to consider the second term. A fermentation may thus be considered as divided into two parts; in the first the yeast increases at the expense of the sugar, and very little fermentation takes place; in the second, very little yeast growth takes place, but considerable fermentation.

When we try to interpret these equations experimentally, they do not appear to be so simple. If a trace of yeast be sown in a suitable liquid, it commences to multiply very rapidly as long as there is oxygen in solution, and as the oxygen becomes used up, the growth slackens. If now there be an excess of sugar, the fermentation proceeds without any appreciable increase of yeast. If the maximum growth be not reached during fermentation, it is produced when this is finished; this is what Pasteur called *la vie continuée*.

If we now turn our attention to the activity, that is the quantity of sugar fermented by the unit weight of yeast in the unit of time, we find this factor varies with the conditions of experiment. Under aerobic conditions it appears to be very great, and is characterised by a large yeast growth; under anaerobic conditions it is characterised by a free production of alcohol, and the number expressing the activity may be great or small, the variation depending on the quickness or slowness of the fermentation.

Duclaux considers that A. J. Brown (J. Chem. Soc. 1893, 369; and 1894, 911) has confused the notion of fermenting power and activity. He selects two groups of experiments in particular for criticism; the first series is summarised in the following table:—

No.	Duration of Experiment.	Grms. of Sugar fermented.	Weight of Yeast.	Number of Cells.	Fermenting Power.	Activity of the Yeast.
	Days.					
1	5	2.5	0.124	8.51	20.2	..
2	5	5.0	0.155	9.94	32.0	..
3	7	10.0	0.177	10.44	56.0	5
4	12	20.0	0.140	11.17	143.0	12
5	20	25.2	0.138	12.26	182.0	9

These experiments Duclaux does not consider to be comparable, as the amounts of sugar in solution vary so much. The last three experiments are, however, fairly comparable as far as the fermenting activity is concerned, as in the equation for calculating this ($P = M + AP$) the value of M is sufficiently small to be negligible. The activities thus calculated are given above, and agree as closely as can be expected. Duclaux states that there is nothing in these experiments in opposition to Pasteur's theory. He also calculates the activity in another series of experiments which Brown made to show that the same number of yeast cells could ferment 30 or 10 grms. of sugar; the activities are 7.7 and 7.2, that is, they are practically the same, again confirming Pasteur's theory.

Duclaux next proceeds to consider the experiments of Giltay and Aberson (this Journal, 1895, 1764). If the well-known equation, $C_6H_{12}O_6 = 2C_2H_5OH + 2CO_2$, were at all accurate, it would be easy to determine if less alcohol and more carbonic acid were formed under certain conditions, that is to say, if a portion of the alcohol were completely oxidised to carbonic acid; but as the reaction cannot be so simply stated, this problem is surrounded with difficulties which Duclaux does not consider have been overcome. Amongst other objections, he considers that a portion of the alcohol was probably carried over into the potash bulbs together with the carbonic acid. He also objects to the experiments made in a current of air containing 20, 50, and 100 per cent. of oxygen, as they were not made on the same day, and even then he considers the differences in the amounts of alcohol oxidised to be small; and that the "respiration" of the yeast is a fairly constant quantity.

Hansen and Pedersen conclude that, whilst aeration increases the rapidity of multiplication of the yeast, it diminishes its fermenting power. This is in accord with Pasteur. They, however, employed different methods, estimating the consumption of sugar by the decrease of the specific gravity, and counting the yeast cells instead of weighing them.

Sowing 10 cells per unit of volume, they found that for equal quantities of sugar fermented in non-aerated wort, there were 112 cells, and in the aerated one 234 cells per unit of volume; and in another experiment 73 and 145 cells respectively in the non-aerated and aerated solutions. These experiments are not directly comparable, as the time was different in each one; in the first two it was three and two days, and in the second pair, two and one and a half days respectively.

If S denote the weight of sugar fermented, L the quantity of yeast, and A the activity in the non-aerated fermentation, and L' and A' the same in the aerated one, then $S = ML + 3AL$, and $S = ML' + 2A'L'$, and as $L' = 2L$ we get $3A = M + 4A'$.

Similarly, from the second pair of experiments, $2A = M + 3A'$.

The values of A , M and A' in these two equations are not the same, but we see that whatever the value of M is, that A is greater than A' ; that is to say, the activity of the yeast is greater in the absence of air than in its presence, which is Pasteur's statement.—A. L. S.

Malt, The Proteids of. T. B. Osborne and G. F. Campbell. J. Amer. Chem. Soc. 1896, 18, 542–558.

The malt employed in this investigation contained—

1. *Bynedistin*, a globulin far more soluble in very dilute salt solution than edistin, the globulin of barley, and differing moreover from the latter in containing more carbon and less nitrogen. Bynedistin dissolved in 10 per cent. salt solution gives a turbidity at 65° C., and a flocculent coagulum at 84° C., but even after protracted heating at 100° C. the coagulation is incomplete. The proteid is partly precipitated by saturating its solution with magnesium sulphate.

2. *Leucosin*, an albumin, identical in composition and properties with that obtained from wheat, rye, and barley. 3. A *Protoproteose*, readily precipitated from aqueous solution, by adding an equal weight of alcohol. Of the same composition as leucosin. 4. A *Protoproteose*, less readily precipitated by alcohol, and differing in composition from the preceding. 5. A *Deuteroproteose*. 6. A *Heteroproteose* in extremely small amount. 7. *Bynin*, a proteid insoluble in water and saline solutions, but readily soluble in dilute alcohol. 8. A proteid insoluble in water, saline solutions, and dilute alcohol. The following proportions of these constituents were found:—

	Per Cent.
Proteid, insoluble in salt solutions and in alcohol	3.80
Glycin, soluble in dilute alcohol	1.25
Bynedistin, leucosin, and proteoses (coagulable soluble in water and salt solutions) (uncoagulable)	1.50
Total proteids	7.84

It appears, therefore, "that during germination, the proteids of barley undergo extensive changes without acquiring, or before acquiring the properties of proteoses; that hordein disappears, and a proteid soluble in alcohol, of entirely different composition, takes its place; and that edistin also disappears and is replaced by a new globulin. The albumin, however, appears to be unchanged in its characters, but its quantity is increased."—H. T. P.

Malting Process, The Effect of Water containing Gypsum on the. G. Felix. Allg. Brauer und Hopfen Zeit. 1896, No. 77.

The author has examined malts prepared respectively with a hard water containing about 323 parts of solid matter per 100,000, of which 212 were gypsum, and a water containing 72 parts of solid matter per 100,000, of which 46 were gypsum; and he finds that the malts prepared from the latter were much more satisfactory in every way; he is inclined to consider that the reason is that the hard water does not remove a proper quantity of soluble matter from the grain.—A. L. S.

Potatoes, The Preservation of. Paulsen. D. Landwirtschaft. Zeit. 1896, No. 4.

The author recommends that the stock of potatoes in distilleries be kept in heaps covered with straw and earth, and protected from the weather by shedding. He states that up to the first occurrence of frost, unripe diseased sorts may be used with advantage.

When potatoes are stored for any length of time changes take place in their composition, the nature of which are chiefly dependent on the temperature, and may be classed under three heads.

(1.) A sugar formation from starch by the action of a ferment.

(2.) A loss of sugar by oxidation.

(3.) A starch reproduction from sugar.

The second decomposition increases considerably with the temperature, the first and third nearly neutralise one another at temperatures between 6°–20° C. and the formation

of sugar being always in excess of the reproduction of starch; below 6 C. the former decomposition is much in excess of the latter, and this explains how it is that frost renders potatoes sweet.—A. L. S.

Potatoes, The Fermentability of the Wort Prepared from Different Varieties of. J. Scheibner. Zeits. für Spiritusind., 1896, 223—224.

The author has determined the yield of alcohol which can be obtained from different varieties of potatoes, and finds that some small tubered sorts yield less alcohol than other large tubered ones; the yield of alcohol being calculated on the amount of the saccharometric extract obtained from the various sorts. This result is caused by the fact that the former yield worts which do not ferment so completely as those yielded by the latter.

The author has tried to complete the fermentation of these extracts by the addition of yeast and malt, and also by prolonging the time of fermentation, and by a combination of these methods he succeeded in raising the yield of alcohol. He suggests that by the use of Pombe or Logos yeasts a better yield may also be obtained.—A. L. S.

Citric Acid Fermentation, Two New Moulds which produce. C. Wehmer. Zeits. für Spiritusind. 1896, 208.

See under XX., page 671.

Mushrooms, Action of the Oxidising Ferment of, on Oxidisable Compounds. E. Bourquelot. Comptes rend. 1896, 123, 315.

See under XXIV., page 683.

Maltose, Determination of, in Worts. L. Braun. Zeits. ges. Brauw. 1896, 19, 241.

See under XXIII., page 680.

Glycerol in Wine and Beer, Determination of, by the Index of Refraction. L. Sostegni. Staz. Sperim. Ital. 1896, 318.

See under XXIII., page 680.

PATENTS.

Aërating Liquids, Improved Apparatus for, especially applicable to Fermenting Tins and Indigo Vats. F. Grunmbacher, Berlin. Eng. Pat. 13,386, June 17, 1896.

See under I., page 641.

Fermented Products, Impts. in and connected with the Manufacture of [Use of Formaldehyde, Formic Acid, and Salts]. J. C. R. G. Boulet, Paris. Eng. Pat. 7258, April 9, 1895.

The patentee claims the use of formaldehyde, its derivatives, compounds, and homologues, also formic acid and its salts, in the manufacture of alcohol; likewise in the treatment of any sugared substance in the preparation and preservation of malt or its infusion, intended for the distillery or other industrial purposes. The application of formaldehyde to the steep water for barley is also claimed.

—J. L. B.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Bread from Flour of Different Qualities, Nutritive Value of. A. Girard. Comptes rend. 1896, 122, 1382—1388.

The author has already shown (*ibid.*, 1309), that the alleged superiority of brown over white bread, as regards nutritive value, is unfounded, since the amount of gluten is practically the same in both.

With regard to phosphoric acid, the average amount found in the husks was 2.37, in the kernel, 0.30 per cent. But when the relative amounts of husks and kernel in flours are taken into account, the differences in white and brown bread are small; and when the total amounts of phosphoric

acid in ordinary rations are calculated, the differences introduced by the bread being white or brown, are quite insignificant. In any case there is a large excess of phosphoric acid in the food over the highest estimate of what is normally eliminated, (*viz.*, 3.19 grms. per day).

It is concluded that for general consumption white bread, well leavened, and prepared from 60 to 65, or, at the most, 70 per cent. flour, is the best. Brown bread may be reserved for those who prefer the flavour, and for those whose digestive powers are uncertain.—N. H. J. M.

Milk, Preservation of, by Potassium Chromate. J. Froidevaux. J. Pharm. Chim. 1896, 16, 155.

The addition of potassium bichromate to a sample of milk, 4 grms. to the litre, will prevent its coagulation for four months. Lately the neutral chromate has been used to preserve milk intended for consumption. The author finds that the quantity employed, 0.04 grm. per litre, is practically useless, and that at least 0.2 grm. is necessary; this quantity, however, gives an appreciable coloration. To test for chromates in milk, the ash of 10 c.c. should be extracted by a little water, the solution slightly acidified by nitric acid, carbonate of magnesia added to neutral reaction, and then silver nitrate. This reagent must be present in some quantity to throw down the chlorides and phosphates. A red coloration indicates the presence of the chromate. When, however, the chromate is present in less proportion than 0.05 grm. per litre, the phosphates in part mask the coloration; a more delicate test is to add to the ash, water slightly acidified by sulphuric acid and then guaiacum tincture, the presence of a chromate is shown by an intense blue coloration which disappears rather quickly.

—A. C. W.

PATENTS.

Meat, Frozen, and other Articles of Food [Thawing in Hot Oil], Impts. in Treating. J. A. Linley, London. Eng. Pat. 13,707, July 17, 1895.

The meat, &c., is thawed by immersing it in hot beef fat, mutton fat, or a highly refined oil. The fatty coating is afterwards removed by beating, or other convenient process. The inventor claims that no moisture of the air condenses on the meat during the thawing and the article does not become sodden or deteriorated.—L. de K.

Impts. in and Means for Preserving [Economy of Vessels]. P. Griffin, Bath. Eng. Pat. 15,255, Aug. 14, 1895.

A glass or earthenware vessel with a suitable opening through which the food is introduced or withdrawn, is constructed. The opening is hermetically closed by a movable air-tight stopper held in position by a screw or bayonet joint. The stopper is provided with a small hole, to allow the escape of steam or vapour, which is afterwards hermetically closed by means of a suitably arranged plug or stopper.

The vessel is filled with the food to be preserved, and if necessary, a certain amount of preserving fluid, such as syrup, is added, and the vessel is then placed for some time in a boiling water-bath. Another plan is to pass steam by means of another hole in the interior of the vessel.

The chief claim of the inventor is that the vessel can be used over and over again, whilst ordinary sealed metallic cans are no longer any use. There is also no danger of metallic contamination in the new process.—L. de K.

Chemical [Acid Treatment Decortication], Improved Process of and Apparatus for Use therein, applicable for the Treatment of Grain. H. H. Lake, London. From E. de Moerloose, Brussels. Eng. Pat. 15,765, Aug. 21, 1895.

The grain is soaked in water containing 0.5—3 per cent. of hydrochloric acid at from 30°—50° C., and a small quantity of a suitable oxidising agent, such as permanganate or bichromate of potash, not exceeding 2 or 4 grms. per 100 litres. To ascertain whether the soaking has been sufficient, the grain is from time to time pressed between the fingers, which should cause the bark to readily break up and separate. The grain is now passed, in a current of

water, between moving brushes with plane or cylindrical surfaces; or they may have their bristles arranged in alternately projecting and receding rows.—L. de K.

Milk, Humanised Condensed. C. G. Moor, London. Eng. Pat. 20,219, Oct. 26, 1895.

High-class cows' milk is concentrated to one third. 33 lb. of this are then mixed with 12 lb. of cream, 10 lb. of milk-sugar, $\frac{1}{2}$ lb. of phosphate of soda, and 44 lb. of distilled water. Before use, the mixture is diluted with twice its bulk of water.

The inventor claims that it is practically identical with human milk, being rich in sugar but poor in albuminoids. —L. de K.

Tea or other Matters, Impts. in and Apparatus for the Production of Extracts of [by Percolation]. G. H. Roque-Dabbs, Shanklin, Isle of Wight. Eng. Pat. 3192, Feb. 12, 1896.

FINELY-DIVIDED tea (tea dust, for instance) is introduced into a series of percolators and water is allowed to pass through, the percolators being heated by boiling water or steam. To obtain the whole of the soluble matter, the tea is again exhausted and the liquid is concentrated by evaporating in a vacuum pan before mixing with the first percolate. —L. de K.

Organic Alimentary Substances, Solid: Improved Process for Preserving. F. O. Jacob, Paris, France. Eng. Pat. 12,150, June 3, 1896.

THE use of high pressure carbon dioxide and methanal vapours, is claimed.—L. de K.

Milk, Impt. in or relating to the Treatment of, for the Purpose of suiting it to Individual Digestions. G. H. Walker, G. E. Gordon, and J. H. Waterhouse, of Boston, U.S.A. Eng. Pat. 14,196, June 26, 1896.

SEPARATION of cream and non-creamy portion, and the use of milk sugar.—L. de K.

Preserving Organic Substances, Improved Process of, more particularly applicable for Alimentary Substances. C. L. Bachelier, Paris, France. Eng. Pat. 14,581, July 1, 1896.

THE use of high pressure carbonic acid, vacuum, and cold is claimed.—L. de K.

(B).—SANITATION: WATER PURIFICATION.

Aniline Poisoning. Leipziger Färber u. Zeugdrucker Zeit. 45, 346.

ANILINE poisoning may occur by the inhalation of its vapours, by direct introduction into the circulatory system, and through absorption by the skin. The characteristic symptoms are:—General depression, lassitude, weakness, difficulty of speech, and blue lips; the patient looking as if intoxicated. Vomiting gives relief, and in fresh air the patient soon recovers. Astringents are said to act beneficially, but alcohol aggravates the effects of the poisoning. It has been observed that most cases of poisoning have been caused by aniline being splashed on the clothing of work-people. In such cases the clothing should at once be changed, and the parts of the body touched by aniline should be washed with water acidulated with hydrochloric acid. The rooms where aniline is used should be well ventilated. Nitrobenzene and toluidine are said to produce effects similar to those of aniline.—I. S.

Nitrates, Reduction of, by Bacteria, and Consequent Loss of Nitrogen. E. H. Richards and G. W. Rolfe. Techn. Quarterly 1896, 9, 40—59.

IN order to reproduce the conditions of a water containing decaying organic matter and nitrates, solutions were prepared from tap-water, milk, and potassium nitrate. These were allowed to decompose, and analyses made at various stages of the decomposition. The conclusion drawn by the authors from their results is that when a decaying organic solution

which contains nitrates does not furnish sufficient oxygen for the bacteria, the latter derive their supply from the nitrates, which they reduce first to nitrites and finally to free nitrogen. In manuring, since nitrates may be readily destroyed through adding too much sewage, the amount of the latter should always be regulated so as to obtain as much oxygen as possible. Artificial aëration, by blowing air through the bulk, is useless; whilst the disposal of the sewage in very thin layers appears to be the most advantageous course. It is suggested that growing plants should be supplied with only as much nitrogen as they can assimilate. Even under the most favourable conditions of aëration some loss of nitrogen appears almost inevitable when decomposing organic matter is added to a nitrified water or soil, since certain bacteria prefer to obtain their oxygen supply from nitrogenous combinations. These results are considered to throw light on the greater efficiency of coarse than of fine material in sewage purification, the aëration being more effective, and less nitrogenous matter being retained to promote the growth of reducing bacteria.—C. A. M.

PATENT.

Sewage and Impure Water, Impts. in the Treatment and Purification of [Using Benzoic Acid and Sol. Benzoates with Carbon and Clay]. J. W. Slater, Tollington Park, Middlesex, and the Native Guano Co., London. Eng. Pat. 18,093, Sept. 27, 1895.

THE sewage is treated with a mixture of equal weights of clay and carbon, then with benzoic acid or soluble benzoates, and after being well mixed, cake alum or aluminium chloride is added, the quantities of these various ingredients depending on the quality of the sewage. Benzoic acid or soluble benzoates are added to the effluent resulting from the treatment of sewage by precipitation or filtration, and secondary fermentation is thus prevented.—J. L. B.

(C).—DISINFECTANTS.

PATENTS.

Sheep Dipping Powders [Sulphur and Arsenical Powders], Impts. in the Manufacture of. F. W. Passmore and Jeyes' Sanitary Compounds Co., Lim., London. Eng. Pat. 11,921, June 19, 1895.

A SOLUBLE sulphur powder is prepared by mixing stated proportions of sodium thio-sulphate and oxalic acid, both anhydrous. The oxalic acid may be replaced by sodium or potassium acid sulphate, cream of tartar, or other dry acid substance. The powder must be preserved from becoming damp, and for use is dissolved in water, forming, owing to the sulphur precipitated, a milky emulsion, so that the sulphur reaches every part of the fleece to which it is applied. To prepare an arsenical powder, arsenic acid, or a soluble arsenic salt, sodium arsenate, preferably, is mixed with the described powder, which, when dissolved for use, yields a solution containing arsenic sulphide as a finely-divided precipitate.—E. S.

Drains and Sewers, Improved Means of [Carbon or Wood Dust, Manganate of Soda, and Sulphuric Acid], Purifying the Air of, or of Suppressing Noxious Vapours generally. R. H. Reeves, Putney, Surrey. Eng. Pat. 18,185, Sept. 28, 1895.

THIS process consists of dropping, in the space requiring purification, sulphuric acid on dry manganate of soda mixed with carbon, fine wood, or other dust. When the evolution of gas has ceased, water is added to the residue, a solution of permanganic acid is thus formed, which treats the sewage or other matter flowing through the drains.—J. L. B.

Disinfectant, Improved, and Cleansing and Purifying Compound. E. Burton, Camberwell. Eng. Pat. 18,229, Sept. 30, 1895.

A SOLUTION of the required strength, of carbolic acid, permanganate of potash, oil of eucalyptus, &c., &c. is added to disintegrated moss, and the preparation is then subjected to heavy pressure.—J. L. B.

Aldehydes, Impts. in or relating to a Process and Apparatus for the Preparation of. A. J. Boulton, London. From G. Barthel, Dresden, Germany. Eng. Pat. 3998, Feb. 21, 1896.

THE process claimed consists in diverting a portion of a stream of alcohol vapour and burning this round the main stream, so as to prevent the admission of an excess of oxygen. The apparatus claimed has a combustion chamber closed at one end, and a separate vaporising chamber, the outlet pipe from which is provided with a large opening directed towards the open end of the combustion chamber, and with a smaller opening directed against the closed end. On igniting the vapours, the stream from the latter opening surrounds that from the former, and prevents access of oxygen to it. Air for the flame enters the burning-tube by holes in its walls.—A. C. W.

Gaseous Mixtures, mainly Formaldehyde, for Disinfecting Purposes, Process and Apparatus for producing. Société Anonyme de l'Institut Raoul Pictet, Fribourg, Switzerland. Eng. Pat. 11,557, May 27, 1896.

THE process for the production of mixtures of formaldehyde, which consists in passing a current of hot gases over trioxymethylene, is claimed, together with an apparatus for producing such mixtures. This essentially consists of two concentric cylinders, between which pass the gases from a fire or burner, the lower part of the inner cylinder is surrounded by a worm, through which the gas employed passes to the bottom of this cylinder, where it goes through a layer of trioxymethylene. The upper part of the inner cylinder, which is narrower and serves for the introduction of the aldehyde polymer, is surrounded by another worm, through which the gases pass from the cylinder and where the vaporisation of the polymeride is completed. The apparatus may also be modified to admit water or formaldehyde solutions and so deliver moist gases.—A. C. W.

XIX.—PAPER, PASTEBOARD, Etc.

PATENTS.

Knots and other Matters, Separating, from Wood Fibre in the Manufacture of Wood Pulp; Impts. in the Method or Means for. The Kellner-Partington Paper-Pulp Co., Ltd., Manchester. From N. Pedersen, Sarpsborg, Norway. Eng. Pat. 15,783, Aug. 22, 1895.

THE object of the invention is the removal of the knots, dirty pieces of bark, &c., from wood fibre in the manufacture of wood pulp. It consists in passing the disintegrated wood, before digestion, through a tank of water or saline solution (according to the specific gravity of the wood employed) on a travelling apron or similar device, the material being thoroughly soaked in transit by rotating paddles, to ensure removal of air-bubbles and free the lighter particles of pure fibre from the heavier impurities, which fall to the bottom and are mechanically removed.

—O. H.

[Paper Filling] Waste Materials obtained in the Manufacture of Ammonium Compounds; Improved Process or Treatment of, to Produce a Substance suitable for Use as a Paper Filling in the Manufacture of Paper. W. Brothers, Rawtenstall, Lancaster. Eng. Pat. 18,503, Oct. 3, 1895.

THE waste materials described in the title, or materials of other origin, consisting essentially of a mixture of calcium carbonate, sulphate, and hydroxide, are suspended in water, and furnace gases are blown through, until the free lime present is carbonated. The neutral compound obtained of calcium carbonate and sulphate may then be applied for paper-filling or otherwise.—E. S.

The Residual Liquors produced in the Manufacture of Vegetable Parchment Paper, Impts. connected with the Application and Utilisation of. [Sulphate of Magnesia and Gypsum.] J. S. Rigby, Liverpool. Eng. Pat. 19,008, Oct. 10, 1895.

THE acid-liquors left on parchmentsing paper with sulphuric acid are returned to the bath: the paper is then

further washed in another series of tanks. The tanks used for the first wash are connected to a main pipe leading to a cistern, whence the acid is delivered to the upper part of towers charged with magnesite, and the solution of magnesium sulphate obtained passes into settlers, and then into crystallising tanks. The carbonic acid given off in the process is collected. The weaker sulphuric acid derived from the second series of washing-tanks is led into mechanical mixing apparatus, into which calcium chloride solution is run, gypsum being obtained. Special apparatus is described.—E. S.

Paper, Manufacture of; adapted for being Written or Drawn upon by means of a Metal Style, and for Polishing and Cleaning Metals; Impts. in the. [Mixture of Pulp and an Oxide or Carbonate.] L. Capazza, Brussels, Belgium. Eng. Pat. 9914, May 9, 1896.

THE pulp from which the paper is made is mixed with a stated proportion of an oxide or carbonate, preferably zinc oxide or carbonate; or ordinary paper is coated with the oxide or carbonate in a sizing-bath. Paper thus prepared may be written upon by a durable metallic style, without the use of pencils or of ink.—E. S.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Pharmaceutical Products, Action of Light upon. A. B. Stevas. Pharm. Journ., Aug. 22, 1896, 165.

THE following descriptive list is given of substances which, according to the United States Pharmacopœia, should be protected from the action of light, either by being kept in dark amber-coloured bottles or in the dark.

Articles affected by Light.—Benzoic acid should be kept in dark amber-coloured, well-stoppered bottles, in a cool place.

Carbolic acid should be kept in dark amber-coloured, well-stoppered vials.

Hydrobromic acid should be kept in glass-stoppered bottles, protected from the light.

Hydrochloric acid, nitric acid, nitric acid dilute, and nitrohydrochloric acid dilute should be kept in dark amber-coloured, glass-stoppered bottles.

Nitrohydrochloric acid should be kept in dark amber-coloured, glass-stoppered bottles, which should not be more than half filled, and kept in a cool place.

Hydrocyanic acid dilute should be kept in small amber-coloured, cork-stoppered vials, in a cool place.

Sulphurous acid should be kept in dark amber-coloured, glass-stoppered bottles, in a cool place protected from light.

Formic acid is darkened by the action of light and air.

Acetic ether should be kept in a cool, dark place.

Ammonium iodide should be kept in small, well-stoppered vials, protected from light.

Amyl nitrite should be kept in small, dark amber-coloured, glass-stoppered vials, in a cool and dark place.

Sulphurated antimony keep in well-stoppered bottles, protected from light.

Apomorphine hydrochlorate keep in dark amber-coloured vials.

Stronger orange-flower water should be kept in loosely-stoppered bottles, in dark place.

Chlorine water should be made fresh, but when kept should be protected from light and air.

Stronger rose water should be kept in a dark place.

Silver cyanide, iodide, nitrate, diluted nitrate, moulded nitrate and oxide should be kept in dark amber-coloured vials protected from the light.

Arsenic iodide should be kept in glass-stoppered vials protected from light.

Bismuth and ammonium citrate keep in well-stoppered bottles protected from light.

Chloral and chloroform should be kept in glass-stoppered bottles, in a cool, dark place.

Ferrie citrate, iron and ammonia citrate, iron and ammonia tartrate, iron and potassium tartrate, iron and

quinine citrate, soluble iron and quinine citrate, iron and strychnine citrate, should be kept in well-stoppered bottles, protected from the light.

Saccharated ferrous iodide should be kept in a cool and dark place.

Soluble ferric phosphate and pyrophosphate should be kept in dark amber, stoppered bottles.

Iron valerianate in a cool, dark place.

Mild mercurous chloride and mercuric cyanide should be kept in dark amber-coloured bottles.

Yellow mercurous iodide should be kept in dark amber-coloured bottles with the least possible exposure to light.

Red mercuric iodide, yellow mercuric oxide, red mercuric oxide, yellow mercuric sulphate, ammoniated mercury and mercury with chalk are to be protected from light.

Iodoform, solution ferric acetate, solution of chlorinated soda and methyl salicylate are to be kept in a cool place, protected from light.

Naphthol keep in dark amber-coloured bottles.

Volatile oils, 23 are directed to be kept in cool places, protected from light.

Physostigmine salicylate and sulphate should be kept in small, dark amber-coloured vials.

Lead iodide is to be protected from light.

Pyrogallol keep in dark amber-coloured vials.

All of the quinine salts should be kept in a dark place.

Resorcin and santonin should be kept in dark amber-coloured vials.

Sodium salicylate, protect from heat and light.

Spirit of nitrous ether in small, dark amber-coloured vials, in a cool place.

Spirit of phosphorus keep in small, dark amber-coloured vials, in a cool, dark place.

Stronium iodide keep in dark amber-coloured glass-stoppered vials.

Terebene should be kept in a cool place, protected from light.

Tincture of chloride of iron should be protected from light.

Other Chemicals acted upon by Light.—The action of light upon silver compounds is a problem upon which a vast amount of study and investigation has been expended. Few investigators agree as to the actual compounds formed, but nearly all have proven that the action is one of reduction.

Silver chloride, when fused repeatedly or until all traces of the nitrate or organic impurities are lost, is unaffected by light. N. de St. Victor discovered that paper coated with egg albumin and dipped in a solution of silver is far more sensitive than when used with the silver salt alone. At the present time silver salts are invariably associated with albumin, gelatin, or collodion in all photographic plates.

Chloral becomes acid on exposure to light and air.

Chloroform, when absolute and all air is excluded, is not acted upon by sunlight, but in the presence of air is rapidly decomposed. The presence of more than $1\frac{1}{2}$ per cent. of alcohol prevents decomposition; smaller quantities retard the action in proportion to the quantity present. In the absence of alcohol chlorine is liberated. In the presence of alcohol the chlorine is converted into hydrochloric acid.

Creosote, when pure, is not acted upon by light, but when a small quantity of tar oils is present, light darkens it.

Sulphurous acid is decomposed by light, forming free sulphur and oxygen. The oxygen combines with a portion of the sulphurous acid to form sulphuric acid.

Hydrocyanic acid is decomposed by light and air, forming different substances under different conditions. The greatest care must be exercised to promote its preservation. The following is the method employed in the prescription department of one American school of pharmacy. A block of wood whose dimensions are 2 by $2\frac{1}{2}$ by 6 ins. is procured. Eight holes of sufficient size that each will accommodate a dram vial are bored in this block. The vials, filled with freshly-made hydrocyanic acid, are corked, placed in the holes prepared to receive them, and the holes closed with corks. When a prescription requiring this acid is received, the acid is taken from one of the vials, and should any acid remain in the opened vial it is thrown away.

Ferric salts.—Inorganic ferric salts, when pure, are stable, but when associated with organic compounds they are invariably reduced to ferrous compounds by the action of light. For example, ferric chloride and the solution of ferric chloride are unaffected by light, while the alcoholic tincture of the solution is partly reduced to ferrous chloride. Hence the U.S.P. directs that it shall be protected. Many of the ferric salts with organic acids are so sensitive to the action of light that they are used for photographic printing. The cyanotypes or blue prints are made by exposing paper coated with a solution of ammonio-ferric tartrate and placed under a negative to the action of sunlight. When the iron is reduced to a ferrous condition, the paper is floated upon a solution of potassium ferri-cyanide, forming ferrous ferri-cyanide. The kallitype printing process is based upon the reduction of ferric oxalate to ferrous oxalate by light. Sodium ferric oxalate acts in a similar manner, producing an orange-coloured image which is developed with a solution containing silver nitrate.

Mercurous chloride, when in the dark, is not acted upon by the air. Exposed to light it gradually darkens, indicating partial reduction.

Mercuric cyanide is affected in a similar manner.

Mercurous iodide is easily decomposed by light into mercuric iodide and mercury. Mercuric oxides, both red and yellow, are partially reduced by light.

Iodoform is decomposed by sunlight with the liberation of iodine.

Volatile oils are easily decomposed and even alcoholic solutions easily affected by the same agent. Therefore not only volatile oils but perfumes also should be protected.

The ornamental display of perfumes in clear glass bottles upon the case or shelves is a mistake. They should be excluded from light.

Spiritus ætheris nitrosi rapidly decomposes under the action of light and air, becoming acid. Samples have been found that had decomposed and refused to give a test for ethyl nitrite.

Syrup of ferrous iodide which has oxidised by the action of air may be completely reduced to the ferrous condition by exposure to sunlight.—A. C. W.

Menthene and Tertiary Menthol, Preparation of. L. Masson and A. Reyher. Bull. Soc. Chim. 1896, 15—16, [15], 965—969.

THE first stage was the preparation of menthyl chloride from secondary menthol by the action of phosphorus pentachloride, added by degrees and in excess, in presence of rectified petroleum spirit. On washing the petroleum solution with water and sodium carbonate, and leaving to evaporate spontaneously, 120 grms. of crude menthyl chloride (from 100 grms. of menthol) were obtained and converted into menthene by heating for some 12 minutes at 150° along with a solution of 75 grms. of potassium hydroxide in 315 grms. of phenol, followed by distillation until the temperature rose to 200° C. The crude menthene, washed with potash and rectified over metallic sodium, yielded 60 grms. of purified substance, boiling at 160° to 166° (uncorrected), and having a sp. gr. of 0.811 at 20° C. It is remarkable for its high *levo*-rotation, $[\alpha]_D = -48^{\circ} 5$. On treating this body with 150 grms. of trichloroacetic acid for half an hour at between 70° and 90° C., and leaving the two in contact overnight, it was found that 47.3 grms. of the acid had entered into combination, i.e., some $\frac{1}{3}$ of a molecule per molecule of menthene. The product, freed from acid, was saponified by alcoholic potassium hydroxide, and the resulting menthol extracted, along with the residual menthene, from water, by means of petroleum spirit, the extract being then subjected to fractional distillation up to 110° C. under progressive reductions of pressure (from 100 mm. down to 23 mm.). The highest distillate (102° — 110°) contained the greater part of the menthol (41 grms.), and yielded, on redistillation, 34 grms. of a colourless, rather oily liquid of sp. gr. 0.8999 at 22° C., consisting of 76.77 per cent. of C and 12.91 per cent. of H. The index of refraction, $n = 1.45979$, equivalent to a molecular refractive power of 47.45, indicates the absence of a double bond: the rotatory power is *nil*. In order to prove the tertiary nature of the product, it was mixed with ordinary menthol and etherified

by the Menschutkin process with pure acetic acid, with the result that only 2 per cent. of the tertiary isomer was affected as compared with 12.5 per cent. of the ordinary menthol.

Of the other fractions, that coming over between 80° and 95° C. chiefly contained dextro-menthene ($[\alpha]_D = 44.2$). This may be accounted for either by the assumption that dextro-menthene was originally present, or that part of the trichloroacetic acid reelected from combination, and in so doing displaced the double bond.—C. S.

Kola, Pharmacology of. P. Carles. J. Pharm. Chim. 1896, 16, 104.

A LARGE proportion of the caffeine in kola is contained in the form of kolanine, a compound of the alkaloid with tannic acid, insoluble in chloroform, but easily soluble in alcohol, and decomposed by alkalis into its constituents in the presence of water or alcohol. According to the author, kolanine does not exist in the fresh nuts, but is formed by the action of the oxygen of the air, due to a laccase. The following method is given for the determination of the caffeine (compare this Journal, 1896, 561, 622):—10 grms. of powdered kola are mixed with 1 gm. of slaked lime and 20 grms. of 80 per cent. alcohol, and dried until the weight is reduced to 13.5–14 grms. The pulverised mixture is four times extracted by boiling on a water-bath with 35 c.c. of a mixture of 100 grms. of chloroform and 20 grms. of 93 per cent. alcohol, the extraction being performed in a flask with air condenser. After evaporation of the solvent and extraction of the residue with water, the solution is evaporated and the alkaloids dried at 100°.—A. C. W.

The "Formopyrine" of Marcourt. F. Stolz. Ber. 1896, 29, 1826.

THIS substance is obtained by the combination of antipyrine with formaldehyde (this Journal, 1896, 372–373).—A. C. W.

Anemonine. H. Meyer. Monatsb. f. Chem. 1896, 17, 283–299.

ANEMONINE is obtained from the crystallisable portion of the extracts from almost all the plants belonging to the anemone and ranunculus group. According to Beckurts (Arch. für Pharm. 230, 182), it possesses the empirical formula $C_{10}H_{12}O_4$, whilst its constitution has also been studied by Hanriot (Bull. Soc. Chim. 47, 683). In two experiments the author obtained 4.8 and 5.2 grms. of pure anemonine from 10 kilos. of fresh *Anemone pratensis*. Besides investigating its properties, he has also prepared several derivatives. Anemonine is easily soluble in boiling alcohol and chloroform, less soluble in benzene and hot water, and scarcely at all soluble in ether and petroleum spirit. From its solution in alcohol and benzene, it crystallises in the form of long, bright needles, and from chloroform in plates, which melt at 150° to a clear, bright yellow liquid. Heated a few degrees above the melting point, anemonine is converted into an amorphous substance which decomposes at 290°. This peculiarity probably accounts for the fact that certain investigators were unable to assign any definite melting point to it. Anemonine is dissolved by alkalis imparting a reddish-yellow or blood-red colour to the solution, which disappears again on acidification. The change is so abrupt that anemonine can be used as an indicator for its own volumetric estimation. In conclusion the author points out that anemonine, $C_{10}H_{12}O_4$, presents a certain amount of similarity, both in constitution and physiological action, to cantharidine, $C_{10}H_{12}O_7$.—J. S.

Pellotine as an Opiate. F. Jolly. D. med. Wochenschr. 1896, 22, 24.

PELLOTINE is a natural alkaloid obtained from *Anhalonium Williamsii*, and forms the active ingredient in the "pellotes" sold in Mexico as narcotics. It is crystallisable, and of a bitter taste; only slightly soluble in water, but readily so in hydrochloric acid, and is represented by the formula $C_{13}H_{19}NO_4 \cdot HCl$. Experiments on 40 patients gave satisfactory results, the smallest quantities being sufficient; subcutaneous injections also proved efficacious.—C. S.

Fennel, Japanese; and its Oil. J. C. Umney. Pharm. J. 1896, 91.

THE Japanese fennel fruit resembles anise in shape, but is more oblong, and has no hair on its surface like the latter. The odour of Japanese fennel is very similar to that of the European variety, and its taste, at first sweet, is marked by the after-bitterness characteristic of the other varieties. The fruits yielded by steam distillation (with the water of the condenser at a temperature of at least 25° C., to avoid separation of anethol), 2.7 per cent. of a pale yellowish oil having an odour similar to that of ordinary oil of sweet fennel. The oil solidifies at -7° C. when stirred, and becomes liquid again at -10° C.; the rather high solidifying point indicates a high percentage of anethol. By fractional distillation of 100 c.c. from a glycerin bath, the following portions were obtained, the quantities being similar to those obtained from French and East Indian fennel oils:—

	Per Cent.
Below 220° C.	26
220°–225° C.	32
225°–230° C.	34
Residue	8

The author found that the terpene constituents of the oil, about 5 per cent., consisted of pinene and dipentene, no phellandrene being present. The oil also contained 10.2 per cent. of fenchone and over 75 per cent. of anethol.—A. S.

Palmarosa Oil. E. Gildemeister and K. Stephan. Arch. Pharm. 1896, 234, 321.

THIS oil, also known as Indian grass oil, false or Indian, or Turkish geranium oil, is obtained from the leaves of *Andropogon Schoenanthus* from Bombay. It consists chiefly of geraniol, and also contains about 1 per cent. of dipentene, traces of methyl heptenon, and between 12 and 20 per cent. of esters, these being geraniol esters of acetic and normal caproic acids.—A. C. W.

Vanilla in Mexico, Cultivation of. J. Soc. Arts, 1896, 44, 716.

THE information given in the paper is taken from the report of Sir H. Dering on the productions of Mexico.

Six varieties of vanilla occur in Mexico, namely, the "mansa," the "cimarrona," the "mestiza," the "pompona," the "puerco," and the "mono," but only the mansa and the pompona are cultivated. The bean, if allowed time to ripen properly, is black and juicy, and will, if well prepared, keep for many years. The beans are gathered, and immersed for half a minute in nearly boiling water, and, after draining, are exposed to the sun. They are then shut up in tight boxes to ferment. When the beans are soft and pliable, they are squeezed so as to evenly distribute the seeds and oily substances contained in them, and are finally divided into five grades according to length, thickness, colour, and appearance. (See also this Journal, 1896, 613.)—A. S.

Calcium Tartrate, Solubility of. H. Enell. Nordisk. Pharm. Tidsskrift. 1896, 3, 196.

ONE part of calcium tartrate is soluble in 2,565–2,632 parts of water, 3,850 parts of concentrated acetic acid, 296–303 parts of 25 per cent. acetic acid, and in 2,280–2,540 parts of saturated acid potassium tartrate solution.

—A. C. W.

Antipyrine, Combinations of, with the Oxybenzoic Acids and their Derivatives. G. Patcin and E. Dufau. Comptes rend. 122, 1335–1338.

1. *Salicylate of antipyrine* [salipyrine] is already known.

11. *Antipyrine para-oxybenzoate* is obtained by mixing a concentrated alcoholic solution of 5.5 grms. of para-oxybenzoic acid with an aqueous solution of 8 grms. of antipyrine. An oily liquid separates and crystallises after some time. The substance may be re-crystallised from boiling water or alcohol. It melts at 78°–82°, is soluble in 130 parts of cold water, much more soluble in boiling water, very soluble in alcohol, and slightly soluble in ether. Ferric chloride gives the antipyrine reaction.

III. *Antipyrine meta-oxybenzoate* is obtained in a similar way, but remains liquid under ordinary conditions. Both of these substances are formed by the union of a molecule of each of the constituents without the elimination of water.

Antipyrine likewise combines with saligenin, forming a liquid substance, but not with methyl salicylate nor anisic acid.—J. S.

Citric Acid Fermentation, Two New Moulds which produce. C. Wehmer. Zeits. für Spiritusind. 1896, 208—209.

Citric acid was detected amongst other acids in a solution on which moulds were growing: Two organisms were isolated which produced citric acid from sugar; and as the author was unable to identify them with any known moulds, he named them *Citromyces Pfefferianus* and *C. Glaber*. In appearance these moulds resemble the common blue moulds, but with practice can be distinguished from them. The most favourable temperature for the germination of the spores is from 18°—25° C. Below 0° and above 25° they do not grow. Before budding, they swell to double their size. Under some conditions there is a production of yeast-like cells, which produce a turbidity.

As much as 4 per cent. of citric acid has been found in the solutions; if allowed to stand for any length of time, the acid is destroyed. The most favourable temperature is 15°—20° C.; the production of the acid is easily controlled by regulating the temperature, and removed from further action by the addition of chalk, when calcium citrate is thrown down in crusts. A plentiful supply of oxygen is, of course, necessary, as, in order to convert 50 grms. of dextrose into citric acid, 13·3 grms. or 10 litres of oxygen are necessary. These two moulds are widely diffused in nature, being found on a number of vegetable products.

—A. L. S.

Atisine, the Alkaloid of Aconitum Heterophyllum. H. A. D. Jowett. Proc. Chem. Soc. 1896, [168], 158.

THE author has investigated the nature and properties of the alkaloid contained in the roots of the non-toxic *Aconitum heterophyllum*. This alkaloid was examined by Broughton in 1873, who named it atisine, and ascribed to it the formula $C_{46}H_{71}N_3O_5$; it was subsequently examined by Wasowicz and by Alder Wright. The powdered roots were extracted by percolation with a mixture of methyl and amyl alcohol, and from this percolate was obtained the crystalline hydrochloride or hydriodide by the method described in the paper.

Atisine, for which the author adopts the formula $C_{22}H_{31}NO_3$, could only be obtained as a colourless varnish, soluble in alcohol, ether, or chloroform, slightly soluble in water, and insoluble in petroleum ether. Its alcoholic solution is levo-rotatory, $[\alpha]_D = -19\cdot6^\circ$, and though the base is amorphous it yields a series of crystalline salts.

Atisine hydrochloride, $C_{22}H_{31}NO_3 \cdot HCl$, crystallises either from water or from a mixture of alcohol and ether in well-defined prisms, which melt at 296° (corr.), and are freely soluble in water or alcohol, but insoluble in ether. The aqueous solution of the salt is dextro-rotatory, $[\alpha]_D = +18\cdot46^\circ$.

When either the base or its salts are mixed with alkalis or acids in either alcoholic or aqueous solution, no fission of the molecule takes place, but a new base, atisine monohydrate, $C_{22}H_{31}NO_3 \cdot H_2O$, is formed. Neither this base nor any of its salts could be obtained in the crystalline condition.

A preliminary examination of the physiological action of the nitrate by Dr. Cash, showed that the alkaloid is non-toxic, and that its action somewhat resembles that of aconine.

Quinine Sulphate, The Testing of. Melchoir Kubli. Pharm. Zeit. f. Russl. 34, Nos. 34—37.

See under XXIII., page 681.

Cocaine, Detection of Eucaïne in. G. Vulpius. Pharm. Central-H. N.F. 1896, 17, 295.

See under XXIII., page 679.

Bismuth Sulphide, Solubility of, in Sodium Sulphide [Estimation of Small Percentages of Bismuth in Alloys]. T. B. Stillman. J. Amer. Chem. Soc. 1896, 18, 683.

See under XXIII., page 678.

Cream of Tartar, Commercial; Composition and Analysis of. A. H. Allen. Analyst, 1896, 20, 174.

See under XXIII., page 680.

Formo-Gelatine, Detection of Unaltered Gelatine in. G. Romyn. Pharm. Weekblad. 33, [1], 1896.

See under XXIII., page 679.

Chloroform, Ethers, &c. Rep. of Commissioners of Inland Revenue for year ending March 31, 1896.

See under Trade Rep., page 684.

Methylated Spirit. Rep. of Commissioners of Inland Revenue for year ending March 31, 1896.

See under Trade Rep., page 685.

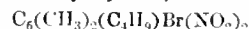
PATENTS.

Aromatic Nitro-Sulphochlorides, Process [Simplified and Shortened] for the Manufacture of. F. von Heyden, Radebeul, Germany. Eng. Pat. 14,276, July 26, 1895.

THIS patent claims the manufacture of nitro-sulphochlorides by the action of chlorosulphonic acid (sulphurylchlorhydric), $SO_2(OH)Cl$, on aromatic nitro-bodies. The reacting substances are mixed together, heated by steam until no more hydrochloric acid is evolved, poured upon ice, and the product filtered off. The mother-liquor contains some nitro-sulphonic acid, which may be converted into nitro-sulphochloride by chlorides of mineral acids.—A. C. W.

Artificial Musk, Impts. in the Manufacture of. Fabriques de Produits Chimiques de Thann et de Mulhouse, Thann, Alsace. Eng. Pat. 15,762, Aug. 21, 1895.

The halogendinitrobutyl xylenes, as



are claimed, together with the processes for their manufacture—(a) By nitration of halogen butyl xylenes, (b) From dinitro-amidobutyl xylene by well-known methods.

—A. C. W.

Pharmaceutical Compounds [Alphyloryacetic - alphyl Esters], Manufacture or Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co." Eng. Pat. 17,417, Sept. 18, 1895.

THE production of phenoxyacetic phenyl ester and its homologues from phenoxyacetic acid (and its homologues) and phenols, the process for producing these compounds by heating the two substances with phosphorus pentachloride, trichloride, oxychloride, &c., and the bodies themselves, as new articles of manufacture and of medicinal value, are claimed.—A. C. W.

"Artificial Camphor," Impts. in or relating to the Manufacture of, and its Treatment. J. C. Richardson, London. Eng. Pat. 18,297, Oct. 1, 1895.

THIS patent claims the manufacture of an efficient substitute for natural camphor by the action of air and hydrochloric acid gas at a regulated temperature upon turpentine, purification of the crystals so produced by steam distillation in the presence of an oxidising agent (sodium permanganate or bichromate), and final purification by melting in an oil-bath at a temperature not exceeding 175° C., then casting or subliming. The fractional steam distillation of the residual oil from the first process, and its purification in order to separate dissolved camphor-substitute, is also claimed.—A. C. W.

XXI.—PHOTOGRAPHY.

Pyrorrylin, New Solvent for. G. Michaelis. Phot. Wochenbl. 1896, 22, 185.

A SOLUTION of gaseous methyl ether in methyl alcohol is employed, the ether being prepared by distilling about

equal parts of methyl alcohol and sulphuric acid at a moderate heat, cooling the vapours, and passing them through caustic alkali and over calcium chloride into the methyl alcohol. Collodion prepared by this solvent is already employed in America for making collodion emulsion paper, and is also recommended for the wet collodion process. The collodion from this methyl alcohol process does not set so rapidly as that prepared with methyl alcohol, and must therefore be laid in a horizontal position to harden after pouring, otherwise an extremely thin layer will be formed.—C. S.

Pyroxylin, B.P., Notes on. Chas. T. Tyer. Pharm. J. 1896, 109.

THE author's experiments on the manufacture of pyroxylin are confirmatory as to the fact that the presence of moisture in the cotton wool, variation of temperature of mixed acids, time of exposure to the action of mixed acids, and method of washing, all have an effect on the finished product. It was found that the U.S.P. formula gave a better product than the B.P. formula, the B.P. product being of inferior solubility when the yield approached theory. The best drying temperature was found to be 90° F.—A. S.

PATENT.

Photographic Developing Solutions, Impts. in. J. Hauff. Feuerbach, Germany. Eng. Pat. 11,306, May 23, 1896.

THE use is claimed, as developers, of compounds of hydroquinone or pyrocatechol with *p*-phenylene-, *p*-toluylene-, *p*-xylylene-, α - β -naphthylene-, or α - α' -naphthylendiamine and their derivatives, in solution together with alkaline hydroxides or carbonates. The combination takes place on bringing the components together in alkaline solution.—A. C. W.

XXII.—EXPLOSIVES, MATCHES, Etc.

PATENTS.

Gunpowder [in Flat Grains], Improved Process of and Apparatus for Making. P. R. J. Willis, London. From W. E. Peyton, Santa Cruz, Cal., U.S.A. Eng. Pat. 17,935, Sept. 25, 1895.

THE plastic, or gelatinous, explosive to be converted into grains for use in ordnance, or small arms, is squirted into the form of a tube by means of a suitable press. The tube as it leaves the press is slit longitudinally by means of a fixed cutter, and opened out into a flat sheet by means of suitably placed guides.

The sheet thus formed is then passed between grooved rollers, which form it into grains of the desired size and shape.—R. B. P.

Explosives [Ammonium Nitrate], Impts. in the Manufacture of. L. Kelbetz, Wiener-Neustadt, Austria. Eng. Pat. 13,270, June 16, 1896.

AMMONIUM nitrate is mixed with "comparatively high graded fatty acids, or with metallic salts (or soaps) of such fatty acids." A small quantity of charcoal may be added to increase the inflammability of the mixture. 100 parts of ammonium nitrate to from 1 to 20 parts of a suitable fatty acid, or of a metallic salt of such acid, are given as suitable proportions, and stearic, palmitic, oleic as suitable fatty acids.—R. B. P.

Explosives [Ammonium Nitrate], Impts. in the Manufacture of. L. Kelbetz, Wiener-Neustadt, Austria. Eng. Pat. 13,269, June 16, 1896.

AMMONIUM nitrate is mixed with aniline or toluidine oxalate, or both, or with another suitable crystalline compound of an aromatic amine with an organic acid.

The following example is given:—Ammonium nitrate, 100 parts, with from 1 to 20 parts of aniline oxalate.

A small proportion (less than 5 parts) of charcoal may be added in order to increase the inflammability.—R. B. P.

XXIII.—ANALYTICAL CHEMISTRY.

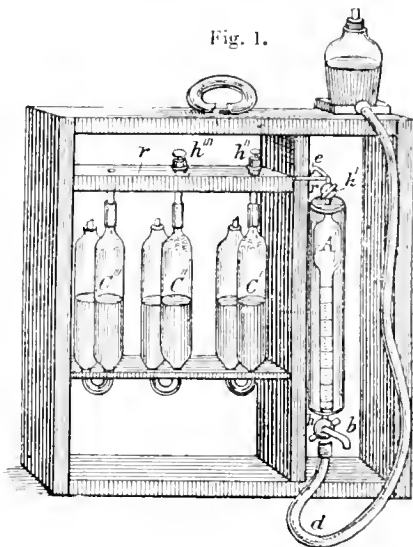
APPARATUS, ETC.

Gas Analysis, Apparatus for. O. Bleier. Ber. 29, [2], 260–265. (See also this Journal, 1896, 294 and 616.)

1.—*Automatic Measurement of Gases in a state of Saturation with Water Vapour.*—To avoid errors due to the influence of the tension of water vapour on the volume of the gas, it is necessary to keep the latter saturated with the former throughout the analysis, the small film of water left adhering to the wall of the measuring vessel being sufficient. The formation of drops is prevented by reducing the rate of outflow.

With this purpose in view, Orsat's apparatus may be modified as follows (Fig. 1):—A three-way tap, *h*, at the bottom of the measuring vessel *A* (capacity 100 c.c.)

Fig. 1.



connects the latter with the tubing *d*, or the horizontal overflow pipe *b*, through which the water can be run off from *A* in 2–3 minutes. At the upper end of *A*, a tap *h'* communicates with the tube *c* for admitting the gas, and with *r*. The latter is tapped at *h''* and *h'''*, the junctions of the capillaries leading to the absorption vessels *C'* and *C''*, no tap being needed for *C'''*.

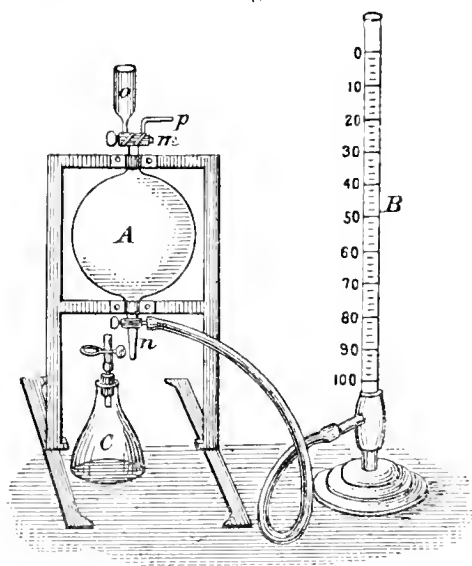
It is claimed for this modification that the operation is more speedy and accurate, there being no error to take into account from the solubility of the gas, and no need to empty the tube *r* before each determination, since only the residual gases from the previous test are present; moreover, the taps *h''* and *h'''* prevent the gas from diffusing further in *r* and so escaping absorption.

11. *Apparatus for Gas Titration.*—The apparatus (Fig. 2) consists of a glass sphere, *A* (500–600 c.c.), mounted on an iron frame. At the upper end, *A* terminates in a tube connected by a two-way tap *m*, with a cylindrical funnel *o*, and a capillary tube *p*, and, at the bottom, in a three-way tap *n*. A vertical measuring tube, *B*, graduated to $\frac{1}{2}$ c.c., is connected with *n* by a 75-cm. tube.

A, having been dried, the gas under examination is introduced, through *n* or *p*, according to its density, and allowed to remain a short time under pressure, to attain the prevailing room temperature. After releasing the pressure, the absorption of the gas is effected by introducing the absorbent liquids through *B*, if measured, or through *o* if in unmeasured quantities, the liquids being drawn off at the end of the operation by a vacuum flask *C* attached to *n*, in which vessel they are subsequently titrated. The residual gas may be examined either in the apparatus itself or trans-

ferred to Orsat's apparatus, &c., for absorption or combustion analysis; in the latter event the results must be corrected to the original volume of gas taken.

Fig. 2.



When the apparatus is used for absorption analyses, the gas is measured as described under 1., by the displacement of water, and the absorbent liquid is contained in B, the degree of absorption being shown by the decrease of the liquid in the tube. Under favourable conditions the method is exact to 0.1 per cent.—C. S.

Filter of Cellulose. H. Pottevin. *Comptes rend.* 1896, 123, [4], 263.

The author finds that a paste composed of finely pulverised and sifted cellulose fibres suspended in water, if slowly dried in slabs some millimetres thick, forms a filtering medium capable of replacing porcelain for the arrest of micro-organisms. The slabs must be supported between sheets of sandstone or perforated metal, and may be arranged in batteries like filter presses. Their advantages are cheapness and the property of being easily reduced to paste again and regenerated for use. The results of two experiments are given, showing the capabilities of such a filter. In the first, a slab 2.5 mm. thick arrested all organisms for six consecutive days, under a pressure of about 10 m. of water; in the second, a slab 1 mm. thick broke down on the third day. Water from a reservoir was used.—L. A.

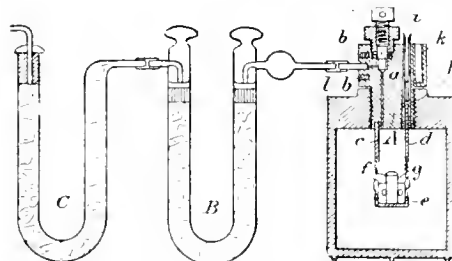
Gas Regulator, A Simple Form of. L. Saarbach. *J. Amer. Chem. Soc.* 1896, 18, 511—513.

The flow of gas is regulated by the motion of a column of mercury, actuated by the expansion of air confined in a bulb. Illustrative cuts are given in the original. The second form shown is suitable for use at high temperatures, being provided with a second bulb and sufficient mercury to furnish a seal sufficient to prevent the escape of the expanded air. The apparatus can be very readily cleaned and refilled, when dirty, and is stated to be only slightly influenced by the daily changes in the atmospheric pressure.—H. T. P.

Fuel, Determination of Heat of Combustion of. W. Hempel. *Zeits. f. angew. Chem.* 1896, 12, 350—352. (See also this Journal, 1893, 179.)

SEEING that the value of a fuel when burned beneath a boiler, or otherwise used in practice, is smaller than is indicated by the result of a calorimetric determination, by the quantity of heat represented by the water formed on combustion and passing away uncondensed, it is desirable to determine the amount of this water and to correct the usual statement of total heat units. When an analysis of

the fuel is made, this can readily be done, but when only a calorimetric determination is contemplated, the arrangement shown in the figure is useful. The device is sufficiently obvious to need but a brief description. A short copper tube *l* is soldered on to the closing cap of the calorimeter



bomb, so as to give communication with the inner cavity. A socket *k* on the other side of the cap serves for the introduction of a thermometer. A drying tube B and a guard tube C attached to *l* completed the arrangement. Before the determination, the well-dried bomb is kept in a desiccator to ensure the absence of casual moisture, and when the combustion is complete, the bomb is connected with the drying tubes and heated with a free flame until all the water is expelled, this being ensured by evacuating the bomb by means of a water-pump, admitting air and again evacuating. Tests on known quantities of water successively admitted to and expelled from the bomb gave satisfactory results.—B. B.

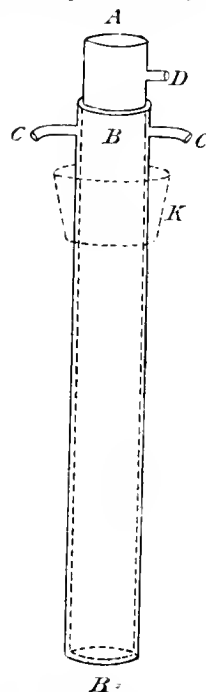
Condenser, A New Form of. R. Walther. *Chem. Zeit.* 1896, 20, 462.

The apparatus shown in the figure is designed, more especially, for use in cases where it is necessary to shake up a flask while it is being heated under an inverted condenser. By its use, this operation can be performed without detaching the flask.

It consists of two tubes, A and BB, of either metal (nickel-plated brass) or glass, one inside the other, and fastened together at the ends, the intervening space being divided into two parts by diaphragms running on opposite sides almost the whole length of the outer tube. The cooling water which flows in at one side, through C, is thus caused to pass downwards to the bottom and ascend, passing out at the opposite side.

The condenser is attached to the distilling flask by means of a stopper K, or is merely placed in the neck of the flask.

The side tube D allows air or other gases to escape when the end A is closed (with a stopper and tap-funnel, for instance). This tube is closed, when the condenser is used in the ordinary manner for distilling purposes, to prevent air from being drawn in.—E. B.



Engler's Viscosimeter, Heating by Means of a Ring-Burner. Holde and Schwarz. *Mitt. Königl. techn. Versuchs. zu Berlin*, 1896, 117—118.

IN the opinion of the authors, Engler's viscosimeter can be satisfactorily heated by the direct application of a burner. The tendency, alleged by Wischin, to overheat the exit tube is negligibly small.—B. B.

INORGANIC CHEMISTRY.—QUALITATIVE.

Ozone, Separation from Hydrogen Peroxide, and Recognition in the Atmosphere. C. Engler and W. Wild. Ber. 1896, 29, 1940.

WHEN a mixture of ozone and hydrogen peroxide vapour is passed over solid chromic acid spread over glass beads, or through a concentrated solution, the hydrogen peroxide is entirely destroyed, but the ozone remains unaltered, though this may not be the case with minute quantities of atmospheric ozone when the chromic acid is but partially reduced. The most certain test for ozone is given by paper soaked in strong manganous chloride solution, which is turned brown by ozone, but not by hydrogen peroxide or nitrous acid, and the brown coloration is changed to blue by guaiacum tincture. The brown coloration given by ammonia does not give the blue with guaiacum. In this test, free halogens, and hypochlorites, &c., must of course be excluded.

—A. C. W.

Gold, A Colorimetric Test for. Carnot. Berg- und Hüttenmann. Zeit. 1896, 55, 215.

IF to a gold chloride solution of known strength, a few drops of arsenic acid be slowly added, and then after some time 2 or 3 drops of dilute ferrous chloride solution and a little hydrochloric acid, a rose-red coloration appears. If too little acid be added, there is a purple precipitate, and if too much, the reaction does not take place and only a bluish tint is produced. 100 c.c. of this solution are mixed with distilled water and zinc added, a coloration varying between red and purple according to the quantity of gold appears and remains a long time. With solutions containing between 0.1 and 1 mgrm., the gold content can be estimated by comparison of the tint.—A. C. W.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Water, Determination of Oxygen in. — Romija. Rec. trav. Chim. des Pays-Bas, 1896, 15, 76.

AN aqueous solution of 1 mol. of manganous chloride, 2 mols. of potassium sodium tartrate, and caustic soda in excess, will absorb the oxygen dissolved in water and become brown. With an excess of manganous hydrate the reaction is complete in 10 minutes, and the oxygen may be estimated by the iodine it liberates from potassium iodide. The test may be performed in a pipette tapped on either side, and having a graduated glass tube (about 1 c.c. capacity) fused on to the upper tap. The water having been introduced, and the upper tube dried, the latter is filled with 1 c.c. of a solution containing 1.12 gm. of manganous chloride and 0.085 gm. of potassium iodide, the said solution being then run into the pipette and an equivalent quantity of water run off through the bottom tap. After shaking up the contents of the pipette, 1 c.c. of a solution (0.1 gm.) of potassium sodium tartrate and an equal quantity of caustic soda solution of the same strength are successively added in the same manner and left for 10 minutes. Finally, 1 c.c. of 25 per cent. hydrochloric acid is run in and the liquid transferred to an Erlenmeyer flask, where the liberated iodine is titrated with thiosulphate. The iodine is directly equivalent to the oxygen originally in solution. In calculating the results, the 4 c.c. of water lost during the addition of the reagents must be taken into account.—C. S.

Potassium, Estimation of. C. Fabre. Comptes rend. 122, 1331—1333.

THE author recommends the following method for saving time in the estimation of potassium as platinumchloride. The potassium platinumchloride, prepared and washed with alcohol and ether in the usual way is treated with boiling water and the solution reduced with magnesium powder (previously washed with alcohol and distilled water). The reduction should take place at about 60° C., and with not too large an excess of magnesium. The action is as follows:— $2\text{Mg} + \text{K}_2\text{PtCl}_6 = 2\text{KCl} + 2\text{MgCl}_2 + \text{Pt}$

The platinum and excess of magnesium are filtered off and the chlorine titrated in the filtrate with decinormal silver

nitrate. Knowing the amount of chlorine it is easy to calculate the corresponding quantity of potassium. A large excess of magnesium, too high a temperature, or too concentrated a solution is apt to give rise to the formation of magnesium oxychloride which would be retained in the precipitate, so it is best in every case to add a few drops of sulphuric acid before filtration, and then to add a slight excess of calcium carbonate to the filtrate. This method is likely to be of use in agricultural laboratories.—J. S.

Potassium Bicarbonate, Use of, in Volumetric Analysis. G. Freyss. Bull. Soc. Ind. Mulhouse, 1896, 250—254.

A NORMAL solution of the salt is prepared. It may be employed to determine:—Alkali hydroxides in admixture with alkali carbonates and coloured impurities; alkali bicarbonates and carbonates, together or singly; the alkali-saturating power of crude phenols (to give the amount of alkali required to dissolve out the phenols present); phenols of known composition in the presence of indifferent oils: of eugenol, for instance, in oil of cloves, &c., or of thymol in oil of thyme.

An example of the method for making the first of these determinations is as follows:—A portion of a solution containing sodium hydroxide, carbonate, sulphate, chloride, and other salts, and of a colour which rendered it difficult to perceive the pink coloration produced in it by the addition of phenolphthalein, was diluted to 10 times its volume. 50 c.c. of the diluted solution were taken, and 100 c.c. of a solution of barium chloride (244 grms. per litre) added, together with a few drops of phenolphthalein solution. Without the precipitate being removed, the standard solution of potassium bicarbonate was then run in, the precipitate of barium carbonate formed carrying down with it the coloured impurities present and making it easy to see the end point of the reaction. The amount of sodium hydroxide in 5 c.c. of the original solution, is obtained by multiplying the number of c.c. required by 0.040.—E. B.

Halogens, Quantitative Determination of the, in Mixtures of their Binary Compounds. A. A. Bennett and L. A. Placeway. J. Amer. Chem. Soc. 1896, 18, 688—692.

THE solution containing the mixed salts is introduced into a distilling flask, 50 c.c. of a 20 per cent. solution of iron alum added and the liberated iodine is then distilled over into 35 c.c. of a 20 per cent. solution of potassium iodide, the amount of iodine in the distillate being determined in the usual way. 35 c.c. of a saturated solution of potassium permanganate are now added to the contents of the distilling flask, together with sufficient water to bring the bulk to about 200 c.c. On continuing the distillation, the bromine is liberated and collected as before. The contents of the distilling flask are then transferred to a beaker, the excess of the permanganate is reduced by ferrous sulphate, with the addition of sulphuric acid, the solution diluted to a definite bulk, in a portion of which the chlorine may be determined by means of silver nitrate.

The method is suitable for rapid technical estimations of bromine or iodine, single analyses occupying from 10 to 15 minutes.—A. K. M.

Sulphates into Chlorides, A New Method of Conversion of. P. Jannasch. Zeits. anorgan. Chem. 1896, 12, 223.

THE sulphate, mixed with 4—5 times its weight of finely powdered anhydrous boric acid, is heated in a platinum crucible until fumes of sulphuric acid cease to come off, which takes about 15—30 minutes. The fused mass is then treated with methyl alcohol which has been saturated in the cold with pure hydrochloric acid gas. On evaporating this mixture with an excess of hydrochloric acid, the boric acid is expelled in the form of its volatile methyl ester, leaving a residue of the chloride of the base present. Or, the boric acid may be more rapidly removed by dissolving the fused mass at once in hydrochloric acid and methyl alcohol, and evaporating. The author states that he has, by this method, transformed into their chlorides, the sulphates of sodium, potassium, and magnesium, and also with similar facility, heavy spar, and some metallic sulphates. The method may be applied with advantage upon silicates after they have been first decomposed by ammonium fluoride.—H. S. P.

Calcium Carbide, Estimation of Sulphides in. F. J. Pope.
J. Amer. Chem. Soc. 1896, 18, 740--741.

A WEIGHED quantity of the calcium carbide is introduced into an Erlenmeyer flask fitted with a stopcock funnel, and connected with two wash bottles containing 150 c.c. of lead acetate solution of known strength. Water is cautiously introduced through the funnel, and when the evolution of acetylene has ceased, dilute sulphuric acid (1:3) is added, and the contents of the flask gently boiled. A current of air is finally passed through the apparatus, the contents of the wash bottles filtered and the lead determined in the filtrate. From the difference between the lead found and that originally present, the amount of sulphur may be readily calculated.—A. K. M.

Fireproof [Fireclay] Materials, Estimation of Alkalis in.
C. Reinhardt. Stahl u. Eisen, 1896, 16, 448.

THREE GRMS. of the material (Fireclay, firebrick, tile, &c.) dried at 100° to 110° C. are moistened with 10 c.c. of water in a platinum dish, and after 40 c.c. of pure fuming hydrofluoric acid and 5 c.c. of concentrated sulphuric acid have been added, the dish is covered with a platinum lid and heated over asbestos for $\frac{1}{4}$ to $\frac{1}{2}$ an hour, until the contents have decomposed. Heating is continued for a further three hours or so (after removing the lid) to drive off the sulphuric acid, silicon and boron also escaping as fluorides. When cold, the mass is treated with 50 c.c. of water, which dissolves everything but the barium, part of the lime, and a small quantity of alumina and silica. The solution is boiled after the addition of a little rosolic acid, and the alumina and iron thrown down by about 10 c.c. of 10 per cent. ammonia, 3 c.c. of hydrogen peroxide being used to oxidise the iron and precipitate the manganese. The liquid being made up to 300 c.c., 200 c.c. (= 2 grms. of substance) are filtered, evaporated, and dried at a red heat in a platinum dish to drive off the ammonia. To the residue, dissolved in 10 c.c. of hydrochloric acid, are added 20 c.c. of water, and, after boiling, 10 c.c. of ammonia and 2 c.c. of ammonium oxalate. At the end of a few hours, filter, evaporate, and heat to redness with a little ammonium carbonate to convert the fusible bisulphates into neutral salts. The residue consists of the sulphates of magnesium, potassium, and sodium, from 2 grms. of substance, together with the impurities in the reagents. The latter must be ascertained by a blank experiment, and, since the impurities are mostly from the defective glass of the bottles, it is advisable to use dry reagents.

To determine the alkalis in the residue, dissolve in 200 c.c. of water, and add to one-half, 10 c.c. of dilute hydrochloric acid, 40 c.c. of ammonia, and 0.5 gm. of sodium biphosphate, filtering off the magnesium precipitate after 12 hours, redissolving it in 10 c.c. of nitric acid, heating to redness and weighing as pyrophosphate. The sodium and potassium are estimated from another portion of the 300 c.c. solution, 75 c.c. of which are heated along with 10 c.c. of dilute hydrochloric acid and precipitated with 5 c.c. of barium chloride solution, the barium sulphate being calculated to potassium plus sodium (in 0.75 gm. of substance).—C. S.

Mortar, The Analysis of. W. J. Dibdin and R. Grimwood.
Analyst, 1896, 197--204.

THE byelaws of the London County Council provide that mortar used under the Metropolitan Management and Building Acts Amendment Act, 1878, shall be composed of "freshly-burnt lime and clean, sharp sand or grit, without earthy matter, in the proportions of one of lime to three of sand or grit; for cement mortar, the proportion of aggregate is increased to 4:1, and burnt ballast or broken brick may be substituted for sand or grit. These proportions are by apparent volume, and it therefore becomes necessary to translate the result of the analysis of the mortar made by weight into the nomenclature adopted in the Act.

The authors have found that average commercial building lime contains 80 per cent. of CaO; hence the percentage of CaO found in a mortar must be increased by one-fourth of its amount to convert it into the corresponding percentage of commercial lime. Further, they state that as, according to their experiments, 17.38 grms. of lime occupy 18.5 c.c. and that 21.13 grms. of broken brick occupy the same

volume, the conversion of a given weight of commercial lime into terms of volume, taking that occupied by an equal weight of broken brick as the unit, may be effected by increasing the value found by one-fourth. Thus a mortar in which 10.89 per cent. by weight of CaO was found, would be calculated to contain $10.89 + \frac{10.89}{4} = 13.61$ per

cent. by weight of commercial lime, i.e., $13.61 + \frac{13.61}{4} = 17.0$ per cent. of commercial lime by apparent volume; in the same mortar, after allowing for moisture and soluble matter from the brick used as aggregate, the percentage of broken brick was found to be 48.75 per cent. by weight. The translation of weight into volume (adopting the volume of a given weight of broken brick as the unit) has already been accomplished by the use of the factor 1.25 for the lime above. Consequently the figures for lime and brick may be directly compared. These are 17.0:48.75 or 1:3 nearly, corresponding with the intended composition of the mortar. Similarly with cement mortar, the authors state that "average Portland cement will contain from 17 to 20 per cent. of soluble silica," and that equal volumes of washed and dried sand and of Portland cement of sp. gr. 3.15 were found to weigh 21.7 and 19.3 grms. respectively, whence they deduce that a sample of cement mortar containing 3.25 per cent. of soluble silica (that serving as the criterion), would contain 18 per cent. of cement, i.e., 19.25 per cent. by volume; seeing that in the same sample the sand and grit equalled 67.34 per cent., the ratio of cement to sand was 1:3.5.

The following is an outline of the method of analysis used by the authors:—10 grms. of the mortar are dried on the water-bath, for the determination of moisture; error caused by absorption of CO₂ is negligible. 10 grms. are mixed with hydrochloric acid of 10 per cent. strength, allowed to stand for one minute, the solution decanted together with the fine earthy matter in suspension. Washing is carried on by decantation until all the supernatant liquor at the end of one minute's subsidence is clear. The clean, washed sand and grit or broken brick is dried and weighed; the earthy matter in the decanted liquid is filtered off and weighed; a known fraction of the filtrate is taken for the estimation of silica and bases. The sample taken for moisture after weighing, is ignited at a dull red-heat, insufficient to decompose the carbonate, and the loss on ignition so found is corrected by moistening the ignited mortar so as to hydrate the lime, drying the product and weighing again.—B.B.

Monazite Sand, The Analysis of, and the Estimation of Thoria. C. Glaser. Chem. Zeit. 1896, 63, 612.

IN devising a process for the analysis of monazite sand, the author found that a useful method could not be constructed from published sources of information. The solution from which the rare earths are to be precipitated as oxalates must not be very acid, as otherwise traces of thoria remain in solution. The author could not obtain complete separations of thoria from oxides of the cerium group by means of sodium thiosulphate or by fractional precipitation with weak ammonia. Where small quantities of cerite earths have to be separated from thoria, this may be done by adding excess of ammonium oxalate to the boiling, slightly acid solution, and filtering off the precipitated cerium oxalates; the thorium oxalate remains in solution and crystallises out, on cooling the filtrate. Experiments giving satisfactory results are quoted to show that a good separation may be effected by precipitating the cerite oxalates by means of ammonium oxalate in boiling solution in presence of ammonium acetate, the thorium oxalate remaining dissolved and being recoverable from the filtrate by precipitation with ammonia. It is best not to add the ammonium acetate until the oxalate precipitate has just formed, otherwise the latter is apt to pass turbid through the filter. The author states that if thorium oxalate, which has been kept in solution by ammonium acetate, is precipitated by ammonia, then after most careful washing and redissolving in mineral acid, even after ignition, it can no longer be completely precipitated in almost neutral solution by ammonium oxalate. The appended table shows the principal reactions of the rare earths.

BEHAVIOUR OF THE EARTHS WITH DIFFERENT REAGENTS.

—	KOH or NaOH.	K ₂ CO ₃ or Na ₂ CO ₃ .	K ₂ SO ₄ or Na ₂ SO ₄ .	Na ₂ S ₂ O ₃ .	NH ₄ HO.
Al ₂ O ₃	Precipitates, soluble in excess.	Precipitates.	Forms alum.	Precipitates in almost neutral solution on boiling.	Precipitates.
Be ₂ O ₃ or BeO ...	Precipitates, soluble in excess; re-precipitates on boiling or diluting.	Precipitates, difficultly soluble in large excess; also on passing in CO ₂ .	No precipitate: no formation of difficultly soluble double salts.	No precipitate.	Precipitates, insoluble in excess.
ZrO ₂	Precipitates, insoluble in excess.	Precipitates, somewhat soluble in excess; is precipitated therefrom by NH ₄ HO.	Soluble double salt, hot; precipitates basic salt on cooling (insoluble in HCl).	Precipitates hydrate mixed with S.	Do.
Gadolinite earths	Do.	Precipitates, soluble in excess. In a few hours precipitates insoluble double salt (Y).	Soluble: precipitates in concentrated solutions, soluble in aqueous solution of K ₂ SO ₄ . (Y does not precipitate at all.)	?	Do.
ThO ₂	Do.	Precipitates, soluble in excess; not precipitated therefrom in cold by NH ₄ OH. Dim on warming, clear again on cooling.	Forms double salt with K ₂ SO ₄ , difficultly soluble in water, insoluble in saturated aqueous K ₂ SO ₄ . Sodium compound much more soluble.	Precipitates, but not quite completely, even on boiling concentrated solutions.	Precipitates, insoluble in excess; precipitates on fractionating before cerium group (Crookes).
CeO	Do.	Precipitates, somewhat soluble in excess.	Double salt, insoluble in solution of K ₂ SO ₄ .	No precipitate.	Precipitates (after ThO ₂), insoluble in excess.
Ce ₂ O ₃	Precipitates, flesh-coloured with excess.	Precipitates, almost insoluble in excess.	..	Do.	Like KOH.
La ₂ O ₃	Precipitates, insoluble in excess.	Do.	Difficultly soluble double salt.	Do.	Do.
Bi ₂ O ₃	Do.	Do.	Do.	Do.	Do.
—	(NH ₄) ₂ CO ₃ .	(NH ₄) ₂ S.	NH ₄ Cl.	(NH ₄) ₂ C ₂ O ₄ .	NH ₄ C ₂ H ₃ O ₂ .
Al ₂ O ₃	Precipitates.	Precipitates hydrate.	Precipitates solution in NaOH.	Does not precipitate.	Precipitates basic salt on boiling neutral solution.
Be ₂ O ₃ or BeO ...	Precipitates; easily soluble in excess; precipitates on boiling. Not certain for separating from Al ₂ O ₃ .	Do.	Hydrate dissolves on long boiling, with loss of NH ₄ HO.	No precipitate; easily soluble double salt.	?
ZrO ₂	Precipitates; soluble in large excess; precipitates on boiling.	Do.	No precipitate.	Precipitates, soluble in excess.	?
Gadolinite earths	Precipitates, easily soluble in excess. After a few hours precipitates insoluble double salt (Y).	Do.	?	Precipitates E. from boiling acid solutions as clear red sandy powder.	?
ThO ₂	Precipitate easily soluble in excess.	Like NH ₄ HO.	No precipitate.	Precipitates, soluble in excess on boiling; precipitates on cooling.	No precipitate; prevents entirely precipitation by (NH ₄) ₂ C ₂ O ₄ ; partly precipitated therefrom by HCl; precipitated as hydrate by excess of ammonia.
CeO	Do.	Do.	Do.	Precipitates, even in rather acid solution. Somewhat soluble in large excess of acid.	Does not prevent precipitation.
Ce ₂ O ₃	Precipitates, soluble in large excess; precipitates on boiling.	Do.	Do.	Do.	Do.
La ₂ O ₃	Like NH ₄ HO; absolutely insoluble in excess.	Do.	Do.	Precipitates in neutral or ammoniacal solution (?).	Do.
Bi ₂ O ₃	Precipitates rose-red, quite insoluble.	Do.	Do.	Precipitates white to pale reddish, almost insoluble in dilute acids.	Do.

Analytical Process.—Decompose 2 grms. of the finely ground sand by continued heating with strong sulphuric acid or by fusing with potassium acid sulphate. The author prefers to fuse only such residue as remains insoluble in sulphuric acid. Transfer the mixture slowly to ice-cold water, when everything dissolves except silica and tantalum acid. Evaporate the residue twice with H₂F, moisten with sulphuric acid, evaporate to dryness, and ignite strongly; the loss in weight gives silica.

Any residue in the crucible is treated with hot sulphuric acid or fused with potassium bisulphate, and whatever now remains insoluble in ice-cold water is put down as *tantalum acid*. Unite the two solutions, and saturate, first hot and then in the cold, with sulphuretted hydrogen, to precipitate *titanic acid, lead, &c.* From the filtrate, boil off the sulphuretted hydrogen, neutralise most of the free acid by ammonia, and add to the boiling solution excess of hot ammonium oxalate solution. For 2 grms. of the sand use 100 c.c. of cold, saturated solution. Thoria and oxides of the cerium group are precipitated as oxalates, and are filtered off.

In solution are phosphoric acid and oxides of iron, aluminium, manganese, beryllium, yttrium, zirconium, and calcium. Add ammonia and filter off the metallic phosphates (preserving the filtrate). After igniting, fuse with fusion mixture, extract with water, and add the filtrate to the one just mentioned. Dilute to a certain volume, and determine *phosphoric acid and alumina* in an aliquot part. Dissolve the carbonates remaining on the filter-paper by means of sulphuric acid, add ammonia, and estimate *lime* in the filtrate. Dissolve the precipitated hydroxides in a little hydrochloric acid, neutralise as nearly as possible with ammonia, and pour into a sufficient excess of solution of ammonium carbonate containing a few c.c. of ammonium sulphide. Filter off the precipitated *iron, manganese, &c.*, and separate them by the usual processes. In the filtrate are the zirconia, yttria, and beryllia, to separate which boil the ammonium carbonate solution for an hour, whereby they are precipitated quantitatively. Redissolve in hydrochloric acid, boil, cool, and add excess of sodium hydrate. Filter off the precipitated *zirconium and yttrium hydroxides*, and separate them as usual by crystallisation of the zirconia as double sulphate with potassium sulphate. The *beryllia* is precipitated from the filtrate by boiling it for an hour.

The precipitated oxalates of thorium and the cerium group are separated as follows:—Ignite, dissolve in sulphuric acid as usual, neutralise most of the free acid by ammonia, add to the boiling solution excess of boiling ammonium oxalate solution, and as soon as the oxalates of the cerium group have mostly formed, add a few c.c. of ammonium acetate solution, and allow to stand overnight. Filter and precipitate the *thoria* from the filtrate by ammonia, and weigh. *Ceria* is easily separated from *lanthana* and *didymia* by the known process of passing chlorine into the suspended hydroxides, freshly precipitated by caustic soda.

The following analyses were made by this scheme, the second and third samples being honey-yellow monazite sand from North Carolina:—

	1.	2.	3.
	Per Cent.	Per Cent.	Per Cent.
Silica.....	6.40	3.20	1.15
Titanic acid.....	4.67	0.61	1.49
Tantalum acid.....	0.66	..	0.39
Phosphoric acid.....	18.38	28.16	26.05
Lead.....	Trace	..	..
Alumina.....	1.62	None	0.15
Lime.....	1.20	None	..
Ceria (as CeO ₂).....	32.93	..	..
Lanthana and didymia.....	7.93	63.80	59.09
Thoria.....	1.43	2.32	1.19
Oxide of iron.....	7.83	None	..
Oxide of manganese.....	..	Trace	0.65
Zirconia and yttria.....	13.98	..	..
Beryllia.....	1.25	1.52	2.68
	98.28	99.61	99.05

—H. B.

Copper, the Cyanide Method of Determination of; Effect of Variation of Acid in. F. N. Flynn. Eng. and Mining J. 1896, 62, 51.

C. and J. J. Bergruer, in their Text-Book on Assaying, state that varying the amount of nitric acid in the cyanide determination of copper does not affect the results, as the decrease in the amount of cyanide required, due to the lessening of the free ammonia, is balanced by the increase due to the formation of ammonium nitrate.

This statement is contradicted by the author, who gives the results obtained by him:—

	C.c.	C.c.	C.c.	C.c.
Nitric acid added.....	None	3.0	5.0	10.0
Cyanide required.....	33.3	34.9	35.4	36.4

The author concludes from these experiments that if the cyanide solution be standardised with a solution of copper nitrate, without the addition of nitric acid equal to the amount used in the regular assay, the results obtained will be very inaccurate.—A. S.

Manganese, Determination of, in Steel; Sources of Error in Volhard's and Similar Methods. G. Auchy. J. Amer. Chem. Soc. 1896, 18, 198—511.

It is shown that:—

1. The accuracy of Volhard's method largely depends on the conditions under which the neutralisation with zinc oxide is effected.

2. High results are obtained by titrating in nitric acid solution.

Stone's modification (in which the evaporation with sulphuric acid, after solution in nitric acid, is omitted) is, however, preferred by the author, on account of its simplicity, and the short time required for a determination; and in the following scheme, the precautions to be adopted are accentuated:—

Dissolve 3.3 grms. of drillings in 50 c.c. of nitric acid (sp. gr. 1.2), transfer the solution to a 500-c.c. flask, neutralise two-thirds of the acid with sodium carbonate, cool, add zinc oxide emulsion until the solution stiffens, avoiding an excess. Dilute to about 400 c.c., mix, allow to stand until the precipitate of ferric hydrate settles (the supernatant liquid should be colourless), and now, and not before, add a considerable excess of zinc oxide. Dilute to the mark, mix, transfer to dry beaker, mix again, allow to settle, and decant off 250 c.c. of the clear liquid, and titrate at a boiling temperature with permanganate (strength 0.0056). After making allowance for the impurities present in the soda and zinc oxide used, the c.c. of permanganate consumed divided by 10 = per cent. of manganese in the sample. Deduct 0.02 per cent.

(See also Sutton's Volumet. Analysis, 7th edit. 1896, page 232.)—H. T. P.

Manganese, Estimation of, in the Presence of Phosphoric Acid. G. Viard. Bull. Soc. Chim. 1896, 15—16, [15], 973—975.

The presence of phosphoric acid vitiates Hannay's method of estimating manganese, since instead of the peroxide, the tribasic phosphate, $Mn_2O_3 \cdot P_2O_5 + 3H_2O$, is precipitated, notwithstanding that the liquid is strongly acid, when the proportion of phosphoric acid exceeds 1 P to 1 Mn. When the ratio is lower—as in the case of manganiferous cast iron—the precipitate will consist of a mixture of peroxide and phosphate, and will, moreover, be incomplete, so that incineration and estimation as pyrophosphate would not yield accurate results, even were it not that the phosphate readily escapes through the filter during the washing.—C. S.

Copper, Crude; The Analysis of. F. Jean. Ann. Chim. 1896, 1, 185.

10 grms. of filings are treated with a dilute mixture of nitric acid and sulphuric acid of 66° B., and the solution is evaporated to dryness; the residue is taken up with water and alcohol, and filtered. The insoluble portion, which consists of lead sulphate and silica, and dioxide of tin, is

digested with a solution of ammonium carbonate, which converts the sulphate of lead into carbonate of lead, which is then dissolved out by nitric acid, and the lead estimated in the usual way. The silica and dioxide of tin, which are not dissolved by the nitric acid, may then be fused with alkaline carbonate to convert the tin into stannate, from the solution of which the tin may be separated by metallic zinc.

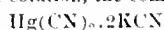
The main filtrate, containing the copper and other metals, is boiled to expel the alcohol, and is then poured into an alkaline solution of sodio-potassium tartrate, heated to the boiling point, and the copper reduced by a solution of glucose. When the precipitation of the copper is complete, the flask is closed, rapidly cooled, and the volume of the liquid made up to one litre with boiled-out water. After allowing the cuprous oxide to settle, 500 c.c. of the clear liquid are taken out, an excess of polysulphide of sodium added, and the liquid warmed at 80° for half an hour. The metals of the ammonium sulphide group are thereby precipitated, whilst arsenic and antimony remain in solution. In the precipitate, iron, zinc, and manganese are separated from nickel and cobalt in the known way, by treating the sulphides with dilute hydrochloric acid. The sulphides of nickel and cobalt are afterwards dissolved by nitro-hydrochloric acid, and then precipitated with bromine and alkali. Arsenic and antimony are precipitated from the solution in the usual way.

The author determines carbon and silicon by dissolving the copper filings in ferric chloride solution.

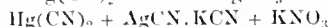
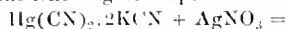
He determines the oxide of copper present by treating 5 grms. of filings in a flask provided with a Bunsen's valve, with hydrochloric acid, some pieces of marble being also placed in the flask; the solution is then poured off, the excess of acid expelled by evaporation, and the copper in solution precipitated by means of zinc; the precipitated copper is then dissolved in dilute sulphuric acid, and its amount determined by titration with stannous chloride solution, according to Weil. The total amount of copper in the sample is determined either electrolytically or by titration with stannous chloride.—H. S. P.

Mercury, General Method for the Estimation of. M. G. Deniges. *Bull. Soc. Chim.* 1896, **15**—16, 862—871.

WHEN a mercuric salt is brought into contact with an excess of potassium cyanide solution, the compound—



is formed, and if to this solution, ammonia and potassium iodide as indicator, are added, then on running in decinormal silver nitrate the following decomposition takes place:—



and the moment this decomposition is complete, the slightest excess of silver nitrate produces an opalescence due to silver iodide.

The method of conducting the estimation is therefore as follows:—10 c.c. of ammonia are added to the solution containing the mercuric salt, and an excess, say 10 c.c., of potassium cyanide equivalent to the decinormal silver nitrate. After a further addition of five or six drops of a 20 per cent. solution of potassium iodide, the decinormal silver nitrate is run in until a permanent opalescence is produced. If 10 c.c. of potassium cyanide and q c.c. of decinormal silver nitrate were used, then $10 - q = a$ represents the amount of decinormal silver nitrate corresponding to the mercury in the solution. For very accurate work, however, this number a must be subjected to a slight correction on account of the decomposition in the sense of the above equation, scarcely ever being quite complete. A certain, always very small, quantity of the double cyanide remains undecomposed, and this small quantity appears to increase slowly with the amount of potassium cyanide used.

The author gives the following rules for performing the correction:—(1) When a lies between 0 and 5.5, then the true titre x is found thus: $x = a \times 0.96$. (2) When a exceeds 5.5 and is less than 9.5, then $x = (a \times 1.04) - 0.45$. Hence the amount of mercury in the solution examined is obtained by multiplying x by 0.020 gm.

The method is of very general application, and is said to be independent of the state of acidity or alkalinity of the mercurial solution, of its oxidising power, its coloration and dilution, and it is possible to conduct the method in the presence of the strong mineral acids, especially HCl and HNO₃. It is therefore likely to be of use in the estimation of mercury contained in drugs and disinfecting solutions, and for the determination of tannins, alkaloids, albuminoids, and in general of all substances capable of forming definite compounds with mercury, e.g., thiophene, sulphourea, mercaptans, and simple or compound ammonias.—J. S.

Bismuth Sulphide, Solubility of, in Sodium Sulphide [Estimation of Small Percentages of Bismuth in Alloys]. T. B. Stillman. *J. Amer. Chem. Soc.* 1896, **18**, 683—684.

THE author finds that, contrary to the usually accepted statement, bismuth sulphide is appreciably soluble in sodium sulphide solution, and consequently the employment of the latter for the separation of bismuth from antimony, arsenic, and tin, according to the method frequently adopted, cannot be depended upon, the method being altogether untrustworthy when bismuth is present in small amount, as, for instance, in "magnolia metal."—A. K. M.

"Insoluble" Phosphoric Acid contained in Mixed Fertilisers, and derived from Bones and the like, and from Rock Phosphates respectively. A. P. Bryant. *J. Amer. Chem. Soc.* 1896, **18**, 491—498.

Rare mineral phosphates, being specifically heavier than bone and other organic phosphates, the author effects the separation of the former from the latter in mixed fertilisers by the aid of a liquid of suitable density. This is prepared by dissolving 75 grms. of potassium iodide and 100 grms. of mercuric iodide in 350 c.c. of warm water, and concentrating the solution (to about 100 c.c.) until its specific gravity is 2.26 at 15.5° C.

Process.—2 grms. of the sample are placed in a glass tube, the lower end of which is tied over with filter paper and cloth, and washed with 200—250 c.c. of hot water to remove soluble phosphates. The "separator" used consists of a short tube (7 cm. \times 1½ cm.), sealed at one end, and connected by rubber to a longer tube (20 cm.). To this contrivance the washed and dried phosphate is transferred and well shaken with 15—20 c.c. of the separating liquid. Particles adhering to the side of the tube are then washed down with a jet of the liquid, and after 5 minutes the lower tube is smartly tapped and the floating matter stirred up to facilitate the separation of the heavy from the light constituents. When the liquid is clear (in about 1 hour), the rubber tube is compressed by a screw-clamp, and the short tube containing the heavy (mineral) portion removed. The light (bone, &c.) particles remain in the upper tube. The fractions are thoroughly washed (the first washings should be preserved and again concentrated for future use) and the "citrate insoluble" phosphoric acid determined in each in the usual way. Test analyses made with mixtures of known composition yielded satisfactory results.

—H. T. P.

ORGANIC CHEMISTRY.—QUALITATIVE.

Petroleum, Application of the Acid Test. Trudy bak. *otd. imp. russk. techn. obschtsch.* 1896, **11**, 181.

THE Committee appointed by the Baku Section of the Russian Technical Society to examine the new Petroleum Testing Regulations formulated by the Government, have reported that sulphuric acid of the prescribed density (1.53) is unsuitable for testing petroleum, the colour of the acid extract being irregular, and not sufficiently decisive in gradation. On the other hand, sulphuric acid of 1.73 sp. gr. being found to give concordant results with all grades of petroleum and at all temperatures between 16° and 32° C., it is recommended that this strength of acid should be used in the proportion of 40 parts by volume to 100 of oil, the mixture being shaken up in a stoppered glass vessel for two minutes, and the acid layer removed and compared with normal solutions of Bismarck brown. The standard solutions are 10 in number, and are graduated

so that the lightest (No. 1) contains 0.0005 per cent. of colouring matter, and the darkest (No. 10) 0.005 per cent., the intermediate shades differing from each other by 0.0005 per cent. The degree to which the oil has been refined is expressed by the number of the solution corresponding to the colour of the acid extract, and the maximum effect in the case of ordinary petroleum distillate is found to be produced by the use of 0.75 per cent. of 66° B. sulphuric acid. Since few of the commercial petroleum examined fell below the limits 1 to 8, the latter shade is recommended as the outside limit for merchantable petroleum.

The Committee report adversely on the Hübl iodine test as proposed by Hirsch, the results depending on the nature of the petroleum rather than on the degree of acid purification. For example, petroleum from the "cracking process" always has a high iodine number on account of the unsaturated hydrocarbons formed in the distillation.

—C. S.

Rape-Seed Meal as an Adulterant of Mustard and Linseed Meals, &c., Test for. A. Jaworowski. Pharm. Zeit. Russl. 1896, 35, 360.

The presence of rape in mustard and linseed meals may be detected in the following manner:—A mixture is made of 10 grms. of common salt, 20 grms. of water, and 0.3 grm. of hydrochloric acid, and heated to 70°, and, after addition of 2–3 grms. of the meal, heated to boiling. After cooling and filtering, free acid is removed by sodium bicarbonate, and the solution divided into two parts. To one part, two or three drops of potassium ferriyanide solution (1 per cent.) are added; the liquid obtained from pure linseed meal remains unaltered by the addition of the bicarbonate and ferriyanide; that from mustard seeds acquires a yellow coloration with sodium bicarbonate, which is not altered by the ferriyanide—at least, not in the first minute. But if the sample contain 5–10 per cent. of rape seed, the liquid is coloured yellow by sodium bicarbonate, and, on addition of potassium ferriyanide, turns brownish, reddish, or violet.—A. C. W.

Sugars, New Hydrazones of the [Separation of Sugars]. A. von Eckenstein and C. A. Lobry de Bruyn. Rec. Trav. Chim. des Pays-Bas, 1896, 15, 97.

OTHER hydrazines than that of phenyl can be employed for the separation of sugars, the hydrazones being prepared in the same manner. For example, methylphenyl hydrazine serves to isolate galactose, and glucose may be separated from fructose by benzyl- and naphthylhydrazine. Melibiose forms an allylphenylhydrazone, insoluble in water and decomposable by benzaldehyde into a crystalline sugar, probably pure melibiose. In addition to differences in solubility, these hydrazones are to some extent characterised by differences in specific rotatory power.—C. S.

Cocaine, Detection of Eucaine in. G. Vulpius. Pharm. Central-II., N.F., 1896, 17, 295.

0.1 GRM. of the cocaine hydrochloride to be examined is dissolved in a graduated cylinder in 50 c.c. of water and two drops of ammonia added. If the sample be pure, the solution will remain perfectly bright for at least one minute, and will remain transparent, although after a time crystals of cocaine may separate. In presence of 2 per cent. of eucaine a decided milk-white opalescence is immediately produced, which disappears on addition of 10 c.c. of water. With 5 per cent. of eucaine, the addition of 20 c.c. of water becomes necessary to render the liquid clear; and progressively more water is required in proportion to the percentage of impurity present.—H. T. P.

Formo-Gelatin, Detection of Unaltered Gelatin in. G. Ronyn. Pharm. Weekblad. 33, [1], 1896.

0.5 GRM. of the sample is mixed with 10 c.c. of water and heated for 10 minutes in the water-bath with frequent shaking. The mass swells considerably, but particularly so in the presence of unaltered gelatin, which dissolves in the

liquid. If the liquid be now passed, whilst hot, through a dry filter, it will congeal on cooling, if gelatin be present; the separation of the latter may be accelerated by placing the filtrate in a freezing mixture and then allowing it slowly to melt.

0.5 GRM. of the sample is mixed with 5 c.c. of water and 1 c.c. of aqueous soda; the mass swells considerably, but much more strongly in the presence of unaltered gelatin. If now a mixture be added of 2 c.c. of normal silver nitrate solution and 0.5 c.c. of ammonia, the mass should begin to darken within one or two minutes, and after five or ten minutes the liquid should have acquired a violet-brown colour. If much free gelatin be present the colour makes its appearance more slowly, and assumes a pure brown shade without any violet. Pure gelatin does not colour until after the lapse of a few hours.

If formo-gelatin, even when quite pure, be treated with boiling water, dissociation sets in, and the filtrate gives with copper sulphate and aqueous potash the biuret reaction. In conclusion, the author opposes the use of a preparation containing free gelatin, as this diminishes its antibacterial properties.—L. de K.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Petroleum, Estimation of the Content of Burning Oil by the Distillation Test. R. Zoloziecki. Chem. Zeit. 20, [67], 645–648.

SEEMING that in practice it is customary to group petroleum distillates according to specific gravity rather than boiling point, the author proposes to follow the same rule in the distillation test in order that the results of the two may be comparable. To this end he employs the still described by Wischin (this Journal, 1895, 1038), but with certain modifications, such as reducing the size to about one-half—to hold 1,000 grms. instead of 2 litres—shortening the jacket, so that it only encloses two-thirds of the still, and doubling the height of the ascending tube, the branch tube leading to the condenser being attached half-way up. The heat is regulated so that the drops of distillate flow quickly one after another from the condenser, one drop forming before the preceding one has quite completed its descent. The upper limits of specific gravity are the most important, and, since the quantity of liquid is so small that ordinary means of determining the specific gravity are inapplicable, a series of mixtures of alcohol and water are employed, ascending in density from 0.860 to 0.875. The specific gravity of the distillate is determined by allowing a drop to fall into the test mixtures and observing its comparative density. This method cannot be adopted for the lower limits, so for these the boiling point is taken as a criterion, 125° to 130° C. being adopted as indicating approximately the advent of burning oil in the distillate. For greater accuracy, the limit should be fixed at 150°, and the product supplemented by the residue from the redistillation of the crude benzine boiling below that temperature.

In order to ensure that all the burning oil has come over, it is advisable to continue collecting the distillate until the specific gravity, after attaining 0.865 to 0.870, begins to decrease again as the result of "cracking." If it be desired to know the proportion of decomposable constituents in the oil, the succeeding fractions, until the specific gravity again increases, may be collected, weighed, and mixed with the burning oil. The quality and density of the products of cracking will vary with the origin of the crude oil and the method of distillation, but their weight may be obtained as described above.

In determining the specific gravity, care is necessary to prevent the acid-water formed during distillation from mingling with the oil drops tested, which may be accomplished by having the outflow pipe of the condenser of glass, the milky-looking condensed water being then readily discernible.

The following estimates of the yield from crude oils, based on the foregoing distillation tests, and compared with the results obtained by the Engler-Kissling fractional distillation of the same oil, may be taken as typical.

Crude Oil.	Fractional Analysis.	Estimate of Yield.			
		Per Cent. (Weight).	Per Cent.	Sp. gr.	
Ropienka.	Up to 150°	18.34	Benzine...	13.14	0.7025
Sp. gr. 0.815.	150°—300°	33.56	Petroleum...	54.98	0.8230
	Residue	48.10	Residue...	31.59	
			Loss	0.70	
Sabounitschi.	Up to 150°	5.49	Benzine...	1.98	
Sp. gr. 0.871.	150°—300°	34.17	Petroleum...	45.93	0.8315
	Residue	60.25	Residue...	51.82	

—C. S.

Petroleum, Determination of Sulphur in. Aufrecht.
Pharm. Zeit. 1896, **41**, 469.

Good petroleum should not contain more than 10—15 mgrms. of sulphur in 100 c.c. To 50 c.c. of the petroleum, 0.5 gm. sodium bicarbonate is added, and the mixture distilled at the rate of 40—50 drops a minute, until about 5 c.c. are left. The residue is placed in a large porcelain dish and repeatedly washed with ether; after spontaneous evaporation of the latter, about 0.5 gm. of sodium is added in small pieces, the whole evaporated over a small flame to a syrup, and then ignited, with the gradual addition of ammonium nitrate, until the ash is quite white. The residue is extracted by very dilute hydrochloric acid, and the sulphuric acid estimated in the filtrate in the usual manner.—A. C. W.

Paraffin in Petroleum, Estimation by ZALOZIECKI'S Method.
K. W. Charitschkow. Trudy bak. otd. imp. russk. techn. obshch. 1896, **11**, 204.

The author finds that the quantity of the alcoholic mixture recommended by ZALOZIECKI for dissolving the higher fractions of the oil is insufficient, 60 volumes being sometimes necessary instead of 20, the actual amount being in direct ratio to the high-boiling constituents present in the oil. The use of large quantities of solvent, however, detracts from the delicacy of the method by preventing the complete deposition of the paraffin.—C. S.

Phenol, Methods for the Quantitative Estimation of.
G. Frerichs. Apoth. Zeit. 1896, **11**, 415.

The author has made a comparison of the known methods. He finds Beckurt's method (Arch. Pharm. 1886, 224, 561; this Journal, 1886, 546—547) to be the best. It yielded the most reliable results both with pure phenol and with phenol compounds. The method consists in acting upon the phenol to be estimated with a known quantity of bromine and then determining the excess of bromine by adding potassium iodide and titrating with $\frac{N}{20}$ sodium thiosulphate; from the quantity of bromine which has been required to form tribromophenol the quantity of phenol is calculated from the equation $C_6H_5OH + 6Br = C_6H_2Br_3OH + 3HBr$.—H. S. P.

Resin Oil in Fatty Oils, Detection of. P. Cornette.
Ann. Pharm. 1896, **2**, 240.

Ten grms. of the suspected oil are saponified with alcoholic caustic soda, the soap is dissolved in warm water, and an excess of a concentrated solution of sodium chloride added. This throws down the fatty acid soaps, leaving sodium resinate in solution. After filtering cold, and washing with salt water, the filtrate, which must be clear, is treated with sulphuric acid in excess, whereupon the resin acids separate in globular form, imparting a milky appearance to the liquid, and, subsequently setting and rising to the surface. A slight turbidity is sometimes obtained with pure linseed oil, but cannot be mistaken for the copious precipitate of resin acids.—C. S.

Hübl [Iodine] Residues, Recovery of Iodine from.
K. Dietrich. Pharm. Central-Bl. N.F. 1896, **17**, 361.

The accumulated residues from Hübl's iodine absorption determinations are evaporated in a porcelain dish until the chloroform has been expelled as far as possible, and they are then made strongly alkaline with caustic potash solution, after which the evaporation is continued to dryness. The

dry mass is then treated with water, which extracts the salts of iodine, the potassium and sodium chlorides, the potassium formate, and the saponified fats, leaving an insoluble residue of mercuric sulphide. On evaporating this solution of the extracted salts as it becomes concentrated, the soap is precipitated, and the evaporation is continued until no more soap separates out, when the liquid is filtered, and a 15 per cent. solution of ferric chloride is then added to the filtrate with constant stirring, until the precipitation of the iodine is completed. The iodine is then separated by filtration, washed, dried by pressure, and reconverted into Hübl reagent.—H. S. P.

Maltose, Determination of, in Worts. L. Braun. Zeits. ges. Brauw. 1896, **19**, 241.

The determination of apparent maltose in worts by means of Fehling's solution is investigated, and the influence of varying experimental conditions determined. To test the influence of the vessel in which the reduction is effected on the results, covered and uncovered dishes and beakers of various forms and dimensions were employed. In addition, experiments were made in currents of oxygen, hydrogen, and air, respectively, and at different pressures. From the results, it is concluded that concordant results can only be obtained by adhering strictly and throughout to a uniform *modus operandi*.—H. T. P.

Calcium Acetate, Analysis of Commercial. E. Barillet.
Rev. Chim. Industr. **7**, [79], 197—201. (See this Journal, 1896, 584.)

The ordinary manner of expressing the total acidity in commercial acetates of calcium, viz., as acetic acid, is inaccurate, since it gives no indication of the proportion of the higher acids of the fatty series present, but simply includes them with the acetic acid. It being important, for various technical operations, to know the percentage of these impurities, and their solubility in water preventing their separation in the method of analysis given by Fresenius, the author experimented on the separation of the barium salts of the fatty acid series by means of absolute alcohol, and found that 100 grms. of that solvent will dissolve respectively 0.0055 gm. of the formate, 0.0284 gm. of the acetate, 0.2610 gm. of the propionate, and 1.1717 grms. of the butyrate of barium. He therefore proposes to make use of this relative solubility by treating the distillate, obtained in the ordinary method of analysis, with boiling absolute alcohol, throwing down the barium as sulphate, and deducting from the total the weight corresponding to the amount of barium acetate soluble in the quantity of alcohol employed; the remainder gives the amount of barium in combination with propionic and butyric acids, the amount of formic acid being so minute as to be disregarded.

In the sample analysis given, 5.0312 grms. of calcium acetate were distilled with phosphoric acid, the distillate saturated with baryta, and the residue left on evaporation, triturated with 800 grms. of absolute alcohol, boiled, and precipitated by sulphuric acid. This treatment yielded 0.3900 gm. of $BaSO_4$, 0.2072 gm. of which represented the barium acetate dissolved in the 800 grms. of alcohol. The remainder, 0.1828 gm., corresponds to the homologous acids, and is equivalent to 2.46, to be deducted from the result of the total acidity determined and expressed in the usual manner as calcium acetate.—C. S.

Glycerol in Wine and Beer, Determination of, by the Index of Refraction. L. Sostegui. Staz. Sperim. Ital. 1896, 318—322.

The glycerol is extracted in the usual way and made up to a definite volume with water; the index of refraction of the solution is determined and also that of pure water. The difference between the indices, calculated to six decimals and divided by 0.00125 will give the percentage of glycerol in the solution.—A. L. S.

Cream of Tartar, Commercial; Composition and Analysis of. A. H. Allen. Analyst, 1896, **20**, 174—182; and 209.

Calcium tartrate is an invariable constituent of cream of tartar when the latter has been prepared from *argol* by

boiling with water, filtering, and crystallising, and the amount is largely dependent on the proportion of water used. In practice, 9 or 10 per cent. is the usual maximum quantity of calcium tartrate, and any material excess over this amount points to adulteration. In crude tartar, especially when derived from plastered wines, sulphates accompany the high percentage of calcium tartrate. In one sample of cream of tartar the author found 20 per cent. of calcium sulphate, apparently added as an adulterant.

In the test given by the British Pharmacopœia of 1885, the soluble ash should require for neutralisation an amount of acid corresponding to 92.15 per cent. of potassium hydrogen tartrate. The author recommends the use of 5 grms., the soluble ash from which should neutralise not less than 24.4 c.c. of normal acid. The standard of purity required by the United States, German, and Japanese Pharmacopœias for cream of tartar has of late years been raised, and is now 99 per cent., and the British standard being so much lower than this, there is, it is said, no excuse for the sale of cream of tartar containing, as in a recent Belfast case, 17.93 per cent. of calcium tartrate.

Much of the cream of tartar now sold appears to have been prepared by one of the modifications of Martignier's process, in which neutralised wine lees are treated with an excess of a saturated solution of potassium sulphate, the gypsum separated, the solution of potassium tartrate decolorised with animal charcoal, and sufficient sulphuric acid added to convert the neutral into the acid tartrate. As thus prepared, one would expect the cream of tartar, though free from calcium tartrate, to contain potassium and calcium sulphates, and this is found to be the case in many samples of commerce.

In examining cream of tartar, the author bases his conclusions on the following data:—The acidity of the sample may be due to potassium hydrogen tartrate and potassium hydrogen sulphate; the normal salts present may be, calcium tartrate, potassium sulphate, calcium sulphate, and neutral potassium tartrate. On ignition—(1.) The potassium hydrogen tartrate leaves potassium carbonate in amount exactly corresponding with the original tartrate. (2.) Any potassium hydrogen sulphate reacts with the potassium carbonate, forming the neutral sulphate, water, and carbon dioxide. (3.) Calcium tartrate yields calcium carbonate, which reduces the alkalinity of the soluble ash. The neutralising power of the total ash will exceed the acidity of the original cream of tartar. (4.) Neutral potassium sulphate does not affect the result. (5.) Calcium sulphate reacts with the potassium carbonate, forming calcium carbonate and potassium sulphate. The alkalinity of the soluble ash is reduced. (6.) Potassium tartrate produces potassium carbonate, but the ash will require more acid for neutralisation than the ash derived from an equal weight of potassium hydrogen tartrate. No neutral potassium tartrate can be present where the cream of tartar has been prepared by Martignier's process, and the author doubts its occurrence in samples prepared by the old method.

If a sample of cream of tartar be free from uncombined sulphuric and tartaric acids, and contain only calcium and neutral potassium sulphates and potassium hydrogen tartrate, the acidity of the original sample will be exactly equivalent to the alkalinity of the total ash. The presence of potassium hydrogen sulphate will cause the original acidity to be in excess of the total alkalinity of the ash, whilst calcium tartrate will make the acidity less than the alkalinity of the ash. Both of these salts cannot be present in the same sample of genuine cream of tartar. Where calcium sulphate is present, the B.P. test under-estimates the amount of potassium hydrogen tartrate, in the proportion of 2.77 per cent. for every unit of calcium sulphate. The author considers that titration of the original sample with caustic alkali, with a limit for the allowable amount of sulphates, would be preferable.

For further examination the following process is proposed:—

(1.) 1.881 grm. of the sample, free from moisture, is dissolved in hot water and titrated with caustic alkali, phenolphthalein being used as indicator. In the absence of potassium hydrogen sulphate and free tartaric acid, each c.c. of

alkali represents 1 per cent. of potassium hydrogen tartrate.

(2.) Ignite 1.881 grm. for ten minutes, boil with water, filter and wash the residue.

Titrate the filtrate with $\frac{N}{10}$ HCl and methyl orange.

With pure tartar, the quantity of acid used will equal that consumed in the previous titration of the bitartrate with alkali. Every c.c. of deficiency of acid equals 0.36 per cent. of calcium sulphate or 0.72 per cent. of KHSO_4 . Any excess of acid needed points to the presence of normal potassium tartrate, every c.c. representing 0.6 per cent. thereof. If the titrated liquid be treated with barium chloride, the BaSO_4 found will form a measure of the CaSO_4 or K_2SO_4 present.

(b.) The carbonaceous residue is ignited, dissolved in 20 c.c. of decinormal acid, filtered from any insoluble residue, and the filtrate titrated with decinormal acid. Each c.c. corresponds to 0.50 per cent. of calcium tartrate, or 0.36 per cent. of calcium sulphate (anhydrous).—C. A. M.

Quinine Sulphate, The Testing of. Melchior Kubli. Pharm. Zeit. für Russl. 34, Nos. 34—37.

THE author states that none of the tests usually employed for the detection of the other cinchona alkaloids in quinine sulphate are satisfactory, and proposes the two following:—

The Water Test.—The foreign alkaloids are less soluble than quinine, their sulphates more soluble; hence the quantity of water required for the solution of the base liberated from a given quantity of the sulphate affords a measure of the purity of the sample. 1.793 grms. of the sulphate, dried at 40° — 50° C. and thus containing 2 molecules of water of crystallisation, or an equivalent quantity of the crystalline salt, are dissolved by boiling with 60 grms. of water in a tared flask for five minutes. Water is then added from a burette until the total weight is 62 grms. The flask is cooled to 20° C., with frequent agitation, and kept at that temperature half an hour. After filtering through a dry filter, exactly three drops of 10 per cent. sodium carbonate solution are added to 5 c.c. of the filtrate, and water at 20° C. is added from a burette until the opalescence disappears. With pure quinine sulphate, an addition of exactly 10 c.c. of water is required; with a mixture of quinine sulphate with other sulphates, a constant increase above this 10 c.c. is required for every 1 per cent. of the impurity.

The figures are as follows:—

	C.c.
Hydroquinine sulphate	0.6
Quinidine sulphate	2.6
Cinchonine sulphate	0.7
Cinchonidine sulphate containing 3 per cent. of hydroquinine sulphate	0.1
Cinchonidine sulphate containing 2.5 per cent. of quinidine, 2.5 per cent. of cinchonine, and 30 per cent. of hydroquinine sulphates	0.75

The large increase in the case of quinidine sulphate is due to the greater solubility of the double sulphate of quinidine and quinine, so that a larger precipitate is produced on the addition of sodium carbonate than with the other mixtures. The author considers that the maximum rise for each percentage of impurity may be regarded as 1 c.c., and the minimum as 0.7 c.c.; he suggests that a total of 12 c.c. should be taken as an official figure, thus allowing about 3 per cent. of impurity.

The Carbon Dioxide Test.—When sodium carbonate is added to a solution of quinine sulphate, saturated at the ordinary temperature, the precipitated alkaloid is very easily soluble in sodium bicarbonate, and on passing a stream of carbon dioxide through the solution, normal quinine carbonate separates in bunches of needles. Quinine carbonate is only very slightly soluble in water, effervesces with acids, is readily soluble in alcohol, and slightly alkaline to litmus paper. In the presence of cinchonine, cinchonidine, and quinidine, the separation of the crystals is lessened and delayed, and may be altogether prevented; hydroquinine does not exert the same influence.

To 5 c.c. of the saturated solution of quinine sulphate prepared as before, are added three drops of sodium carbonate solution, and the precipitate is dissolved in 5 c.c. of bicarbonate solution free from normal carbonate. Carbon dioxide,

which must be free from air from the beginning, is passed in at the rate of 80—100 bubbles per minute for 30 minutes at 15° C.

The cylinder is then gently shaken until the volume of the supernatant liquid remains constant; with a voluminous precipitate this will occupy about 30 minutes. The contents are then placed in a cylinder graduated to $\frac{1}{10}$ or $\frac{1}{2}$ c.c. and allowed to stand until clear; with samples containing 1—3 per cent. of impurity, the liquid must frequently stand till next day, the separation being hastened by agitation. Pure quinine sulphate gives a precipitate of 1.4—1.5 c.c. of amorphous flocks to the naked eye, but under the microscope seem to be bunches of needles; with 1 per cent. impurity, the precipitate is granular; with 3—4 per cent., it glistens by transmitted light; and with more than 10 per cent. there is no precipitate.

Quinine Sulphate containing	Sulphates of				Remarks.
	Cin- chonidine.	Quinidine.	Hydro- quinine.	Cin- chonine.	
Per Cent.	C.c.	C.c.	C.c.	C.c.	
1	1.8—1.9	1.8	1.2—1.3	1.8—2.1	Partly granular.
5	0.6	Trace	1.2—1.3	1.0	Granular
10	Trace	..	1.2—1.3	Not given	..

Samples with impurities of 1, 2, 3, 4, 5 per cent. would thus require 11, 12, 13, 14, 15 c.c. of water in the water test and give 1.8—2.0 (partly granular), 1.4, 1, 0.8, 0.5 c.c. of precipitate in the carbon dioxide test, the last four precipitates being all granular.

Commercial samples examined by the two tests gave the following results:—

No.	Water Test.	Carbon Dioxide Test.	Impurity.
	C.c.		Per Cent.
1	10.5	1.4—1.5 c.c. not granular	0.5
2	10.5	1.5—1.6 c.c. not granular	0.5
3	15.0	Trace.....	7.0
4	18.5	No precipitate.....	12.0
5	17.0	More than traces.....	7.0 quinidine and cinchonine.
6	16.5	Traces.....	9.0

—A. C. W.

Essential Oils and the like, Detection of the Adulteration of. E. Gossart. Bull. Soc. Chim. 1896, **15**, [3], 597—609, also 666—688.

The principle underlying this method, and its application to the examination of spirits, have been previously noticed (this Journal, 1893, 790). The author now claims the process to be of general utility, and especially serviceable for detecting the adulteration of essential oils with alcohol, turpentine, cheaper essences, &c., and he gives many examples in illustration, for which the original papers must be consulted.

In dealing with any particular essential oil, &c., a test liquid (prepared by adding to a pure specimen of the same oil a certain proportion of the adulterant sought for) is used, drops of which are projected on the surface of the sample under examination. The presence of the particular impurity is then indicated if the drops "roll," and, *vice versa*, its absence (as a rule) if they immediately plunge below the surface. The test fluid is compounded with just sufficient of the impurity to cause 10 consecutive drops of it to plunge in the pure sample. Quantitative indications may then be obtained, if it be noted that the transition stage between rolling and plunging (*i.e.*, when 4—6 drops out of 10 roll, the remainder plunge) corresponds to a more or less definite proportion of impurity in the sample—to be determined by trial. In practice, the sample is then diluted (with a pure specimen) until partial rolling is observed. From the degree of dilution the percentage of impurity may be calculated. Briefly summarised, the method may be summed up thus:—

1. The sample (found to be adulterated) under examination must be diluted with a pure specimen of the same essence, until partial rolling, or cessation of complete rolling, of the test drops is obtained. The corresponding percentage of adulterant multiplied by the degree of dilution represents the proportion of impurity present in the sample.

2. Ten drops are always employed, the number of them that roll being noted.

3. In some cases it is necessary to dilute the test liquid with alcohol, benzene, &c., in order to increase its tendency to "roll"; the sample must then in every instance be similarly diluted prior to examination. This operation must not be confounded with the dilution directed under 1. The latter has for its object the reduction of the particular impurity to a certain recognisable amount, and must be effected prior to the addition of the auxiliary liquid.

—H. T. P.

Trimethylamine, Separation of, from Ammonia. H. Fleck. J. Amer. Chem. Soc. 1896, **18**, 670—672.

The mixed hydrochlorides are repeatedly extracted with boiling absolute alcohol, and the solvent is then distilled off. The residue is then boiled with an excess of caustic soda, the vapours evolved conducted into a large bulk of water, the product exactly neutralised by sulphuric acid and evaporated to dryness. On treating the residue with cold absolute alcohol, trimethylamine sulphate dissolves, whilst ammonium sulphate is insoluble. The alcoholic solution is distilled, and the residue, when dried, gives the amount of trimethylamine sulphate.—A. K. M.

Gas-purifying Material, Revivification of. W. Leybold. J. f. Gasbeleuchtung, 1896, **39**, 506.

See under II., page 642.

Kola, Pharmacology of. P. Carles. J. Pharm. Chim. 1896, **16**, 104.

See under XX., page 670.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ozone. C. Engler and W. Wild. Ber. 1896, **29**, 1929.

From the experimental work detailed in this communication, it is concluded that there is now no reaction known by which a modification of oxygen is produced by the decomposition of ozone which can be regarded as the antiozone of Schönbein, Meissner, and others, or as the free ions (—O—) or incompletely combined atoms (—O—O—) of Helmholtz and Richarz.—A. C. W.

Diamonds of Steel. M. Rosset. Comptes rend. 1896, **123**, [2], 113—115.

SIXTEEN Moissan had obtained diamonds by saturating steel with carbon at 3,000°, and cooling under great pressure, it was probable that very hard steel, produced at a high temperature and cooled under pressure, would also contain carbon having the properties of the diamond. After dissolving the metal in strong acids and treating the residue with strong nitric acid, fused potassium chlorate, hydrofluoric and sulphuric acids successively, crystalline residues were obtained having the properties described by Moissan. Regular octahedra of a size not exceeding 15 microns, and irregular fragments as large as 0.5 mm., were found in different samples.—A. C. W.

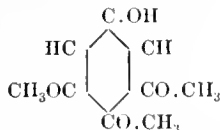
Ketopentamethylene [Wood-Tar], Condensation with Aldehydes. D. Vorländer and K. Hübner. Ber. 1896, **29**, 1836.

KETOPENTAMETHYLENE (adipinketone), $C_{12}H_{16}O$, can be shown to be present in wood-tar by shaking the fraction boiling at 120°—135° with an equal volume of benzaldehyde dissolved in 6 vols. of alcohol and 1 vol. of caustic soda (10 per cent.). A thick precipitate of dibenzalketopentamethylene, $C_{12}H_{16}O(C_6H_5)_2$, is obtained. Traces of acetone in wood-spirit may be tested for in a similar manner.

Pyroxanthin, obtained from crude wood-spirit by shaking with lime or caustic soda, was shown to be difurfuralketopentamethylene. Adipinketone was also found in acetone oil.—A. C. W.

Antiaris Toxicaria, The Milky Juice of. H. Kiliani. Archiv. der Pharmacie, **234**, 438.

FROM this juice the author has separated antiarol, the trimethyl ether of tetrahydroxybenzene—



which, on oxidation, yields dimethoxyquinone, and the glucoside antiarin, $\text{C}_{27}\text{H}_{40}\text{O}_{10} + 4\text{H}_2\text{O}$ (Muhler, Ann. **28**, 304, gives $\text{C}_{14}\text{H}_{20}\text{O}_5 + 2\text{HO}$), which, on warming with dilute hydrochloric acid, is split up into antiarigenin, $\text{C}_{21}\text{H}_{30}\text{O}_5$, and a sugar, $\text{C}_6\text{H}_{12}\text{O}_5$, isomeric with rhamnose.

—A. C. W.

Mannose, Sorbose, and Galactose; Ammonia Derivatives of. Lobry de Bruyn and F. van Leent. Rec. trav. Chim. des Pays-Bas, 1896, **15**, 81.

THE ammoniacal solution of pure mannose syrup in methyl alcohol, deposits, on the addition of ether, an amorphous mass, gradually becoming crystalline, and having the formula $\text{C}_{12}\text{H}_{23}\text{O}_{10}\text{N}$, its rotatory power being $[\alpha]_D = -28^\circ.3$. This derivative of mannose differs from the corresponding ammonia compounds of the other sugars, in that it is formed by the union of 2 mols. of mannose with 1 mol. of ammonia, the reaction being accompanied by separation of water. The sorbose derivative, which may also be prepared as above, is very unstable; probably sorbosamine agrees with the formula $\text{C}_6\text{H}_{13}\text{NO}_4$. Galactosamine, when boiled with methyl alcohol, loses one-half its ammonia, with the deposition of a very hygroscopic crystalline body, having the formula $\text{C}_{12}\text{H}_{23}\text{O}_{10}\text{N}$. No salts of this substance could be prepared, and it is probable that under the action of acids it is split up into sugar and ammonia.—C. S.

Mushrooms, Action of the Oxidising Ferment of, on Oxidisable Compounds. E. Bourquelot. Comptes rend. 1896, **123**, 315—317.

THE author describes the action of the ferment of mushrooms on several phenols and aromatic amines. In the case of orthoeresol, oxidation sets in at once when the solution is neutral, but more slowly when alkaline; the oxidation of the meta-compound takes place in either a neutral or slightly alkaline solution, whilst with paraeresol, the addition of a trace of sodium carbonate assists the oxidation. Hydroquinone, pyrogallol, and resorcinol are also acted upon by the mushroom ferment. Guaiacol and eugenol are rapidly oxidised, and the action takes place much more readily in a neutral or acid (acetic) medium than in an alkaline solution. In the case of the toluidines, the addition of a little acetic acid favours the oxidation, and this is also the case with xylydine.

The author compares the action of the mushroom ferment to that of the oxidising agents used in the production of colouring matters, and he describes the formation of a product analogous to magenta which he obtained from aniline with the help of the fungus *Russula delica*.—A. K. M.

New Books.

THE INDIGENOUS DRUGS OF INDIA: Short Descriptive Notices of the Principal Medicinal Products met with in British India. By KANNY LALL DEY, Rai Bahadur, C.I.E., F.C.S. Late Professor of Chemistry and Chemical Examiner to Government. Hon. Member, Pharmaceutical Society of Great Britain. Joint President, Section of Pharmacology, Indian Medical Congress, 1894, &c. Assisted by WILLIAM MAIR, Assoc. Pharm. Soc. of Great Britain. Second Edition. Revised and Entirely Re-written.

Thacker, Spink, and Co., Calcutta. W. Thacker and Co., 87, Newgate Street, London, E.C. 1896. Price 16s.

THIS is an 8vo. volume, with frontispiece representing the author, Dr. Dey, and a preface by Dr. George Watt, in which comments on the suitability of the work as a students' manual. The author himself specially commends it as a guide to indigenous medicines for students at Netley and elsewhere, proceeding to the Indian Medical Services, and also to Medical Men and Medical Missionaries going to India. Then follow a Prefatory Memoir, an Introduction, Indian Pharmacology—A Review. Tables of British Indian Equivalents, and then the subject-matter proper, filling 334 pages, Appendices filling 14 pages, a Botanical Classification of Natural Orders of Plants enumerated in the work, filling 7 pages, and a copious alphabetical index covering 31 pages.

The subject-matter itself, "The Indigenous Drugs of India," is alphabetically arranged as regards the substances described, so that principal species can be at once turned up in the body of the work, independently of the index. There are four Appendices:—I. Aconitum Napellus, and Aconite Collection in the Himalaya. II. Ailanthus Exceelsa. III. Fluid Extracts. IV. Foods of India.

A SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS; OR, THE QUANTITATIVE ESTIMATION OF CHEMICAL SUBSTANCES BY MEASURE, APPLIED TO LIQUIDS, SOLIDS, AND GASES. Adapted to the Requirements of Pure Chemical Research, Pathological Chemistry, Pharmacy, Metallurgy, Manufacturing Chemistry, Photography, &c., and for the Valuation of Substances used in Commerce, Agriculture, and the Arts. By FRANCIS SUTTON, F.I.C., F.C.S. Seventh Edition, Enlarged and Improved. J. and A. Churchill, 7, Great Marlborough Street. 1896. Price 18s. 6d.

THE fifth edition of this work was noticed in this Journal, 1886, 619—620, since which the sixth edition has appeared in 1890, and now this, the seventh edition, is issued. The sections of the work altered by reason of general improvement and additions, with others entirely new, comprise chiefly those concerned with the articles on Calibration of Instruments, the Kjeldahl Process, Boric Acid, Hydrofluoric Acid, Fluorides, Arsenic, Chromium, Copper, Cyanogen and Cyanides, Iron, Lead, Manganese, Mercury, Nickel, Phosphoric Acid, Sugar, Sulphur and its Compounds, Tannin, Zinc, Oils and Fats, and Urine.

The subject-matter of the present edition fills 575 pages, and the illustrations number 112. An alphabetical index ends the work, and fills 10½ pages.

The growth and development of the work will be observed by a glance at the notice of the fifth edition, which shows (*loc. cit.*) that this fifth edition contained 483 pages of matter, 8 pages of index, and 90 woodcuts.

Trade Report.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

ANTICIPATED RESULTS OF THE SICILIAN SULPHUR TRUST.

U.S. Consular Reports, August 1896, 773.

Consul Canby, of Messina, under date of June 20th, transmitting to the Department a translation of the chief clauses of the proposed sulphur trust of Sicily—fully covered by the report of Consul Brühl, of Catania, printed in Consular Reports, No. 190 (July 1896)—states that it means an enormous advance in price, and will materially affect American interests, the exports to the United States averaging about 100,000 tons annually. The first result will be to direct attention, much more than at present, to the pyrites mines of Spain, although, if reports be true, the same syndicate have made overtures to Sir Charles Tennant, president of the Tharses mines, the largest mines in that country.

The formation of this trust may give additional impetus to the advance of American mines—those of Louisiana, for

instance, where the process has, so it is reported here, long since passed the experimental stage. The existence of this trust will, it is predicted, in a short time place the price of Sicilian sulphur at the highest figure it has ever touched, and if there ever was a time for profitable trade in the American product, as opposed to the foreign product, that time is the present.

Under date of June 17th, 1896, Consul Seymour, of Palermo, transmits the following statistics covering the exports of Sicilian sulphur to the United States:—

Period.	1896.	1895.
	Tons.	Tons.
Month of April	11,970	5,179
Three months ended April 30th	56,305	24,119
Ten months ended April 30th	129,562	82,403
Stock on hand April 30th	137,381	112,000

SOAP IN EGYPT.

Chamber of Commerce Journal, August 1896, 147.

Under the denomination of "common soap," a soap of very ordinary quality is imported into Egypt for laundry purposes and use by the natives. The quantity fluctuates considerably, as is shown by the appended figures for the last ten years, giving the amount of common soap imported (in kilos.):—

1886	5,247,606	1891	4,438,183
1887	1,843,757	1892	6,130,941
1888	3,110,133	1893	5,091,049
1889	3,386,761	1894	4,851,589
1890	4,131,525	1895	5,369,469

Values have latterly fallen, in consequence of increased competition between native-made and imported soap. For the last two years the imports have been derived as follows:—

From	Kilo.	Francs.	Kilo.	Francs.
Turkey	4,544,725	2,306,300	5,268,880	1,992,100
France	133,137	59,300	129,790	55,400
Greece	81,680	40,900	105,210	48,500
England	74,647	37,300	72,273	37,600
Italy	7,170	3,000	10,434	3,700
Austria	4,523	2,300	17,88	800
Belgium	2,431	1,000	5,951	2,300
Other countries.....	3,226	1,500	1,249	500

An investigation made into the characteristics of the various classes of soap in vogue shows that the Syrian product is most esteemed by native consumers, because it is generally dry and hard, containing tallow in proportions varying as the manufacturer has sought to lower his selling price at the expense of quality. According to quality Syrian soap varies from 40 to 80 frs. per 100 kilos, delivered on quay at Alexandria; a current type of Cretan soap fetches 59 frs. 60 per 100 kilos, delivered to warehouse in Alexandria. Grecian soap is not expected to improve its position, owing to the large quantity of tallow contained in it. In Egypt itself the soap-manufacturing industry is a developing one, there now being four factories established and others in course of installation. These factories import their caustic soda and silicate of soda from England and Belgium, their tallow from Italy, and their oils from England, Turkey, and Greece; but cotton oil, extracted in Egypt, is principally utilised. For native-made soaps, those most used fetched, delivered in warehouse: 1st quality, 72 frs. 60; 2nd quality, 62 frs. 20; 3rd quality, 52 frs.; 4th quality, 21 frs. 50 per 100 kilos.; while black soap is quoted at 50 frs., all per 100 kilos. A somewhat large quantity of soft soap is used in the country for the lubrication of driving-belts and various cleaning and machinery purposes. England supplies the main part, as her soft soap is of a more pleasing colour than the black-looking Marseilles product, but even the military authorities have recognised that the French product has some virtues

by latterly giving it preference. Perfumed soaps find only a limited outlet, the total value only reaching 122,200 frs. in 1895, but that was well in advance of 1894, with only 87,300 frs. as the value. The chief amounts were credited as follows:—France, 31,309 frs.; England, 30,300 frs.; Germany, 22,200 frs.; Italy, 21,800 frs.; next coming Belgium, Austria, Hungary, and Turkey.

ZINC IN RUSSIA.

Chamber of Commerce Journal, August 1896, 148.

After coal, zinc production occupies the chief place in the rising industry of Poland, and its development is the more rapid because the only mines known in the Empire are situated in the basin of Sosnowice-Dombrowa. Two companies possess the monopoly: that of Sosnowice, which acquired in 1890 the mines and works of Kramst; and that of Derwiz-Szewcow-Pomeranoff, to which, in 1891, the Government farmed for sixty years its works in the basin of Dombrowka. The zinc ore workings are exclusively concentrated in the neighbourhood of the town of Olkusz. The ore there found in the largest quantity is calamine, which gives, after smelting, 7 to 30 per cent. of zinc. There is also found, but in a lesser degree, "blende" or native sulphurous zinc. As the upper deposits are becoming exhausted, the two companies have undertaken the construction of galleries intended to divert the water and to allow of a search at a greater depth for thicker beds of ore. When extracted the ore is transported, either by waggon, or by the Lvangrod-Dombrowa railway, about 25 kiloms. away from the mines to the factories of Bendrin and Pauline. There are only two rolling mills in the kingdom—one at Sosnowice and the other at Slawkow—whose output is in the shape of plates or sheets; whilst there is also a zinc-white factory. On comparison of the results of 1895 with those of the preceding year, an important increase in production is to be noted. During last year 125,634 poods more of calamine were extracted, and 31,339 poods more of zinc were produced than in 1894; while the rolling mills turned out more by 25,892 poods, and the output of zinc-white was higher by 1,100 poods. The figures on which those improvements were registered are given below in poods:—

Product.	1894.	1895.
Calamine extracted	3,367,237	3,492,871
Zinc made	274,774	306,113
Output of the rolling mills	146,337	172,229
Output of zinc-white	41,002	42,102

These works employ 2,100 hands, of whom 1,400 are in the mines and 700 in the factories. Owing to the fall in prices the prospects of the industry are not very favourable, but it is thought that they will improve, as the heavy import duties render competition almost impossible on the part of the Silesian industry.

CHLOROFORM, ETHERS, &c.

Report of Commissioners of Inland Revenue for Year ending March 31st, 1896.

Chloroform has the distinction of having yielded the smallest amount of revenue to the Customs of any article on the tariff. It is subject to a duty of 3s. 1d. per lb., and the gross receipt of duty acknowledged by the Department for the year 1895-96 is 1*l.* sterling. In the previous year it was 6*l.* A single Winchester seems to have been imported. Chloral hydrate pays 1s. 3d. per lb.; the imports of the past year paid duty 1,131*l.*, or 8*l.* less than in the previous year. Collodion realised 12*l.* in each year (at the rate of 25s. per gallon). Acetic ether is charged at 1s. 10d. per lb., butyric ether at 15s. 8d. per gallon, sulphuric ether at 26s. 2d. per gallon, and iodide of ethyl at 13s. 7d. per gallon. These preparations yielded 160*l.*, 277*l.*, 15*l.*, and nothing respectively in 1895-96; in the previous year the amounts were 35*l.*, 154*l.*, 28*l.*, and nothing in the same order, showing a notable increase in the imports of acetic and butyric ether. Transparent soap, in the manufacture of which spirit has

been used, pays a duty of 3*d.* per lb. British manufacturers seem able to more than hold their own in this. The duty paid in 1895-96 was 118*l.*, while it was 140*l.* in the previous year.

METHYLATED SPIRIT.

Report of Commissioners of Inland Revenue for Year ending March 31st, 1896.

There are 23 licensed makers of methylated spirit in England and Wales, two in Scotland, and one in Ireland. The retailers number 10,871 in England and Wales, 1,246 in Scotland, and 543 in Ireland. There are two more English makers' licences granted than in 1894-95, while retailers have increased by 442 in England, by 75 in Scotland, and by 39 in Ireland. That the use of methylated spirit is increasing is evident from the statement that 3,930,072 galls. were received for methylation last year, and 3,587,003 in the year before.

GENERAL TRADE NOTES.

THE EXPORT OF ILLUMINATING OIL FROM BATOUM.

According to the *Melbourne Journal of Commerce*, in 1895 Russia shipped 292,424,000 galls. of illuminating oil to the following countries:—

Austria-Hungary.....	29,555,000
Belgium.....	10,827,000
Bulgaria and Servia.....	3,839,000
China.....	12,562,000
Egypt.....	8,472,000
United Kingdom.....	30,865,000
France.....	15,896,000
Germany.....	4,835,000
Holland.....	1,601,000
Italy.....	6,147,000
India.....	45,822,000
Japan.....	3,800,000
Java.....	15,056,000
Turkey.....	19,671,000
Far East.....	43,107,000

The balance went in smaller lots to other countries, 28,000,000 galls. going to Russian ports reached *via* Batoum. The shipment of nearly 300,000,000 galls. of refined oil from the port of Batoum in 1895 is of no slight importance when it is borne in mind that the United States exported in 1895 only 677,000,000 galls., or but little more than twice as much.

THE MATERIALS FOR DENATURING SPIRIT.

Chem. Zeit. 1896, 533.

A mixture of wood spirit and pyridine is used in Germany for denaturing spirit; the former is entirely supplied by the home manufacturers, whilst about one-half of the latter has to be imported from England. There is also a considerable difference in the price: one litre of wood spirit only costs 0.55 mark, against 1.40 mark, the price of pyridine.

This mixture has been in use for the last nine years, and, taking into consideration the above facts, it appears, in the writer's opinion, to be desirable, in the interests of German manufacturers, to revise the regulations.—A. L. S.

THE TRADE AND INDUSTRIES OF BERLIN IN 1895.

Berichte über Handel u. Industrie von Berlin i. J. 1895.

POTATO PRODUCTS (pp. 108--109).—Business remained quiet throughout the year, the textile and paper industries not being sufficiently developed to exert a favourable influence. Speculation being prevalent only to a limited extent, the few buyers of starch and flour for a rise were caught in consequence of the heavy crop and large stock left over from the previous year. The price per 100 kilos. of potato starch and flour decreased regularly from 17.10 marks in January down to 14.20 in November and December. The chief consumers were the dextrin manufacturers, the output in this article being 87,250 sacks, against 73,596 sacks in 1894, but the export trade in starch decreased by some 65,800 sacks.

The wet starch trade suffered in consequence of American (maize) competition with the exports of potato sugar and syrup, prices falling from 9.40 marks (January) to 7.65 (December). The home trade in syrup about maintained its position, but the profits were small, prices declining from 20 marks per 100 kilos. in January to 17 marks in November—December.

SPIRITS (pp. 114--115).—The production of spirits did not fall below 1894 figures to any appreciable extent, but the large stocks carried over from the former year, coupled with the slow demand, made the outlook rather depressing. However, the introduction of the export bounty of 6 marks per hectolitre caused a revival of the foreign trade, the exports between August and December amounting to 108,763 hectolitres, an excess of 83,343 hectolitres over the corresponding period of the preceding year. The bad credit of some of the purchasing countries and the keen competition of the cheap maize spirits militate against the export trade in Berlin-made fine spirits. The French market for these is closed by reason of the high tariff and the improved quality of the French home-manufactured article, and the first-named cause also operates in respect of Spain. The Silesian distillers secure the Italian trade and Bohemian molasses spirit supplies the decreasing demands of Switzerland, at least in the cheaper grades. Most of the bountied spirit goes to the Levant, and this trade is in the hands of distillers on the Baltic coast, they having the advantage over Berlin in freights. Portugal is about the only buyer of Berlin wine spirit, and that not in large quantity.

In the home trade Berlin suffered, before the modification in the spirit tax, from the competition of the molasses distillers, but since the latter have found an outlet abroad, the home market has not been so much cut up.

The price of spirits was rather higher than 1894, 70 per cent. spirit being quoted at 32.5, against 32.1 in December. The bounties for rectifying spirit are still too low, even for the finest qualities, to offer any adequate rate of interest on the large capital required.

CEMENT.—The industry laboured under even more unfavourable conditions than before, prices having receded, and the carriage of coal increased in consequence of the scarcity of water. In the last half of the year the article was in more demand for the erection of the exhibition buildings. Manufacturers have established a minimum price for the ensuing twelve months, which should lead to an improvement in the condition of the industry.

DRUGS (pp. 176--178).—The trade is in a more satisfactory condition than it has been for many years, the use of medicaments in Germany having largely increased since the introduction of the sick club and accident insurance legislation for the working classes. An increasing tendency to revert to vegetable medicaments is noticed. Export business was very good, Central and Southern America (especially Argentina) and Russia being the largest buyers. The establishment of German banks on the other side has greatly facilitated business and lessened risks. The tariff war with Spain affects the drug trade, and the treaty with Russia has not increased the volume of business beyond that formerly done, many buyers having become accustomed to place their orders with other countries. Prices, after sinking for a long time, are firmer, and less affected by speculation.

Ethereal Oils.—The chief oils rose considerably in price, especially the Messina essences, bergamot, citron, and orange. Peppermint, rose, and neroli oil were also dearer, but aniseed, fennel, angelica, and coriander oil receded in price.

Petroleum spirit rose some 30 per cent. in the spring, in sympathy with petroleum, but rapidly went back in price.

Carbolic acid advanced some 10 per cent. at the close of the year.

Quinine is firm at about 40 marks per kilo.

Cocaine.—The consumption has increased. The maximum of value was reached in March (740 marks per kilo.), but the closing price fell to 500 marks. The new plantations in Ceylon and Java are expected to compete keenly with Bolivia and Peru.

Borax and boric acid, which are controlled by a ring, remained unchanged, and outside makers have ceased to make offers.

Glycerin increased rapidly in value from 75 to 125 marks in consequence of the increased demand for making dynamite and for other purposes, and the diminished production owing to the decline in the stearin candle industry.

Iodine.—The price was kept up by the ring, in spite of outside makers, but the position is precarious, and a drop of 50 per cent. may happen any day. Japan has lately entered the lists as a producer of iodine.

Lactose fell to 85 marks per 100 kilos., but on an agreement of most of the makers, rose to 180 marks.

Salicylic acid and its preparations, manufactured by a large number of new makers, fell 50 per cent.

Tartaric acid recovered from the low price of the preceding year, and reached 250 marks per 100 kilos.

Bismuth and its salts underwent great fluctuation, falling from 17 marks per kilo. in 1894 to 7.50 marks in 1895.

DYESTUFFS.—*Indigo*.—The conditions have greatly improved, the Bengal crop, 160,400 maunds, being almost double that of 1894. In Lower Bengal and Behar the quality was generally good, and in Benares, average. But the Oude indigo was chiefly low grade. Prices increased in December 1894, so that in the following month fine Bengal touched average rates, Behar being 15 rupees lower, and Oude standing at 50 rupees over opening prices. There being little stock, good business was done, and importers who had bought early made good profits. The Madras crop was also large (204,880 Madras maunds) and of satisfactory quality. In Java, 590,000 kilos. were produced, but prices were comparatively high and business consequently restricted. Guatemala shipped 6,861 "serone" to Europe. The prospects of the new crop being unfavourable, prices for all grades have an upward tendency.

Cochineal.—A short crop readily disposed of at high prices.

Dyewoods.—The position of the market was satisfactory, the vacillating tendency of the early season being followed by a firmer tone, especially towards the end of the year.

Logwood.—The unsatisfactory quality of many of the Laguna shipments diverted the attention of buyers to other kinds, Yucatan and Campeachy finding ready purchasers. Cape Haiti logwood was poor, and lost its market status. Jamaica wood met with extensive application throughout the year. Yellowwood remained low, only the inferior qualities, being scarce, advancing.

The values of red-wood depreciated, the supply being large. Altata Lima wood was good in quality.

Quebracho Wood.—Large quantities were shipped to Europe, and prices receded in the autumn, but recovered towards the close of the year.

Myrabolams.—The demand was extensive, but the abundance of low-grade stuff kept down the price of the better qualities coming into the market in the late summer and autumn.

BONES, BONEMEAL, AND OTHER MANURES (p. 181).—The bone trade suffered through the diminished demand for bonemeal, and although the Association of Bone Grinders became an accomplished fact, the weakening of Indian prices kept values down.

The demand for artificial manures was restricted in consequence of the unsatisfactory condition of agriculture, and the agitation against the use of these fertilisers.

Bonemeal suffered most, the existence of the trade being imperilled by the publication of Maerker's adverse deductions from his experiments on the manurial value of ground bones, notwithstanding that these views are not shared by other chemists of repute.

Superphosphate also declined to unprofitable prices as a result of over-production—the increased quantity of sulphuric acid at disposal, since the introduction of new methods of soda manufacture, being devoted to this purpose. Florida phosphate exhibited a parallel tendency, and any improvement depends on the agricultural situation.

The increased stocks and diminished rates of nitrate of soda forced down the price of sulphate of ammonia. Attempts to syndicate the nitrate exporters have so far been without result. Other nitrogenous substances, such

as blood meal, horn meal, flesh meal, and leather meal, were neglected, as a result of cheap ammonia salts and the warnings against animal nitrogen issued by the agricultural experimental stations.

Glue alone met with a good sale, the increased demand and cessation of manufacture during the hot summer months clearing out stocks and raising values by 5 marks per 100 kilos. America and England bought freely.

Extracted bone fat kept at the same level as in the previous year, an advance in the autumn being counteracted by the lowering of the rates for tallow.

OILS AND FATS (pp. 181–183).—*Linseed oil* is mostly obtained from the Harburg, Breslau, and Danzig crushers, also from England and Holland. Imports (including cottonseed oil to 1.7), 2,264,199 kilos. Prices 48 to 50 marks per 100 kilos. for good clear oil.

Cottonseed Oil.—Large quantities imported from England at 43–45 marks per 100 kilos. for double refined Hull oil.

Hemp Oil.—Seldom offered.

Olive oil came chiefly from the Levant, Spanish and Italian prices being too high on account of the short crop. Imports, 320,300 kilos.; denaturised oil, 397,339 kilos. Prices: prime Smyrna, 64–69 marks; Italian green sulphur oil, 45–48 marks.

Palm oil sold easily at 48–50 marks for prime Lagos.

Cocoanut Oil.—Values receded until autumn, but improved as Indian prices advanced. Most of the oil is prepared from Coprah at Harburg and Magdeburg. Prices: 50–53 marks; imported Cochin oil, 60–63 marks.

Palm kernel oil comes on the Berlin market from the Harburg and Magdeburg crushers, and one works in Berlin. Best pressed oil made 45–47 marks.

Tallow.—The plentiful supply at low rates from Australia depressed values. Imports (including other animal fats), 2,688,875 kilos. German candle tallow made 58–55 marks, soap grades 53–48; Australian, 48–56, according to quality, closing firm; Russian (soap), 90–88 marks.

Olein.—The market is supplied from Belgium, Holland, Hamburg, and the Berlin factories, and Newsky olein from St. Petersburg again appeared after a long interval. Trade in the summer was brisk, to meet the demands of the textile industry, but slackened off later. Prices: saponified olein, 51–50 marks; distilled 45–50 marks, rising to 47–51; Newsky, 51 marks.

Fish Oil.—The meagre results of the Norwegian cod fishery caused an advance in values. Pale Greenland seal oil made 46–48 marks; Copenhagen seal, 58; Bergen brown liver oil, 42–50 marks.

Fats.—The inland and American makers sent regular supplies at weakening rates. Prices: natural bone fat, 44–42 marks; extracted, 40–38 marks; medium lard fat, 43–41; fulling grease, 30–36, according to quality.

Mineral Oils.—Large quantities were sent from Russia and America. Prices: low grades 20–28 marks; medium engine and cylinder oils, 30–45; heavy cylinder oils, 50–80 marks.

SOAP, PERFUMES, AND CANDLES (pp. 182–183).—*Household Soaps*.—The cheapness of fat enabled makers to secure a satisfactory margin during the first six or eight months, but selling prices weakened subsequently. The volume of trade was normal, and the results showed a marked improvement over the two preceding years. But little export trade is done, buyers' ideas of price being too low.

Toilet Soaps and Perfumery.—An increased consumption of toilet soaps is recorded, but prices ruled too low in comparison with raw materials. Quality has improved in consequence of home and foreign competition.

The abolition of the permission to employ duty-free spirit for perfumery has had an unfavourable effect on the industry, which the increased import duties and the return of duty on the alcohol in exported wares have not counteracted. French manufacturers have established works in Germany to compete with the native makers. The export trade is small, owing to the preference accorded to French and English goods; and a similar preference is manifested by some dealers in Berlin for French extracts.

Some 1,350,000 kilos. of cocoanut oil and 500,000 kilos. of tallow were consumed in the manufacture of toilet soaps.

Stearin and Candles.—The position of the stearin industry improved, and, prices of fats being low and steady, the rates for candles were uniform at 100, 90, 80 marks for the three grades manufactured. Business was very quiet until the end of August, when the Sedan celebration caused a large increase of orders, and the trade then continued good till the end of the year.

Glycerin fluctuated greatly, and prices in the Paris market, influenced by the American demand, rose from 62.50 francs to 75 francs (July), and, by leaps and bounds, to 125 francs in December, closing 5 francs lower at the end of the month. The short supply is due to the decreased production of stearin candles of late years, and to the prices having been too low to make the recovery of glycerin from spent soap lyes profitable.

THE CHEMICAL INDUSTRIES OF BERLIN (pp. 183—186).—So far as quantity of produce is concerned, the year proved a very favourable one, but in many instances prices were unsatisfactory. The various commercial treaties seem to have helped only a few articles, and the tariff war with Spain has almost killed the trade with that country. Complaints are rife that the high railway rates spoil the German manufacturers' chance of competing with foreigners.

Nitrogenous raw materials steadily decreased in value throughout the year. *Nitric acid*, apparently independent of the price of nitrate of soda, averaged 23 marks per 100 kilos., packed for 36° refined acid, but *sulphate of ammonia* fell every month.

Carbonate of ammonia was in good demand at 69—70 marks *ex works*. *White crystallised sal ammoniac* found increasing use for battery purposes at an average of 59 marks per 100 kilos., but was affected by the fall in *ammonia*, which declined from 36 marks, packed, to about 30 marks (sp. gr. 0.910). 96 to 98 per cent. *potash*, notwithstanding the competition of substitutes, maintained its value, 36 marks, and even rose a couple of marks at the end of the year, stocks being short.

The international associations controlling the production of *oxalic acid* and its salts kept the price steady at 70 marks. *Boric acid* and *borax* were in brisk demand, at about 60 and 40 marks respectively.

Chlorate of potash continued depressed, prices falling to the extremely low rate of 80 marks per 100 kilos. for technically pure chlorate.

Calcined Glauber Salt.—To protect themselves from further loss, the associated makers raised the price a little, but, notwithstanding the fair amount of inquiry, little profit was made.

Crystal soda sold in increased quantity, but to small advantage, no advance being obtainable, the opening of another factory increasing the already keen competition.

Water glass remained on the same level as 1894, both in price and in volume of business; the exports showed a slight falling off.

A large business was done in *concentrated sulphuric acid*, but even the previous low prices could not be maintained, the inferior grades for agricultural purposes selling extremely cheap. *Hydrochloric acid* fell from 6 marks to 5.50, in consequence of over-production.

Wood spirit declined in the first half of 1895 to the lowest prices ever known, but recovered a little subsequently, and the same remarks apply to *methyl alcohol*. *Acetic acid* also receded in value in sympathy with calcium acetate, but America reports an improved tone, which should react on this market.

A further increase in the consumption of *liquid carbonic acid* for mineral waters and raising beer is noted. The apparent large margin between cost and sale price caused a number of new enterprises to spring up, so that values declined, even in the summer season, although the demand was larger. Prices at the end of the year ruled from 32½ to 30 pfennige per kilo. wholesale. The export business is small, adverse tariffs and high transport charges crippling the Berlin trade in this direction.

The position of the *coal-tar products* trade gradually but decidedly improved. Pitch was in good demand, and the

higher prices obtainable reacted on the crude coal-tar market. Good business, though at low rates, was done in oils for impregnating and coating purposes (carbolineum, &c.).

In the finer products, *anthracene* only maintained the rates of the previous year, but *benzol* and *naphthalin* sold well, the former being in increased demand for carburetting and anilin colour making, so that a scarcity set in at the end of the year and prices almost doubled. The advance is not expected to be of long duration, an extension of the manufacture by the coke factories being in contemplation.

Naphthalin is on a better footing, the whole production finding a ready market for colour-making and disinfecting purposes.

Pyridine was also in good demand, and prices rose some 30 per cent., chiefly through the combined action of the English tar distillers, a cause which operated also in the case of *anthracene*. The large stock of this latter article in the hands of the syndicate has been apparently almost exhausted by the increased export.

An increased consumption of the *intermediate products for the coal-tar colour industry* is also apparent. Foreign competition in these articles is keen, the producers being able, by making use of inland water carriage, to undersell the German makers even in Germany. The only remedy would appear to consist in the imposition of a special tariff.

Activity prevailed in the *coal-tar colour industry*. Prices, which were previously regular, rose suddenly in the final quarter, even more rapidly than the rates for *benzol*. The large shipments of aniline oil to America depleted stocks to an extent almost unknown hitherto. The activity of the colour-consuming industries, coupled with the steadiness of exchange and other causes, contributed to the development of the trade, England and America being the principal foreign buyers. Sales to Russia and Austria might have been larger had the article received more attention in the framing of the commercial treaties, and, as for the Spanish trade, unless some agreement is arrived at, this market will be lost to Germany.

In the *cheaper, innocuous, chemical pigments*, the only increase of business noted is to America and Belgium, the inland trade and the exports to the treaty countries exhibiting no development.

Lacs and varnishes evinced considerable improvement, industrial requirements compensating for the reduced demand from the building trade. A satisfactory business was done with Belgium and Sweden, but high rates of transport place Berlin at a disadvantage except where water carriage is available.

The values of many *pharmaceutical chemicals* declined, especially *salicylic acid*, which fell 4 marks per kilo. in January, through an extension of the number of works. In gall products, glycerol, and a few other articles, the market conditions were, however, more favourable. The very large and unexpected additions to the Italian tariff on chemicals greatly hindered the export trade to that country.

AMERICAN PETROLEUM IN 1895.

Ironmonger, September 19th, 1896, 481.

The complete statistics relating to the production and distribution of American petroleum for the year 1895 have just been prepared by Mr. Joseph D. Weeks, and issued by the United States Government. The figures are of exceptional interest, seeing that they show, contrary to general expectation and in opposition to the course of prices, a considerable increase in the production last year. "The most notable features in connection with the production of crude petroleum in 1895," says Mr. Weeks, "are (1) the notable increase in production, especially in Ohio, Indiana, and California; (2) the decrease in stocks; (3) the rise in prices; and (4) the extension southward of the profitable producing districts in the Appalachian range."

The production of petroleum in the United States increased from 49,344,516 barrels in 1894 to 52,983,526 barrels in 1895, most of the important producing districts sharing in this increase. The production of Pennsylvania increased from 18,077,559 barrels in 1894 to 18,231,412 barrels in 1895—an increase of 153,853 barrels, or eighty-five

hundredths of 1 per cent.; of Ohio from 16,792,154 barrels in 1894 to 19,545,233 barrels in 1895—an increase of 2,753,079 barrels, or 16·4 per cent. This increase in Ohio was fairly distributed throughout the two important Ohio producing districts. The production of Indiana increased from 3,688,666 barrels in 1894 to 4,386,132 barrels in 1895—an increase of 697,466 barrels, or nearly 19 per cent.; while the production of California, owing to the new discoveries at Los Angeles, increased from 705,969 barrels in 1894 to 1,208,482 barrels in 1895—an increase of 71 per cent., the largest percentage increase of any of the States. On the other hand, there was a slight decrease in the production of West Virginia and New York. The “barrels,” it may be mentioned, are the American ones of 42 Winchester gallons, which is almost equivalent to 35 Imperial gallons. The stocks of crude petroleum in the Appalachian oil field at the close of 1895 were 5,344,784 barrels, as compared with 6,499,880 barrels at the close of 1894. The largest stocks at the close of any one month in 1895 were 5,859,348 barrels in January, as compared with 11,755,219 barrels, the largest stocks in 1894, which were also at the close of January. The smallest stocks at the close of any one month in 1895 were those of June, being 4,275,506 barrels, while the smallest stocks at the close of any one month in 1894 were those of December, as noted above. The average stocks at the close of each month in 1895 were 4,879,775 barrels. The average price of oil certificates in Pennsylvania in 1895 was 1·35½ dols., as compared with 83¢ c. in 1894, and was the highest price since 1877. The total value of the petroleum produced last year was 57,691,279 dols., or about 1·09 dols. (say, 4s. 6d.) per barrel. The increased production of California has arisen chiefly in the Los Angeles district, large deposits having been discovered almost in the centre of that beautiful city. Of the 2,225,308,092 gallons of crude petroleum produced last year the exports were:—Crude, 111,285,264; naphthas, benzine, gasoline, &c., 14,801,224; illuminating, 714,859,144; lubricating, 43,418,942; and residuums, 137,508 gallons. To the United Kingdom the exports were as follows:—Crude, 3,997,013; naphthas, 7,343,355; illuminating, 279,064,124; and lubricating, 21,209,497. For illuminating oils the United Kingdom is by far the largest customer. Germany coming second, *longo intervallo*, with a total of 100,829,113 gallons. Of crude oil, France is far and away the best customer.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st August	
	1895.	1896.
	£	£
Metals.....	1,579,276	1,891,201
Chemicals and dyestuffs	514,841	403,728
Oils.....	679,032	642,811
Raw materials for non-textile industries.....	5,056,281	5,036,984
Total value of all imports	34,587,396	32,472,622

SUMMARY OF EXPORTS.

Articles.	Month ending 31st August	
	1895.	1896.
	£	£
Metals (other than machinery)	2,447,504	2,620,419
Chemicals and medicines.....	659,762	537,522
Miscellaneous articles.....	2,395,064	2,518,560
Total value of all exports.....	20,481,935	20,501,560

IMPORTS OF METALS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
One..... Tons	11,404	15,055	47,825	60,743
Regulus..... "	6,401	9,472	133,023	227,125
Unwrought..... "	2,654	5,107	121,405	245,108
Iron:—				
One..... Tons	439,765	455,218	308,973	337,908
Bolt, bar, &c..... "	8,110	6,329	63,033	49,940
Steel, unwrought..... "	910	2,088	7,277	21,154
Lead, pig and sheet..... "	15,714	15,987	164,296	165,170
Pyrites..... "	48,182	34,708	85,430	60,759
Quick-silver..... Lb.	101,510	2,272	9,872	320
Silver ore..... Value £	..	..	151,047	118,500
Tin..... Cwt.	68,678	91,834	218,151	277,000
Zinc..... Tons	4,415	5,977	68,947	102,838
Other articles..... Value £	..	..	190,337	198,528
Total value of metals.....	..	..	1,579,276	1,891,201

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Alkali..... Cwt.	24,318	18,474	9,910	8,311
Bark (tanners', &c.) ..	62,003	31,192	24,194	11,965
Brimstone..... "	53,214	..	10,421	2,091
Chemicals..... Value £	..	..	104,349	122,311
Cochineal..... Cwt.	353	272	2,416	1,777
Cutch and gambier Tons	2,458	2,174	52,792	42,992
Dyes:—				
Alizarin..... Value £	..	..	28,274	17,062
Anilin and other..... "	..	..	36,372	37,171
Indigo..... Cwt.	2,765	1,351	33,297	18,122
Nitrate of potash..... "	22,207	26,035	20,577	20,433
Valonia..... Tons	3,108	1,657	37,267	17,154
Other articles..... Value £	..	..	135,002	105,299
Total value of chemicals.....	..	..	514,841	403,728

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Bark, Peruvian .. Cwt.	1,487	1,936	4,110	4,135
Bristles..... Lb.	342,429	296,789	48,413	397,400
Caoutchouc..... Cwt.	25,584	25,143	281,707	280,507
Gum:—				
Arabic..... "	5,224	3,335	13,539	6,258
Lac, &c..... "	6,150	10,755	36,047	51,682
Gutta-percha..... "	3,579	4,748	31,884	49,219
Hides, raw:—				
Wet..... "	52,039	40,108	119,953	94,495
Dry..... "	895,466	37,099	298,740	78,125
Ivory..... "	887	1,126	39,613	41,614
Manure:—				
Guano..... Tons	3,403	813	27,422	3,741
Bones..... "	5,305	3,911	22,559	12,446
Nitrate of soda..... "	5,384	938	26,542	7,295
Phosphate of lime..... "	52,003	34,278	87,763	55,377
Paraffin..... Cwt.	42,985	47,789	46,115	46,328
Lanen rags..... Tons	1,891	1,562	16,495	15,403
Esparto..... "	21,893	14,126	89,708	57,811
Pulp of wood..... "	24,371	25,025	158,084	126,252
Rosin..... Cwt.	126,103	159,321	29,005	42,158
Tallow and stearin..... "	245,985	161,922	285,847	161,237
Tar..... Barrels	37,281	30,228	26,955	18,711
Wood:—				
Hewn..... Loads	269,745	314,922	510,325	696,790
Sawn..... "	847,275	970,231	1,745,537	2,129,936
Staves..... "	18,104	18,657	72,681	67,461
Mahogany..... Tons	1,671	3,160	12,630	31,759
Other articles..... Value £	..	..	1,134,427	918,404
Total value.....	..	..	5,056,281	5,036,984

Besides the above, drugs to the value of 54,778£ were imported, as against 145,807£, in August 1895.

IMPORTS OF OILS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Cocoa-nut..... Cwt.	1,929	9,562	2,182	10,348
Olive..... Tuns	839	813	31,074	28,904
Palm..... Cwt.	136,791	96,850	142,345	99,270
Petroleum..... Gall.	11,808,498	14,958,840	235,632	274,959
Seed..... Tons	1,838	1,877	39,048	59,134
Tran. &c..... Tuns	2,976	2,748	59,388	45,302
Turpentine..... Cwt.	105,204	74,344	105,810	69,900
Other articles .. Value £	..	..	72,553	74,394
Total value of oils...	..	..	679,032	642,811

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Alkali..... Cwt.	479,220	323,363	124,852	89,857
Bleaching materials ..	111,604	80,993	39,579	27,689
Chemical manures Tons	46,932	35,145	171,640	135,398
Medicines..... Value £	..	..	83,127	84,215
Other articles... ..	..	..	240,564	220,353
Total value .....	..	..	659,762	557,522

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Brass..... Cwt.	8,559	9,294	33,711	38,437
Copper:—				
Unwrought.... "	57,242	28,791	128,085	71,041
Wrought..... "	18,890	21,405	54,109	65,509
Mixed metal.... "	16,192	11,731	35,047	29,089
Hardware..... Value £	..	..	160,427	164,123
Implement..... "	..	..	101,278	103,959
Iron and steel... Tons	259,414	311,596	1,708,721	1,917,109
Lead..... "	2,645	2,854	31,459	29,995
Plated wares... Value £	..	..	29,727	27,356
Telegraph wires ..	..	..	29,488	65,476
Tin..... Cwt.	7,608	10,037	25,993	32,175
Zinc..... "	17,570	13,510	12,074	9,848
Other articles .. Value £	..	..	67,415	66,902
Total value .....	..	..	2,417,504	2,620,119

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
			£	£
Gunpowder..... Lb.	826,400	550,800	20,005	10,971
Military stores.. Value £	..	..	134,595	159,152
Candles..... Lb.	1,917,300	1,534,600	30,972	22,567
Caoutchouc..... Value £	..	..	103,704	103,071
Cement..... Tons	40,638	25,217	65,452	43,350
Products of coal Value £	..	..	89,763	105,157
Earthenware ... "	..	..	173,198	154,087
Stoneware..... "	..	..	11,591	19,777
Glass:—				
Plate..... Sq. Ft.	140,267	152,728	7,098	9,821
Flint..... Cwt.	8,767	7,268	19,945	16,406
Bottles..... "	59,473	57,723	29,512	27,831
Other kinds.... "	23,138	19,695	16,391	15,259
Leather:—				
Unwrought.... "	14,140	11,094	132,550	101,683
Wrought..... Value £	..	..	38,054	40,931
Seed oil..... Tons	3,673	5,044	74,304	92,646
Flooreloth..... Sq. Yds.	1,709,000	1,631,200	71,198	71,323
Painters' materials Val. £	..	..	126,356	128,641
Paper..... Cwt.	63,987	70,941	100,931	112,273
Rags..... Tons	4,642	3,647	26,193	22,153
Soap..... Cwt.	68,692	57,531	68,744	59,407
Total value .....	..	..	2,595,064	2,548,560

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

18,259. H. A. Jones. Improvements in deoxidising furnaces. Aug. 18.

18,287. W. M. Fowler. Improvements in clarifying liquids. Complete Specification. Aug. 18.

18,377. C. W. Ramstedt. Improvements in apparatus for heating or cooling liquids. Aug. 19.

18,383. J. F. Stephenson. An improved apparatus for automatically removing solid matter from water or other liquids. Complete Specification. Aug. 19.

18,455. W. C. Welsh. Improvements in smoke-consuming furnaces. Aug. 20.

18,706. E. M. V. Gibb. Improvements in thermometers. Aug. 24.

18,717. A. J. Boulton.—From C. A. Macdonald. An improved mode of and apparatus for cooling, purifying, and drying air for chilling and freezing purposes. Complete Specification. Aug. 24.

19,039. W. Defries. Filtering apparatus. Aug. 28.

19,172. T. F. Irwin, J. J. Atkinson, and J. D. Young. Improvements in apparatus for filtering liquids. Aug. 31.

19,290. A. J. Boulton.—From O. Patin. Improvements in or relating to electrical furnaces. Sept. 1.

19,297. W. R. Lake.—From R. Spasciani. Improvements in carboys, demijohns, and the like. Sept. 1.

19,042. G. Obitz. Improved method of and means for supplying fuel to furnaces and the like. Sept. 2.

19,405. E. Dieble. An improved continuous counter-current saturation apparatus. Complete Specification. Sept. 2.

19,483. W. O. Thomas. Improvements in compressors and pumps. Sept. 3.

19,764. W. R. Lake.—From A. Schwabe. An improved method of and apparatus for maintaining a uniform temperature in laboratory ovens, incubators, drying rooms, and the like. Complete Specification. Sept. 7.

19,800. T. Preece and A. Preece. Improvements in combined self-producing gas furnaces and muffles for use in enamelling metallic articles. Sept. 8.

20,004. H. Ward and F. W. Nock. A cock for combining water and steam in any desired quantities. Sept. 10.

20,987. J. von Grubinski. Apparatus for purifying and heating feed water for steam generators. Complete Specification. Sept. 10.

20,209. W. C. Thomas. An improved apparatus for charging gas producers. Sept. 12.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

15,958. L. M. H. R. Baudoin and P. E. L. Schribaux. Process and apparatus for concentrating liquids. Aug. 26.

16,058. H. C. Michell. Manufacture of flake mica for boiler coverings and other uses. Sept. 2.

16,137. J. G. Culvert. New or improved means and apparatus for bringing into intimate contact with each other liquids of different densities. Aug. 26.

17,912. F. Garros. Filtering apparatus. Sept. 16.

18,722. A. W. Paul. Condensers and like apparatus for use in the transference of heat between fluids. Sept. 9.

1896.

8273. J. G. Nash and J. M. Borrow. Process and apparatus for preventing the incrustation in boilers. Sept. 2.

12,015. H. Seek. Apparatus for separating light from heavy substances. Aug. 26.

14,774. O. Guttman. Apparatus for mixing or obtaining reactions between liquids and gases. Aug. 26.

15,682. B. T. Lacy. Roasting furnaces. Aug. 26.

15,757. P. M. Justice.—From H. F. Atkinson. Apparatus for injecting vapour or gas into furnaces. Aug. 26.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

16,277A. L. V. Pratis and P. Marengo. The utilisation of hydrogen gas for the obtaining of light, heat, and power. Date claimed July 22, 1896. Sept. 2.

18,207. R. P. Pietet. Improvements in the manufacture of acetylene, and in apparatus therefor. Filed Aug. 17. Date applied for Jan. 25, 1896, being date of application in France. Complete Specification.

18,208. R. P. Pietet. Improvements in the purification of acetylene, and in apparatus therefor. Complete Specification. Filed Aug. 17. Date applied for Jan. 25, 1896, being date of application in France.

18,493. S. Levin. Improvements in the manufacture of mantles for incandescent gas lighting. Aug. 20.

18,575. J. T. Sheard and the Sheffield United Gas Light Co. Obtaining cyanides in the manufacture of gas. Aug. 22.

18,782. F. J. Koopmann. A process of desulphurising gas in the manufacture thereof. Aug. 25.

18,819. W. Clark.—From A. Meyenberg, M. Wendorf, and S. Heulein. Improvements in incandescent lamps for the combustion of petroleum. Aug. 25.

18,863. T. Holliday. Improvements in apparatus for making and storing acetylene. Aug. 26.

18,888. E. Viard and E. Geisenberger. Improvements in apparatus for generating, storing, and delivering acetylene gas. Aug. 26.

18,915. B. Kosmann. A process for the separation of certain rare earths, and the manufacture therefrom of fabrics for use in incandescent gas lighting. Aug. 26.

18,924. A. Spranger. Improvements in the production or manufacture of ozone solutions. Complete Specification. Aug. 27.

18,992. E. Chesnay and L. Pillion. Improvements in apparatus for generating, storing, and delivering acetylene gas. Filed Aug. 27. Date applied for Jan. 31, 1896, being date of application in France.

19,044. A. F. de Villepigue, V. Fournier, and G. Shenton. Process and apparatus for extracting oxygen from the air. Complete Specification. Aug. 28.

19,059. W. P. Thompson.—From D. H. Chivert, France. Improvements in or appertaining to the production of acetylene gas, and apparatus therefor. Aug. 28.

19,077. H. Maxim. Improvements in the manufacture of incandescence mantles for gas and vapour lamps. Aug. 28.

19,126. G. Voigt. Improvements in apparatus for producing acetylene gas. Aug. 29.

19,215. P. Stiens. Improvements in incandescent mantles. Aug. 31.

19,288. A. J. Boudt.—From H. E. Fuller. An improved construction of apparatus for generating gas by the chemical action of a liquid upon a solid material. Complete Specification. Sept. 1.

19,487. F. H. Bonnefin and D. Hancock. Improvements in or connected with mantles, caps, or hoods for incandescent gas-lighting. Sept. 3.

19,521. J. S. V. Bickford. Improvements in apparatus for lighting and heating by means of petroleum vapour. Complete Specification. Sept. 3.

19,522. V. H. F. de Sonis. Improvement in acetylene gas lamps. Sept. 3.

19,536. G. Beck. New process of fabrication of a mantle or cap serving for gas or other burners to illuminate by incandescence. Sept. 4.

19,639. A. Lege. An improved mode of electrical gas-lighting. Sept. 5.

19,677. P. R. de F. d'Humy. Improvements in the manufacture of fuel briquettes. Sept. 5.

19,691. B. Parkin and W. S. Pickering. A new or improved method of enriching gas for illuminating and for other purposes. Sept. 5.

19,711. J. Steiger. Improvements in the manufacture of artificial fuel. Sept. 7.

19,841. E. M. T. Boddam. An improved method of and apparatus for producing gas for purposes of propulsion. Sept. 8.

19,953. G. Kremer. Improvements in the production by the cold process of gas for lighting and motive power, and apparatus therefor. Sept. 9.

19,957. H. Wellstein. An improved process of manufacturing mantles for incandescent burners. Complete Specification. Sept. 9.

19,973. P. Bode. Improvements in incandescent gas burners. Complete Specification. Sept. 9.

19,979. A. Rolf. Improvements in or connected with incandescent gas lights. Complete Specification. Sept. 9.

20,029. J. L. Shepherd. A new and improved method of protecting "Welsbach" incandescent or other incandescent or hollow flame gas lights. Sept. 10.

20,074. G. W. Gaskell and R. R. Gibbs. Improvements in or relating to the generation and storage of acetylene. Sept. 10.

20,083. W. W. Hughes and S. Willson. Improvements in generators for acetylene gas. Sept. 10.

20,084. W. W. Hughes and S. Willson. Improvements in or relating to the treatment or utilisation of peat and its products. Sept. 10.

20,090. E. Chesnay and L. Pillion. Improvements in apparatus for generating and storing acetylene gas. Filed Sept. 10. Date applied for Feb. 13, 1896, being date of application in France.

20,104. B. van Dyken. Improvements in apparatus for the manufacture and utilisation of acetylene gas. Sept. 11.

20,130. D. Waddell, A. Waddell, and F. Waddell. Improvements in the means of assisting combustion of fuels consuming smoke and in the more effective application of heat therefrom. Sept. 11.

* See Note (*) on previous page.

20,125. W. Young, S. Glover, and T. Glover. Improvements in the manufacture of illuminating gas. Sept. 11.

20,156. P. R. de F. d'Humy. Improvements in or relating to the manufacture of fuel. Sept. 11.

20,216. W. Watson and R. Hudson. An improved system of and means for illuminating. Sept. 12.

20,225. P. Fritzsche. Obtaining ether from gases containing ethylene and apparatus therefor. Sept. 12.

20,238. H. Turner and W. Allen. Improvements in or applicable to smoke-burning apparatus. Sept. 12.

20,251. E. Chesnay and L. Pillion. Improvements in apparatus for generating and storing acetylene gas. Filed Sept. 12. Date applied for Feb. 25, 1896, being date of application in France.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,716. W. Darby, I. Darby, and J. H. Punchard. Method and means of burning liquid hydrocarbons in conjunction with an incandescent hood or mantle to produce an incandescent oil burner. Sept. 9.

19,771. J. C. Bayley. Method and apparatus for generating and regulating the consumption of acetylene gas. Aug. 26.

20,453. J. H. Exley. Apparatus for generating acetylene gas. Sept. 9.

20,468. J. F. Atkinson. Automatic apparatus for the manufacture of acetylene gas. Sept. 9.

20,667. N. Notkin. Method and apparatus for automatically and continuously carburetting air for illuminating and heating. Sept. 2.

20,727. J. H. Exley. Apparatus for generating acetylene gas. Sept. 9.

21,089. J. McL. McMurtrie and Lucal Lim. Apparatus for the burning of fluid hydrocarbons for lighting and heating purposes. Sept. 16.

1896.

5976. E. Appieby and H. F. Harris. Apparatus for automatically and safely generating and storing acetylene. Sept. 2.

8509. P. G. de Schodt. New or improved system and means of illuminating and heating applicable with gas and mineral oils. Sept. 2.

10,372. E. Andreoli. Apparatus for the production of ozone. Sept. 2.

14,448. N. Caro and W. Saulmann. Manufacture of incandescent bodies, or mantles, for lighting purposes. Sept. 16.

16,425. G. Shenton and D. A. F. de Villepigne. Means for vaporising and burning liquid fuel. Sept. 16.

17,194. W. L. Voelker. Materials for incandescent mantles and processes for manufacturing the same. Sept. 9.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

18,221. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. Improvements in the manufacture and production of phthalic and sulpho-phthalic acids. Aug. 17.

18,489. H. R. Vidal. Improvements in the manufacture of sulphuretted colouring matters. Aug. 20.

18,720. T. R. Shillito.—From J. R. Geigy and Co. Improvements in the production of red colouring matters. Aug. 24.

19,174. W. S. Simpson and Brooke, Simpson, and Spiller, Limited. Improvements in colouring matters. Aug. 31.

19,516. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of colouring matters of the group of the rhodamines and of rhodol. Complete Specification. Sept. 3.

19,831. S. Pitt.—From L. Cassella and Co. Production of black colouring matter. Sept. 8.

19,946. R. Blank. A process for the manufacture of compounds of the series of the indoxyl acids and of dyestuffs of the indigo series. Sept. 9.

19,976. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of basic diazo colouring matters. Sept. 9.

20,250. B. Willeox.—From The Badische Anilin and Soda Fabrik. The manufacture and production of colouring matters from dinitro-naphthalenes. Sept. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,836. A. Welter. Process for producing the salts of aniline and its alkyl derivatives, and of all its homologues. Aug. 26.

20,313. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of azo dyestuffs from new *m*-nitraniline sulphonic acid. Sept. 9.

20,944. A. G. Green and H. Benfey. Treatment of technical nitro-toluene. Aug. 26.

21,342. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new triazo colouring matters. Sept. 9.

21,919. H. H. Lake.—From Farbwerk Muhlheim. Manufacture of sulpho acids of the naphthalene series, and of colouring matters derived therefrom. Sept. 2.

22,114. O. Imray.—From P. Reny. Manufacture of azo, diazo, and polyazo colouring matters with phenylene and toluylene oxamic acid. Sept. 9.

1896.

15,493. G. Cerekel. Preparation of ortho-sulphamine benzoic acid. Aug. 26.

17,293. M. Lange. Process for the manufacture of intermediate compounds containing two diazo groups. Sept. 9.

V.—TEXTILES, COTTON, WOOL, SILK, ETC.

APPLICATIONS.

18,360. F. N. Turney. Improvements in apparatus for degreasing wool, cotton waste, and other fibrous materials. Aug. 19.

18,517. W. J. A. Donald. See Class XIII.

18,555. G. T. Oliver. Improvements in the preparation of material or composition for waterproofing or ornamenting the surface of fabrics. Aug. 21.

18,693. J. Crossley and Sons, Lim., and J. Brooks. Improvements in the manufacture of cotton yarns or threads. Aug. 24.

18,701. C. D. Abel.—From C. Grenert. Process and apparatus for the manufacture of imitation lace, embroidery, and the like. Aug. 24.

19,217. A. Moorforts. Improvements in machines for finishing yarn in the form of hanks or skeins. Aug. 31.

19,951. J. McCreath. Improvements in wool drying. Sept. 9.

19,954. P. A. Newton.—From A. Nobel. Improvements in the manufacture of artificial silk. Sept. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 20,669. F. Walton. Manufacture of floor-cloth. Sept. 9.
20,670. F. Walton. Manufacture of mosaic floor-cloth and apparatus therefor. Sept. 9.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

- 19,128. J. Schneider. Improvements in the treatment of fibres and fibrous or textile materials to improve the appearance or finish and facilitate the operation of dyeing. Sept. 2.
19,950. M. Beraud. Improvements in dyeing animal and vegetable fibres. Sept. 9.
20,208. G. M. L. Irvine-Moore. A substance to displace bitartrate of potash in wool and silk, &c. dyeing. Sept. 12.

COMPLETE SPECIFICATION ACCEPTED.

1896.

3058. W. Hepworth-Collins. Improvements in machinery and process for scouring, bleaching, dyeing, and otherwise treating yarn and other spun fibrous materials in cops or in similar compact forms. Sept. 16.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

- 18,239. M. N. d'Andria. Improvements in and connected with the manufacture of magnesium sulphate. Aug. 18.
18,468. I. Quirin. Proceeding for cleaning carbonic acid. Aug. 20.
18,589. J. Hargreaves and R. Armstrong. Improvements in the manufacture and treatment of detergent and bleaching compounds, and in apparatus employed therein. Aug. 22.
18,953. H. W. Smith. Improvements in the manufacture of cyanide of potassium. Aug. 27.
19,041. K. Jung and B. Steuer. Improved process and apparatus for regenerating chlorine. Aug. 28.
19,222. J. Y. Johnson.—From The Chemische Fabrik Electron Actien Gesellschaft. Improvements in the treatment of bleaching powder to preserve it from loss of active chlorine. Aug. 31.
19,364. W. Cooper. Improvements in treating brine. Sept. 2.
20,068. W. R. Clarke and The United Alkali Co., Lim. Improved means for effecting the absorption of chlorine gas, applicable in the manufacture of chlorates and bleaching liquor. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 16,257. B. Hargreaves. Manufacture of chlorates, and means and appliances therefor. Sept. 2.
19,445. H. S. Elworthy and P. D. Henderson. Manufacture of carbonic acid gas by the utilisation of waste product produced in making calcium carbide. Aug. 26.
19,692. A. R. Davis. Apparatus for the manufacture of salt. Sept. 16.

1896.

- 13,881. W. R. King and F. Wyatt. Process for the manufacture of calcium carbide. Sept. 9.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

- 18,581. W. Maguire. Improvements in the method of decorating tiles and hollow-ware. Aug. 22.
18,729. G. Alefeld. Improvements in the production of metallic lustre on glass, porcelain, and the like. Aug. 24.
19,123. H. Kunze. An improved printing process for producing metallic decorations on earthenware, glass, and the like. Complete Specification. Aug. 29.
19,746. F. Hancock and C. B. Winzer. Apparatus for pottery purposes. Sept. 7.
19,906. A. Roland. An improved process for ornamenting surfaces of pottery, glass, and the like. Sept. 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

- 18,295. J. F. Kleine. Improvements in fireproof ceilings and floors. Aug. 18.
18,622. G. F. Thomson. Improvements in the manufacture and treatment of artificial and other stone roofing and other tiles and enamel, and in apparatus therefor. Aug. 22.
18,714. From J. Jungbluth. Improvements in artificial stone for street pavements, pathways, and like purposes, and in the method of producing the same. Complete Specification. Aug. 24.
18,990. A. J. Boulton.—From Tortorici and Grasso. Improved process and apparatus for the treatment of articles of cement, plaster, chalk, and the like. Aug. 27.
19,001. J. A. Yeadon. Improvements in the manufacture of cements or other analogous materials. Aug. 28.
19,047. A. L. C. Nodon and L. A. Bretonneau. A new or improved process and means for drying or senilising wood. Aug. 28.
19,079. E. S. Flian. Making and burning cements, limes, &c. Aug. 29.
19,213. C. H. M. Lyte. Improvements in mosaic tile, cement parquet, and like flooring or pavement. Aug. 31.
19,419. A. McLean. Improvements in artificial stone. Sept. 2.
19,936. J. Steiger. Improvements in the manufacture of artificial stone, preservative paint, and other analogous materials. Sept. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

- 16,661. J. Thomlinson. Manufacture of plaster, cement, mortar, and the like from chalk. Sept. 9.
21,295. O. Schwarz. A material suitable for use in building and the like, and means for manufacturing the same. Aug. 26.
22,873. O. Schwarz. Improvements in the formation and connection of plates or blocks for building purposes, and apparatus for manufacturing the same. Sept. 16.

1896.

- 16,136. J. Leuba. Paving blocks. Sept. 16.

X.—METALLURGY, MINING, Etc.

APPLICATIONS.

- 18,276. H. H. Lake.—From H. Schweitzer and E. E. Lungwitz. Improvements in the production of steel and in the refining of iron ore. Complete Specification. Aug. 18.

18,417. C. Phillips. An improved dry process or method for ore-dressing and gold-separating, and apparatus for same. Complete Specification. Aug. 19.

18,494. F. Ellershausen. Improvements in the treatment of complex sulphide ores. Aug. 20.

18,537. J. Ducot. Apparatus intended to determine the quantity of metal which a galvanoplastic bath should deposit on the object treated. Aug. 21.

18,616. J. Legge. Improvements in puddling and other like furnaces. Aug. 22.

18,620. W. Jordan.—From F. N. Blanc and T. S. Crane. Improvements in process and apparatus for protecting iron and steel ships from fouling by a copper coating. Aug. 22.

18,750. J. Y. Johnson.—From B. Hall. Improvements in solutions for hardening iron and steel. Aug. 25.

18,760. F. O'C. Prince. Improvements in means for introducing, diffusing, and regulating the air blast to cupolas for melting metal. Aug. 25.

19,178. J. Shanks. Improvements in moulds for casting. Aug. 31.

19,410. J. Lones and E. Holden. An improvement or improvements in the manufacture of buffer-iron or steel for the buffer barrels or cylinders of railway carriages, trucks, and waggons. Sept. 2.

19,640. W. van Wart, F. W. Poop, and J. J. Bradley. Improvements in the means for and method of producing certain kinds of metal especially adapted for use in the manufacture of the tubes and other of the component part of cycles of all kinds, autocars, and other wheeled vehicles, which improvements are also applicable for other industrial purposes. Sept. 5.

19,718. G. Bennett. Improvements in ingot moulds for the casting of ingots of iron, steel, or other metals, such as iron or steel alloys. Sept. 7.

19,883. E. Fischer and C. G. Penney. Improvements in apparatus for extracting metals. Complete Specification. Sept. 9.

20,131. W. Roberts. Improvements in and machinery or appliances for the manufacture of plates and sheets of copper, brass, and German silver. Sept. 11.

20,253. J. S. Wallace and J. Castell-Evans. A new or improved method of obtaining metals and other elements from ores or substances containing them. Sept. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,072. C. Rainey. Dry concentrators for the treatment of ores. Sept. 16.

14,166. A. C. J. Charlier. Process for the volatilisation of galena into white compounds of lead, and of zinc into white compounds of zinc, the making of litharge, and the smelting of metals from their ores or slags. Aug. 5.

16,634. J. S. MacArthur. Obtaining precious metals from solutions. Sept. 9.

17,190. H. R. Lewis and C. Gelstharp. Separation or extraction of copper, zinc, lead, silver, gold, and other metals from ores or compounds containing the same, and the recovery of chlorine used in the treatment of such ores or compounds. Sept. 16.

17,320. J. Woolford. Apparatus for collecting metallic fumes. Sept. 16.

19,265. J. G. Accles and J. Pinfold. Improvements relating to the working of aluminium and to apparatus therefor. Aug. 26.

20,440. R. I. Roman. Manufacture of tubes of aluminium and its alloys. Sept. 16.

21,186. R. I. Roman. Manufacture of a new aluminium alloy. Sept. 16.

21,699. J. Raine and B. W. Raine. A process for the utilisation of old steel rails or new rail crops without re-melting. Sept. 2.

1896.

15,542. W. H. Howard. Desilverisation of lead bullion. Sept. 2.

15,965. R. H. Peak. Process of converting ferric oxide into magnetic oxide of iron. Sept. 9.

17,074. T. Andrews. Apparatus for consolidating metallic scrap. Sept. 9.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

18,191. J. Brandt. Improvements in galvanic batteries. Aug. 17.

18,249. W. S. T. Martin and H. Weymersch. An improvement in the preparation of filaments for glow lamps. Aug. 18.

18,326. H. Weymersch. Improved preparations for accumulator plates. Aug. 19.

17,519. J. B. Whittemore. Improvements in or relating to electrical primary batteries. Complete Specification. Aug. 21.

18,570. F. Dannert. Improvements in electric batteries. Complete Specification. Aug. 21.

18,627. A. Heil. A depolarized galvanic element. Aug. 22.

18,628. J. F. Bachmann, A. Vogt, C. C. Weiner, J. Kirehner, and A. König. Incandescence body for electrical glow lamps and process of manufacture of the said body. Complete Specification. Aug. 22.

18,648. R. Kennedy. Improvements in electrical storage or secondary batteries. Aug. 22.

18,951. A. Conder and E. P. Michelot. Improvements in electrical accumulators. Aug. 27.

18,974. J. L. Dobell. A new or improved apparatus for electrically smelting metals, and for other like purposes. Aug. 27.

19,045. A. Heil. Manufacture of secondary galvanic elements. Aug. 28.

19,218. E. J. Constam and A. von Hansen. Manufacture or production of chemical products by electrolysis. Aug. 31.

19,301. A. Preiss. Improvements in storage batteries. Sept. 1.

19,308. W. Walker, jun., F. R. Wilkins, J. Lones, and J. Lones. Improvements in utilising the residual products obtained in the working of certain kinds of voltaic batteries. Sept. 1.

19,505. H. Maxim. Improved methods and apparatus for electro thermally treating materials. Sept. 3.

19,877. D. G. Fitzgerald. Improvements in connecting the plates or elements of voltaic cells and batteries. Sept. 8.

20,035. D. Mathieu. Improvements in electrical batteries. Sept. 10.

20,061. J. A. Sinclair. Improvements in the manufacture of filaments for electric lamps. Sept. 10.

20,062. J. A. Sinclair. Improvements in the manufacture of filaments for electric lamps. Sept. 10.

20,077. T. F. Boland, C. J. Hubbell, and H. C. Hubbell. Improvements in and relating to primary batteries. Complete Specification. Sept. 10.

20,106. S. A. Rosenthal.—From S. J. Von Romocki. Improvements in secondary batteries. Sept. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,557. E. Andreoli. Electro-deposition of gold and silver. Sept. 9.

16,569. L. Epstein. Manufacture of electrodes for voltaic batteries. Sept. 2.

17,063. T. L. Willson. Electric smelting. Aug. 12.

18,487. J. Heibling. Electrolytic manufacture of ferro-manganese, ferro-chrome, ferro-aluminium, ferro-nickel, and other alloys having an iron base. Sept. 9.

19,442. A. Hirsch. Improved method and apparatus for welding by electricity and for other purposes. Aug. 26.

19,745. J. Korner. Manufacture of plates for electric accumulators or secondary batteries. Sept. 16.

21,283. A. S. Elmore.—From J. O. S. Elmore. Electro-depositing of metals. Sept. 16.

1896.

3712. F. Monterde, C. Chavant, and J. George. Improvements in electro-accumulators. Sept. 16.

16,726. F. W. Schneider. Electrodes for secondary batteries. Sept. 16.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

18,478. W. H. Caird.—From A. Delisser. Improvements in the manufacture of mottled soap. Aug. 20.

18,940. F. Sahlfeld. A process of obtaining sebacic acid from wool or fulling grease. Complete Specification. Aug. 27.

19,257. F. M. Sanders and The Digby Patents Co. An improvement in the manufacture of soaps. Complete Specification. Sept. 1.

19,903. H. Hadfield. Improvements in the manufacture of soap and in the frames used in the manufacture of soap and in the method of cutting or "slabbing" soap. Sept. 9.

COMPLETE SPECIFICATION ACCEPTED.

1895.

19,021. J. W. Barclay. Manufacture of soap. Sept. 2.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

18,485. W. Morison. Improvements in acid-proof electrical non-conducting articles and composition therefor. Aug. 20.

18,517. W. J. A. Donald. Improvements in and relating to the impregnating of materials with india-rubber, gutta-percha, and the like. Aug. 21.

18,864. D. Forbes and J. S. Weymouth. A gelatinous resilient composition applicable for wheel tyres and other purposes. Aug. 26.

19,046. Siemens Bros. and Co., Ltd., and E. F. A. Obach. Improved process and apparatus for the extraction of gutta-percha from the leaves and twigs of the *Lonandra* Gutta and kindred plants. Aug. 28.

19,310. J. Wetter.—From M. Weinrich. Process for revivifying bone black or animal charcoal. Sept. 1.

19,318. G. W. N. Hamilton. An enamel paint and combination of materials for composing same. Complete Specification. Sept. 1.

19,788. A. C. J. Charlier. Improvements in the manufacture of white lead. Sept. 8.

19,936. J. Steiger. See Class IX.

20,020. E. Wood. Improvements in quick-drying paints and varnishes. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,175. J. Noad. Method and means of producing lead oxide. Sept. 9.

22,460. O. H. Hamilton. Production of basic carbonate of lead or "white lead." Aug. 26.

1896.

11,210. H. L. Haas. Polishing compositions. Aug. 26.

13,886. W. P. Tatham and W. Tatham. Manufacture of white lead. Sept. 2.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

18,278. W. P. Thompson.—From B. Trenekmann. An improved process for tanning skins. Aug. 18.

20,154. R. W. James.—From S. Alimonda. An improved process for the tanning of skins. Complete Specification. Sept. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

5644. J. A. McIntosh. An improved method of treating hides and skins, &c. Sept. 2.

15,044. F. E. Burlingame. Manufacture of leather. Sept. 2.

17,370. E. E. E. Martens. A new or improved process for the preparation of liquid glue for joiners, upholsterers, and the like. Sept. 16.

XV.—AGRICULTURE AND MANURES, Etc.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

20,203. R. Silcock. Preparation or treatment of bones and mineral phosphates for fertilising purposes. Sept. 2.

1896.

15,473. E. Paternotte. Chemical manure mixers and the like. Aug. 26.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

19,815. G. Ranson. An improved process for refining and purifying sugar. Sept. 8.

19,825. M. von Schmidt and R. C. Wiener. A process to dissolve gum which is otherwise indissoluble. Sept. 8.

COMPLETE SPECIFICATION ACCEPTED.

1896.

17,195. J. A. Link. Improvements in and relating to adhesive compounds. Sept. 9.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

18,423. C. W. Ramsay. Improvements in the preparation of distilled beverages. Aug. 20.

18,624. F. Hannao. Improvements in or relating to the manufacture of malt and to kilns therefor. Aug. 22.

18,639. F. G. Powell, A. Powell, M. E. W. Powell, and R. H. R. Powell. Improvements in the manufacture of beer wort gyle or the fluid from which drinkables are made. Aug. 22.

19,245. S. E. Field. Improvements relating to malting. Sept. 1.

19,252. J. W. Crichton. A new or improved apparatus for keeping whiskey and other liquids cool. Sept. 1.

19,317. W. T. Clark. Improvements in the process of manufacturing and bottling beer and apparatus therefor. Sept. 1.

19,616. K. Pattermann. Improvements in or connected with the germination of barley and apparatus therefor. Sept. 1.

COMPLETE SPECIFICATION ACCEPTED.

1896.

9923. H. Gronwald. New or improved process and apparatus for increasing the stability of beer and other liquids containing carbonic acid. Sept. 2.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

18,275. L. G. Fagersten and C. F. P. Korssell. An improved process of sterilizing or pasteurizing milk and cream. Complete Specification. Aug. 18.

19,675. J. E. Duke. Improvements in the manufacture of liquid extracts of coffee or other substances and in apparatus for the purpose. Sept. 5.

B.—Sanitation.

18,444. F. P. Candy. Improvements in apparatus for use or in connection with the purification of sewage and polluted water. Aug. 10.

19,189. E. Green. New or improved apparatus for the mechanical treatment of sewage. Aug. 31.

C.—Disinfectants.

20,246. H. Hiscott. The manufacture of an improved disinfectant or composition for antiseptic disinfecting, sanitary, and other purposes. Complete Specification. Sept. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1895.

15,852. W. C. Kaufmann. Carbonated milk. Aug. 26.

17,061. S. D. Rowland. Concentrating alimentary or pharmaceutical liquids or other substances, and apparatus therefor. Sept. 2.

22,968. A. E. Cole. Improvements in Swiss or condensed milk. Sept. 16.

B.—Sanitation.

1895.

19,360. H. J. N. Berge. Processes and apparatus for the purification of drinking water. Aug. 26.

1896.

15,611. W. G. Waterman.—From L. Alers-Haukey. Apparatus for purifying water. Aug. 26.

16,034. E. W. Ives. Apparatus for the treatment of sewage and other liquids. Sept. 9.

C.—Disinfectants.

1895.

19,814. E. W. Rowsell and C. Stansfeld. A crystal carbolic disinfectant and deodorant powder. Sept. 9.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATION.

18,265. M. Honig. Improved manufacture of tannin-extract from sulphite cellulose lyes. Complete Specification. Aug. 18.

COMPLETE SPECIFICATION ACCEPTED.

1895.

19,471. G. W. A. FitzGeorge and H. J. Brown. Rapid paper-coating process. Sept. 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

18,369. T. O. Kent. A new or improved essence of cocoa and the method of preparing the same. Aug. 19.

18,981. A. Koelliker. The manufacture of acid salts of piperazine and fatty acids, and the production therefrom of double salts of lithia and piperazine. Aug. 27.

19,603. P. Auchinachie. Improvement in the distillation of aromatic waters, such as elder-flower water, rose-water, and the like. Complete Specification. Sept. 4.

19,744. J. J. A. Trillat. Improvements in the production of formic aldehyde vapours. Filed Sept. 7. Date applied for Feb. 5, 1896, being date of application in France.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

17,061. S. D. Rowland. See Class XVIII. A. Sept. 2.

20,827. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of pharmaceutical substances. Sept. 2.

22,351. G. W. Johnson.—From C. F. Boehringer and Soehne. Manufacture or preparation of vanillin. Aug. 26.

1896.

11,538. A. Krefting. Method of treating seaweed to obtain valuable products therefrom. Sept. 2.

16,947. J. C. Mewburn.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. Improvements in mono-alkyl ethers of pyrocatechin and in the production of such ethers. Aug. 26.

16,162. J. C. Mewburn.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. New perfume and process for the manufacture of the same. Aug. 26.

XXI.—PHOTOGRAPHY.

APPLICATIONS.

19,726. W. Grunow. A new or improved apparatus for developing, fixing, and toning photographs. Complete Specification. Sept. 7.

20,080. A. C. Edwards. Improvements in means or apparatus employed in the manufacture of photographic films. Complete Specification. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,935. A. Hill and A. A. Barratt. Obtaining photographs in true relief in gold, silver, and other metals. Sept. 2.

22,692. G. Koppmann. Light-proof coloured positive-paper. Sept. 16.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

18,547. A. Nobel. Improvements in the manufacture of ordnance powder. Aug. 21.

19,071. H. Maxim. Improvements in the manufacture of smokeless explosive compounds. Aug. 28.

19,740. W. G. Hay. Improvements in and connected with explosive shells. Sept. 7.

20,069. W. P. Thompson.—From La Société des Explosifs Industriels. Improvements in the manufacture of explosives. Complete Specification. Sept. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,574. P. Fowler and A. W. F. de Courey Bower. Lucifer matches. Aug. 26.

20,307. A. Pain. Detonating fog signals for railways. Sept. 2.

1896.

10,403. H. Boyd. A new explosive. Sept. 16.



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NOTICES.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready about the end of the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

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Foreign and Colonial Members are reminded that the subscription of 25s. for 1897, payable on January 1st next, should be sent in good time to the Treasurer, in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation, should reach the General Secretary not later than January 15th, 1897.

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SESSION 1896-97.

Nov. 2nd:—

J. A. Voeleker, Ph.D. "The Production of Inoculating Materials for use in Agriculture (Nitrazin)."
Arthur Caldecott. "The Smelting and Refining of Cyanide Bullion."**Liverpool Section.**

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SESSION 1896-97.

Nov. 4th.—Chairman's Address. "The Synthesis of Physiologically Active Organic Compounds."

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SESSION 1896-97.

Nov. 6th.—Chairman's Address.

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SESSION 1896-97.

Dates of Meetings.—Nov. 19th, Chairman's Address, Dec. 17th, Jan. 25th, Feb. 25th, March 25th, April 25th.

Nottingham Section.

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SESSION 1896-97.

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SESSION 1896-97.

Dates of Meetings.—Glasgow: Nov. 21th, Jan. 26th, March 30th, April 27th. Edinburgh: Dec. 22nd, Feb. 23rd.

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SESSION 1896-97.

Dates of Meetings.—Oct. 26th, Nov. 30th, Jan. 25th, Feb. 22nd, March 25th, and April 26th.

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SESSION 1896-97.

The opening meeting of the Session was held at the College of Pharmacy, 115, West 68th Street, on Friday evening, Oct. 23.

The following papers were read:—

Chairman's Address.

J. A. Bradburn. "The Ammonia-Soda Process and the Alkali Trade of the United States."

G. W. Thompson. "On the Determination of Sulphate of Lime in Paints."

H. Endemann. 1. "Formaldehyde as a Reagent," 2. "On Asphaltum."

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Concentrating Liquids, Process and Apparatus for. L. M. H. R. Baudoin and P. E. L. Schribaux, Paris. Eng. Pat. 15,958, Aug. 24, 1895.

A process for concentrating wine or similar liquids, is described. It consists in vaporising the volatile components of such liquid, so as to reduce them to an extract; in condensing separately and successively the water and alcoholic vapours; and in mixing the condensed alcoholic vapours with the extract. The apparatus consists of an evaporator, a serpentine coil to condense the steam, a receiver heated by a steam coil so as to enable the condensed water to be reconverted into steam when desired, an alcoholic vapour condenser, an alcohol extraction pump, and a mixing chamber, wherein the alcohol and extract are mixed.—R. A.

Heating, Evaporating, and Concentrating Infusions and Liquids, Impts. in Means or Apparatus for. A. M. Huggill, J. Overton, and R. H. Catley, Liverpool. Eng. Pat. 19,103, Oct. 11, 1895.

Is apparatus for heating, concentrating and evaporating infusions, the patentee uses a steam or otherwise heated tray, inclined at an angle. This tray is constructed of a series of tubes, through which the heating medium circulates.—R. A.

Cooling Liquids, Impts. in, and Apparatus connected therewith. W. T. Ramsden, Middlesex, and A. G. Southby, Forest Gate, Essex. Eng. Pat. 19,782, Oct. 22, 1895.

This invention relates to improvements in apparatus for cooling liquids, such as water, or wort, by exposing them on surfaces exposed to currents of air. The liquid is made to fall in a shower or spray within a vessel through which air is drawn or forced, in an upward direction, by means of an exhauster, air propeller, or other suitable appliance. A series of perforated trays are fixed horizontally alternately to opposite sides of the vessel crosswise, so that, while the liquid falls vertically through the trays, the air is caused to pass between the trays, and through the falling liquid.—R. A.

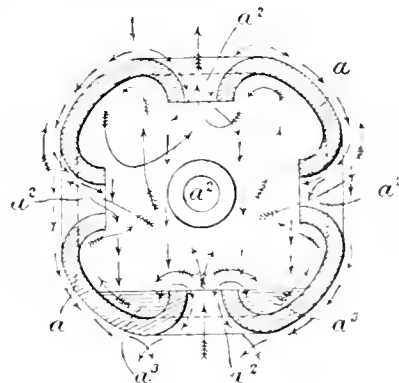
* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Lack, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Liquids of Different Densities, New and Improved Means and Apparatus for bringing into Intimate Contact. J. G. Calvert, Gothenburg, Sweden. Eng. Pat. 16,137, Aug. 28, 1895.

An apparatus is described for intimately mixing together liquids of different densities. It consists of a vessel provided with agitating, mixing, and churning devices and also means for admitting the heavier liquid in regulated quantity "into the upper part" of such vessel, and for withdrawing it at the lower part, and also means for admitting the lighter liquid, in regulated quantity, "into the lower part" of the vessel, and withdrawing the resulting liquid at the upper part of it.—R. A.

Means for facilitating Contact between Liquids and Gases for the Purpose of obtaining Reactions. O. Guttman, London. Eng. Pat. 14,774, July 3, 1896.

The towers, wherein reactions between gases and liquids are usually effected, are filled with hollow bodies made of glass, earthenware, or other substance which will not



be acted upon by the gases or liquids used. The bodies are formed with openings a^2 , provided with short internal necks, and may be corrugated, to increase their surface. In the figure, the direction taken by the gases is indicated by feathered arrows, and that taken by the liquid by unfeathered arrows, a portion of the liquid being retained in the recesses a^2 round the internal necks.—R. A.

[Salts, &c.] *Purifying Centrifugally-Separated Substances. A New and Improved Process for.* A. Rohrbach, Erfurt, Germany. Eng. Pat. 15,485, July 13, 1896.

The patentee states that instead of employing saturated steam, or a mixture of steam and air—which are liable to partially redissolve centrifugally-separated substances owing to the condensation of the steam—superheated steam, or a mixture of superheated steam and air, gives better results in a centrifugal machine. The temperature of the steam should be so regulated that it condenses only so much as is necessary to dissolve the impurities. The substance may be subjected to a preliminary purification, by washing it with a concentrated solution of the salt operated on.—R. A.

II.—FUEL, GAS, AND LIGHT.

Gas Works Purifiers, Revivification in. H. Termin. J. f. G.-beleuchtung, 39, [40], 650.

IN place of emptying the purifiers by hand every time it becomes necessary to revivify the oxide of iron, a hole 50 mm. wide is bored under the lowest floor in each, and connected with a discharge pipe leading to the chimney shaft. Back draught is prevented by a valve near the chimney, and each purifier is fitted with a separate cut-off valve.

The gas valves being closed, the ventilators are opened, and revivification is effected in the time otherwise occupied in emptying and refilling the purifiers. The necessary water is supplied by sprinkling the upper surface of the oxide of iron. Even after use six times over, the oxide does not obstruct the passage of the gas, but, as a precautionary

measure, the ordinary process of revivification is then adopted.

The temperature of the exhaust pipe should not exceed 40°C ., and is regulated by the taps affixed to the purifiers. The ill odour produced in the purifying house, when revivifying by steam, is destroyed by means of the hot gases in the retort furnaces.—C. S.

Acetylene, The Limiting the Explosive Proportions of, and Detecting and Measuring the Gas in the Air. F. Clowes. Brit. Assoc., Chem. Section, 1896.

THE value of acetylene as an illuminant, and the discovery of its ready production from calcium carbide, have led to the manufacture of this gas in some quantity; and acetylene will probably be dealt with in still larger volume in the near future. It becomes, therefore, important to devise methods of detecting its presence in the air, arising from leakage and escape, and to measure the percentage of the gas present at any place. It is also important to ascertain what proportions of the gas, when present in mixture with air, will lead to explosion if the mixture should be kindled.

The detection of small proportions of the gas will not be readily effected by its smell when it is prepared in a state of purity. At present the smell is made much more pronounced by the impurities which the commercial gas contains. Further, the smell will not in any case furnish a means of measuring the proportion present in the air. The method applied by the writer to the detection and measurement of fire-damp and coal-gas in the air, however, serves for detecting and measuring acetylene as well. A small hydrogen flame, set to either 5 or 10 mm. in height, as may be necessary, shows a pale but well-defined "cap" in air containing any proportion of acetylene below the lowest explosive proportion. When the hydrogen flame is exposed to the air to be tested for acetylene in a darkened space, it is at once tinged yellowish-green. The bluish pale cap has the following heights with varying proportions of acetylene, when the hydrogen flame is 10 mm. in height:—

0.25 per cent. gives 17 mm. cap.
0.50 " " 19 " "
1.00 " " 28 " "
2.00 " " 48 " "

When the hydrogen flame is reduced to 5 mm.:—

2.50 per cent. gives 56 mm. cap.
2.75 " " 79 " "

A convenient portable form of apparatus was shown by the writer, which enabled air to be passed readily over the standard hydrogen flame in a darkened vessel, and which quickly furnished the reading of the height of the cap.

In determining the limits of explosibility, when acetylene is mixed in gradually increasing proportion with air and kindled, the writer adopted a simple method, referred to at the last meeting of the Brit. Assoc. (1895). It was found that air must contain at least 3 per cent. of acetylene before it can be kindled by a flame and the mixture caused to burn throughout. As the proportion of acetylene is increased, the explosive character is augmented. When 22 per cent. of acetylene are present, carbon begins to separate during the burning. The amount of carbon which separates, increases until the explosive character of the mixture disappears. This point is reached when 82 per cent. of acetylene are present in the air.

The limiting percentages in air which are explosible, are accordingly as follows, and may be compared with those already determined by the writer for other combustible gases:—

Acetylene	3 to 82
Hydrogen	5 to 72
Carbon monoxide	13 to 75
Ethylene	4 to 22
Methane	5 to 13

It will be seen that acetylene gives a wider range of explosive proportions than any other of these gases does. Probably this is due to its endothermic nature, which leads to the gas being able to generate heat by its own decomposition. Heat thus generated would undoubtedly aid in causing explosion, and would thus extend the limits of explosive mixtures.

Welsbach Incandescent Light. Söhren. J. für Gasbeleuchtung, 1896, 39, [34] and [35], 545—550 and 561—566.

WHEN the Auer von Welsbach incandescent light first came before the public, about the middle of the year 1886, it gave an illuminating power of about 14 candles with an hourly consumption of 2.8 cb. ft. of gas, or 5 candle power per cb. ft. per hour. The mantles were composed of various mixtures of the oxides of zirconium, lanthanum, yttrium, magnesium, thorium, cerium, &c. They were so fragile and the illuminating power was so little better than that given by the ordinary burner, that it was not until 1891, when Welsbach had further perfected his invention, that the new light really attracted public attention. The illuminating power had then increased to about 50 candles, with an hourly consumption of 3.5 cb. ft., or 14 candles per cb. ft. per hour, and the mantles lasted for about 800 hours. A more recent development has been the alcohol incandescent lamp, suitable for districts where no gas supply is available.

The author discusses the various forms of burner used for incandescent gas lighting. The most noteworthy recent improvements consist in arrangements for regulating the air supply to the burner, and for effecting a very thorough mixture of the air and gas before the latter is burnt.

In making the mantle, a tubular-formed fabric of the purest cotton, free from ash, is used, and is first thoroughly purified by means of hydrochloric or hydrofluoric acid. It is then impregnated with "lighting fluid," consisting of a solution of the nitrates of the rare earths; and one end, which is to constitute the upper end of the mantle, is treated to another impregnation, either with the fluid or with solution of aluminium and magnesium nitrates, &c., in order to strengthen it. After drying, the upper end of the fabric is drawn together somewhat, by means of asbestos thread, the whole is suspended from a holder, and the cotton burned away, leaving a skeleton of the oxides. The average weight of an impregnated mantle is 5.123 grms.; after "burning off," 0.680 gm.; and the available surface is 54 sq. cm., of which 45 sq. cm. act as glowing surface.

According to Welsbach's first patent, mantles for emitting white light consist of various mixtures of lanthanum, yttria, zirconia, and magnesia, neodymia being added to produce yellow light, and ceria to produce greenish light. His second patent claims the use of thorium in such mixtures as the above, and the use of ceria to produce an intense yellow light; it also claims the use of niobates, tantalates, silicates, titanates, and phosphates of thorium, zirconium, and magnesium for strengthening the contracted part of the mantle, and the use of ammonium nitrate in the fluid to expedite the "burning off." A later patent claims the use of thorium mixed with uranium oxide in making mantles. According to Mackean (this Journal, 1891, 196), the individual pure oxides give, with a consumption of 3.0 cb. ft. of gas per hour, at a pressure of 1 in., the following results:—

Lanthana	22.5 candle power: light, white.
Zirconia	12.2 " " white.
Thorium	25.0 " " bluish white.
Yttria	19.8 " " yellowish white.
Ceria	4.0 " " nearly red.

It is therefore evident that the extraordinary illuminating power of the Welsbach light is not due to one of the oxides alone, but to certain mixtures of them.

The chief sources of the rare earths are *orthite* and *allanite*, containing 10—20 per cent. of cerous oxide, 3 per cent. of yttria, 10 per cent. of lanthana, some ceria, &c.; *gadolinite*, with yttria, lanthana, cerous oxide, ceria, &c.; *scenotime*, with 62 per cent. of yttria, 11 per cent. of cerous oxide, 27 per cent. of phosphoric acid; *eukenite*, with 31 per cent. of niobiac acid, 18 per cent. of yttria, 2 per cent. of cerous oxide, &c. (according to other analyses, containing still more Nb_2O_5 and Y_2O_3); *yttriotantalite*, with 19 per cent. of yttria, &c.; *ferugonite* and *tyrite*, with 48 per cent. of niobiac acid, 46 per cent. of yttria, and 4 per cent. of cerous oxide; *cerite*, with 13 per cent. of cerous oxide, and 8 per cent. of lanthana and didymia; *zircon*, with 57 per cent. of zirconia, tantallic acid, &c.; and *monazite*, with

cerous oxide, lanthana, &c. These minerals contain but little thorium, and are very scarce, and accordingly very expensive. Thorium was obtained at first from *thorite* and *orangeite*, which occur as small crystals scattered through Norwegian igneous rocks, and contain on an average 73 per cent. of ThO_2 , 17 per cent. of SiO_2 , and 10 per cent. of water. These minerals are, however, so extremely rare, as is also *aceschynite* (which contains 15 per cent. of ThO_2), that some other source had to be found to meet the demand for thorium. *Monazite* has met the want: it is a mineral occurring in large quantities in the gneiss and granites of the Brazilian coast and in the river sands of North and South Carolina and Canada. *Monazite* contains about 3 to 4 per cent. of ThO_2 , and the sand at present shipped to Europe consists of 70 per cent. of *monazite*, mixed with zircon, xenotime, ilmenite, magnetite, gravel, and organic matter. Drossbach found in Brazilian *monazite* 60–70 per cent. of cerous oxide, 0.5 to 1.5 per cent. of thorium, and erbia, with other oxides of the yttrium group. Fresh sources of *monazite* are continually being discovered, and the price of sand containing 70 per cent. of *monazite* is about 30*l.* per ton f.o.r. in N. Carolina, 37*l.* per ton f.o.b. New York, or 18*l.* per ton c.i.f. Hamburg.

Analyses of mantles made by the German Incandescent Gas Light Co. having shown that the prescriptions of Welsbach's patents were not being exactly followed, but that the mantles consisted chiefly of thorium, with about 1 to 2 per cent. of ceria, a great number of competing companies have been manufacturing mantles of similar composition, on the supposition that such prescriptions were not protected by Welsbach's patent, so that there are now about 74 manufacturers of incandescent burners in Germany. The prices have accordingly been much reduced, and in the endeavour to obtain a still cheaper form of mantle, Häfner has patented a combination of alumina and oxide of chromium. Much costly litigation has been entered upon by the competing companies in endeavouring to procure the revocation of Welsbach's patents, and the decision of the Supreme Court has turned out much to Welsbach's disadvantage.

The concluding part of this paper is devoted to a description of the author's experiments in choosing a suitable brand of incandescent burner for the gasworks at Bonn, and a general discussion on street lighting, bye-pass lighting, glass and mica chimneys, &c.—H. B.

Thorium Nitrate, Commercial Investigation of. The Separation of Thorium and Cerium. R. Fresenius and E. Hintz. *Zeits. Anal. Chem.* 1896, **35**, 525.

From the results of analyses of incandescent mantles and of commercial thorium nitrate, the following conclusions are drawn:—(a.) The mantles containing least ceria, are, nevertheless, appreciably richer therein than the most impure commercial thorium nitrate reputed to be richest in ceria. In the mean, the mantles examined contained 1 per cent. of ceria, which is about five times the amount found in the most impure thorium nitrate. (b.) Thus the ceria found in the mantles cannot be regarded as an impurity due to the use of commercial thorium nitrate, but must either, at least in part, have been added, or must occur in the mantles through the use, unintentional or not, of a correspondingly impure thorium nitrate rich in cerium.

The ratios of the two earths in the mantles varied between 2.02 grms. of ceria to 96.42 grms. of thorium, and 0.38 grm. of ceria to 28.91 grms. of thorium. By an analysis executed in the following manner on two mixtures of this composition, it was shown that such amounts of ceria can be separated. A solution containing 13.890 grms. of thorium and 0.2910 grm. of ceria, was diluted to 4 litres, and, after addition of sodium thiosulphate, heated to boiling. The precipitate was filtered off and washed, the filtrate precipitated by ammonia, this precipitate filtered, washed, dissolved in hydrochloric acid, and the solution evaporated. The residue was dissolved in water and a little hydrochloric acid, and the solution again boiled with thiosulphate, the small precipitate so obtained filtered off, the filtrate precipitated by ammonia, and the previous treatment repeated. Finally, the precipitate was dissolved in nitric acid, the solution evaporated, and the aqueous solution of the residue precipitated by oxalic

acid, the precipitate ignited and weighed. The cerium dioxide so obtained still contained 0.0021 grm. of thorium; after correcting for this, the weight of ceria found was 0.2852 grm., as compared with 0.2910 grm. taken. A similar result was obtained with a solution containing the earths in the other ratio given. (See this Journal, 1896, 675.)

The final conclusion is that thorium nitrate can now be prepared in a more pure state than that used in the manufacture of mantles, and that either cerium is added to the impregnating liquid or a thorium nitrate rich in cerium is intentionally employed.—A. C. W.

Petroleum: Raising the Flashing Point v. Improved Lamps. Chem. Rev. Fett- u. Harz Ind. **3**, [47], 177–183.

With reference to the objections that have been urged against the possibility of regulating the sale of "safe" lamps, the opinion is expressed that there could be little difficulty in prescribing that each lamp should be provided with a lengthened wick-duet, reaching to the bottom of the receiver and so cutting off communication with the external air. It is also pointed out that the use of high-test oil would, by reason of the decreased capillarity of the heavy oils, necessitate a modification of the lamps in the direction of shallower receivers, in addition to the provision of a stronger draught to ensure complete combustion.

An exception to the general rule that an increase in the flashing point is attended with a more rapid rate of decrease in the flame of the lamp, is afforded by an expensive "safety oil" sold in Austria, which, with a specific gravity of 0.778, has a flashing point of 41½° C. (Abel). This oil, however, in experiments made with a "Reform Kosmos" burner, giving a 70-mm. flame, was consumed at a greater rate per hour (40 grms.) than a Roumanian oil of sp. gr. 0.8295 and flashing point 21.5° C. (37 grms.), tested under identical conditions. A third oil (sp. gr. 0.826; flashing point 28.5° C.) burned at the rate of 37.5 grms. per hour. A Russian oil, also subjected to the same test, behaved as follows:—

(a.) Oil of sp. gr. 0.820 and flashing point 28.7° C. Consumption, 38 grms. per hour.

(b.) Same oil with 1 per cent. of benzine (0.763); sp. gr. 0.8195, flashing point 28.5° C. Consumption, 40.8 grms.

(c.) Same oil with 5 per cent. of benzine; sp. gr. 0.8187, flashing point 21° C. Consumption, 43 grms.

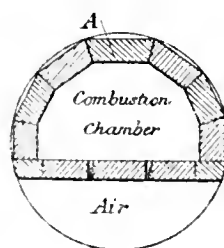
With the safety oil, the curve of illumination rose rapidly, and then remained fairly stationary, but in the case of the second and fourth oils, it declined after attaining the maximum.

The conclusion drawn by the writer is to the effect that light oils with high flashing point can but seldom, and heavy oils never, be burned in ordinary lamps, and that a reconstruction of the lamp being necessary, it may just as well be effected in such a manner that low-test oil can be burned with safety. Furthermore, in addition to the increased cost of high-test oil, the larger quantity burned per hour entails an additional expense on the consumer.—C. S.

Petroleum, Trial of, as Fuel for Boilers, with Movable Hearths, conducted at the Works of Wegher and Richmond, Ltd. L. Le Chatelier. *Bull. de la Soc. d'Encouragement*, 1896, **8**, 1169–1174.

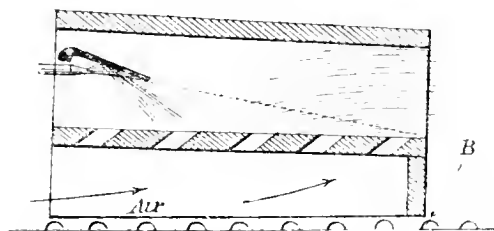
The first trials were made with a boiler heated from a concentric movable combustion chamber of sheet iron,

Fig. 1.



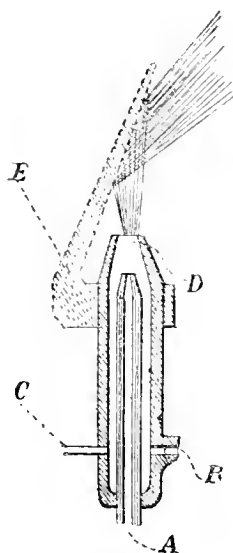
protected internally by an arched lining of refractory bricks, and supplied with air through openings in a floor within the chambers, in which the bricks are arranged as shown in Fig. 1: air is also admitted to the fire space beyond the

Fig. 2.



movable chamber through orifices (Fig. 2) in the grill B. The chamber is constructed in two parts, 1.1 metre and 0.6 metre respectively in length, and the shorter part, being movable, admits of modifying the total length at pleasure. The grill had three ranges of thin bevelled bricks, arranged "en chicane," so that the air spaces admitted of ready adjustment, and also so that the direction of the air currents should be nearly at right angles to the jets of petroleum and steam. The boiler experimented with was one of a pair, coal being used in heating the other. The contents of the boiler was 4,450 litres, containing, at medium level, 3,450 litres of water. Crude American petroleum of 0.910 density was used. The burner was of the pulverising injector type (Fig. 3), the central tube A, contracted at its

Fig. 3.



opening, giving passage to steam, while petroleum, previously heated to 40°–50° C. by passage through a water-jacket kept at 100° by communication with one of the boilers, enters at B, mingling in the annular tube with the air entering at C. A metal deflector E, has a concave surface presented towards the jet, and facilitates the mixture of the petroleum and air. Another form of deflector in sheet-iron, a trapeze in vertical section, and widening towards the mouth, is also shown. The cistern containing the petroleum is placed at such a height as to give a pressure at the tuyère of 0.3 kilo. The tube conveying the petroleum is of 31 mm. internal diameter, and that carrying the steam is of 12 to 15 mm. diameter, and in part of its length the steam is superheated by passage through one of the tubes of the second generator, previously put under pressure. The total section of holes for admission of air to the chamber was 7 square decimetres for a chamber 1.5 metre long.

The results of a three hours' trial were that 10.25 kilos. of water were vaporised per kilo. of petroleum consumed. During this trial, the temperature in the furnace, behind the generator and above the register, was from 210°–235° C., and a constant pressure of 6 kilos. was maintained. In subsequent trials a better result was obtained by bringing the burner and its deflector nearer to a horizontal position than at first, a vaporisation of 12.6 kilos. of water per kilo. of petroleum consumed, at a rate amounting to 500 kilos. of water vaporised per hour, being attained. The temperature taken in the combustion chamber by the *Le Chatelier* pyrometer varied between 900° and 950° C.; the maximum attained at the back of the boiler was 250°. The corresponding temperatures for the companion boiler, heated by the combustion of coal, were respectively 800° and 226°.

The tube combustion chamber was afterwards shortened, by means of its movable piece, by 0.4 metre, and the section of air holes diminished to 5.5–6.0 square decimetres of total section, when it was found possible to increase the consumption of the petroleum up to 15 to 50 litres per hour, while the time necessary to raise the pressure in the boiler was reduced to little over an hour. These later trials gave a production of 511 kilos. of steam per hour, or 14.2 kilos. per square metre of heating surface, each kilo. of petroleum volatilising 12.3 kilos. of water. The highest temperature obtained in the hearth was 850°, and 230° to 235° at back of the boiler. The rate of combustion was regulated according to the character of the smoke issuing from the chimney; normally, a slight yellowish smoke, the appearance of any black smoke requiring correction. It was found necessary to place a filtering screen in the petroleum reservoir, to prevent clogging of the burner.

Conclusions.—It results from these experiments that, under the specified conditions of working, namely, the charge of petroleum, reheating, superheating, dimensions of the hearth, access of air, &c., it is possible to vaporise 12.5 kilos. of water per kilo. of petroleum. The volume of air required for the combustion, deduced from the chemical composition of the petroleum, may be taken as equal to 25 cubic metres per kilo. of the combustible, and the air openings of the ash-pit door and grill need to be so regulated as to obtain a speed of air current of between 4.5 and 6.5 cubic metres per second. It will be understood that these figures are not to be taken as absolute; that they depend upon the installation and the trials made as described, and they may be considerably modified under changed conditions, such as in working with apparatus of a different type, or even of similar type, but of different force. These results confirm preceding conclusions: that the vaporising power obtained with coal and with the heavy petroleum oils are sensibly proportional to the calorific power of these fuels, which is, roughly, in the relation of 1 to 1.5 for the case considered. In the course of the trials, 11,000 calories have been taken as the figure representing the calorific power of the petroleum oil used. Hence it may be seen that the utilisation, in per cents. of the total heat, is sensibly the same in both methods of heating, whether it be with coal or with the heavy petroleum oils.

A further trial is described with a semi-portable machine, No. 3, of 10 horse-power, in which the consumption of petroleum proved to be 1.785 kilos. per horse-power per hour, agreeing closely with an estimate previously made, based upon the usual consumption of coal in working the boiler.—E. S.

Ethylene, Estimation of, in Gaseous Mixtures. P. Fritzsche. *Zeits. f. ang. Chem.* 1896, 456.

See under XXIII., page 745.

Petroleum in Canada. Ironmonger, Oct. 3, 1896, 3.

See under Trade Rep., page 752.

Acetylene for Lighting. Chem. and Drug., Oct. 17, 1896, 580.

See under Trade Rep., page 753.

PATENTS.

Refractory Substances [Pencils for Arc Lights], Impts. in the Manufacture of, and Apparatus therefor. E. A. Pellet, Paris. Eng. Pat. 15,103, Aug. 10, 1895.

MAGNESIA, derived from strongly heated magnesium carbonate, is moulded under great pressure into blocks or pencils of suitable form, which are packed into a crucible in alternate layers with charcoal. The crucible, closely covered, is heated by the combustion of gas carbon or graphite in a furnace, the inner wall of which is built up of magnesium carbonate moulded into bricks, the outer wall being of fireclay bricks and the interval filled in with charcoal and covered with earth. After long-continued heating to the highest attainable temperature, the fire is allowed to die out, and the furnace is sealed until it is cold. The inner wall of magnesium bricks, after being thus heated, furnish the magnesia from which the pencils are moulded for the next charge. Magnesia blocks or pencils thus prepared are used in arc lamps in such manner that the carbous of a lamp bear against the magnesia block placed between them, the pressure being maintained by means of a weight or spring, thus dispensing with complex apparatus. —E. S.

Gas [from Coal, Coke, Petroleum, and Water], Impts. in the Manufacture of. T. G. McKwen, Leytonstone. Eng. Pat. 15,366, Aug. 15, 1895.

THE coal is fed into a closed furnace and passes down over two inclined planes, losing its volatile matter in transit, and falling into the fire below in the condition of coke. The vapours from a mixture of oily matters and water, heated in a saddle boiler over the fire, escape and mingle with the products of combustion in a brick chequer-work flue, whence they pass over the coal on the upper incline and effect its distillation. Thence they are led downwards through a second chequer-work of firebrick (on to which is sprayed hydrocarbon oil to further enrich the gas), then upwards through a third chequer-work, and down through a chequer-work pile of firebrick to the outlet. —C. S.

Fluid Hydrocarbons for Lighting and Heating Purposes [Vapour Burners], Impts. in and relating to Apparatus for the Burning of. P. C. Tennant, Bishopsgate, London, and A. H. Crockford, Dartford, Kent. Eng. Pat. 16,515, Sept. 3, 1895.

THE apparatus is designed to produce a vapour burner or "industrial lamp" which shall efficiently burn the lower grades of petroleum oils, such as heavy or crude petroleum, or tar oil from gasworks. Reference is made to two previous patents, Nos. 235 and 9305 of 1895. The vaporising chamber consists of tubes or passages which cross or intersect each other between the inlet and outlet passages, four pairs being illustrated. A wind guard or ignition tube is adjustably mounted between the nozzle jet and the vaporiser. The oil-supply vessel is arranged approximately at an angle of 15° to the axis of the burner head, being mounted in a tubular piece or chamber at the upper end of the stand pipe, so that it can be turned about its axis. —R. S.

Petroleum [Injection with Air and Superheated Steam] Burning Furnace. W. T. Chamberlain and C. B. Beebe, Boston, U.S.A. Eng. Pat. 14,465, June 30, 1896.

THIS invention relates to the feeding and distributing of oil in petroleum-burning furnaces, the oil as it enters the combustion chamber being mixed freely with air and superheated steam. The combustion chamber is supported within the boiler by a large number of hollow stay bolts, the outer ends of which are all connected to the oil-supply pipe, while the inner ends are preferably covered with very fine wire gauze. A pipe leads superheated steam from the dome to a small chamber beneath the combustion chamber. This small chamber is connected to the combustion one by hollow bolts, through the centre of which pass smaller tubes open externally to the atmosphere, whereby both superheated steam and air pass freely in fine streams into the combustion chamber, where they meet the oil sprays. —R. S.

Liquid Hydrocarbons, in Conjunction with an Incandescent Hood or Mantle, to Produce an Incandescent Oil Burner; Method and Means of Burning. W. Darby, J. Darby, and J. H. Punchard, all of Pentonville, London. Eng. Pat. 16,716, Sept. 6, 1895.

THE object of this invention is to modify an oil lamp so that it can be used with a Welsbach or like mantle. The oil is vaporised, and mixed with a large proportion of air before it reaches the mantle, where the full combustion takes place. To accomplish this, the usual circular wick has an inner and an exterior wick tube, with both of which it is in combination. Within the former of these wick tubes is a projecting perforated cylinder allowing air to pass to the wick from the central and air tube. Above the wick are two other perforated air tubes, one a little above and to the outside thereof, the other higher up and towards the centre. The latter carries a perforated rose, upon which the crutch supporting the mantle is placed. This arrangement and connection of wick with wick tubes, and perforated cylinders, and these with the air supply, is for the purpose of "producing and regulating, first, the partial combustion of the oil at the wick; and, secondly, the complete combustion within the mantle of the gases produced by such partial combustion." —R. S.

Bunsen Burners, Incandescent Burners, and the like; Impts. in. W. P. Thompson, Liverpool. From A. Baudsept, Brussels. Eng. Pat. 17,927, Sept. 25, 1895.

WITH the object of increasing the intimacy of the mixture of air and gas in the burner, and so abolishing the internal cold zone of the Bunsen flame, the inventor employs a series of fixed (gauze) or movable (fan) atomisers at the nozzle of the burner, and maintains the speed of the gas current by means of several tuyères of increasing size in the lower part of same, the air supply entering by way of a number of perforations in the surrounding wall of the burner.

For the purpose of incandescent lighting, a smaller supply of gas is admitted than for heating, and the tuyères are modified so as to obviate the destruction of the mantles by too excessive heat. —C. S.

Incandescing Mantles, Impts. in Materials [Magnesium Calcite] for, and Processes for manufacturing the same. W. L. Voelker, Elizabeth, New Jersey, U.S.A. Eng. Pat. 17,191, Aug. 4, 1896.

A SOLUTION of equivalent proportions of calcium and magnesium nitrate is evaporated to dryness and heated until decomposed. If a yellow tinge of light be desired, one-eighth of 1 per cent. of cerium nitrate is added to the original mixture; or to obtain a ruddy tinge, the same proportion of chromium nitrate. The mixed oxides are fused in an electric furnace having a thick interior lining of pure lime. The fused oxides flow into a mould or open vessel beneath, while the charge within the furnace descends by gravity towards the electrodes. The fused mass is finely ground and worked up with a viscous compound, and, after rolling, is subjected to prolonged pressure at about 110 F. It is then rolled into sheets or drawn into threads for forming mantles. A mixture of one part each of camphor and gun-cotton, and 40 parts of oil of cassia, with four parts of sulphuric acid, is made and forms the viscous material; one part of this mixture is combined with three parts of the calcium-magnesium oxides, and treated as described. —E. S.

Carbonic Acid Gas, Impts. in the Manufacture of, by the Utilisation of Waste Products produced in making Calcium and other Carbides. H. S. Elworthy, Bandra, Bombay, and P. D. Henderson, London. Eng. Pat. 19,445, Oct. 16, 1895.

See under VII., page 719.

Gas Producer [Gas from Smalls and Dust], An Improved. A. Clouard, Caen, France. Eng. Pat. 20,430, Oct. 29, 1895.

THIS producer is designed for the preparation of permanent combustible gases, chiefly from rich small and dust coal.

The principle of the method consists in the introduction of a current of steam and air at two different levels in the (vertical) furnace—one to maintain the combustion of the fuel, and the other to assist the distillation of the upper layers of coal. The products of distillation are returned through a side flue to the centre of the furnace, where, meeting the downward portion of the upper current, the tars, &c., are decomposed into permanent gases, and the whole of the products of distillation and combustion escape through a side outlet at a somewhat lower level. When the coal is very rich, a current of air is admitted into the furnace on the same level as the returned products of distillation, to assist in their decomposition by aiding the combustion of the coke at that level. The mass of coke formed in the upper section of the furnace continually requires breaking up—an operation effected by a stoking fork suspended in the head of the retort, and caused to descend automatically by a hydraulic arrangement (or other suitable means). Several modifications of the furnace and its appendages are given.—C. S.

Acetylene Gas, Impts. in Automatic Apparatus for the Manufacture of. J. E. Atkinson, Liverpool. Eng. Pat. 20,468, Oct. 30, 1895.

This invention relates to automatic apparatus for generating acetylene from calcium carbide, and consists of two generators communicating with a gas-holder, and each provided with a removable box to hold the carbide. The generators are independently connected, through regulating cocks controlled by the movement of the gas-holder, to a multiple-way cock for the water supply, having a port so shaped that the cock opens slowly as the gas-holder begins to descend, and rapidly afterwards. Communicating pipes and valves are so arranged that when the carbide in one generator is exhausted, the water automatically passes to the other freshly charged generator, after which the exhausted box may be emptied and refilled.—R. S.

Acetylene [New Generator] for Illuminating Purposes, New or Improved Apparatus for Producing and Consuming. A. H. J. Schülke, Berlin. Eng. Pat. 14,929, July 6, 1896.

The generator—forming the base of the lamp—consists of a water vessel containing a bell receiver, in which is suspended the carrier to hold the calcium carbide. The limit of ascent of the bell is determined by projecting stops on the outer vessel, and when this point is reached, any further gas disengaged, escapes through a central tube projecting through the bottom of the vessel and leading to a larger bell gas-holder, where it is stored, to be returned automatically as the pressure in the receiver diminishes.

The lamp is situated above the receiver.—C. S.

Calcium Carbide, An Improved Process and Apparatus for the Manufacture of [Electrical Furnace]. W. R. King and F. Wyatt, New York, U.S.A. Eng. Pat. 13,881, June 23, 1896.

In this process, finely pulverised lime and coke are used in about equal proportions and subjected to electrical action in the open air; or, to economise ground space, a furnace constructed as follows may be employed:—The furnace is open at the top and has vertical walls constructed of fire-brick, which need not be lined with protective material, as they are not subjected to great heat. Through the centre of the bottom of the furnace there projects up, a good-sized carbon stick, forming the negative electrode. The positive electrode is adjustably mounted on a swinging frame which stands at one side of the furnace. The powdered mixture of coke and lime is shovelled in to any desired height, and a conducting core formed of a fine carbon rod, is thrust down through the mass till it reaches the lower electrode. The upper electrode is lowered on to it, and the material is heaped up round the side of the electrode so as to prevent the access of air. On the passage of the current, the core is gradually burnt away and the electrode descends, and the process is stopped when the voltmeter readings show that a nugget of carbide has been formed. The nugget is removed to a distance to cool by a pair of grasping tongs thrust down into the mass, a fresh core is inserted, more material shovelled in, and the furnace is

started again, the action being practically continuous. In this process the incandescence principle is employed instead of the arc, and either a direct or an alternating current may be used.—G. H. R.

Liquid Fuel Stores or Furnaces, Impts. in. B. J. B. Mills, London. From P. Carmien, Montbéliard, and A. Yvonnet, Roanne, both in France. Eng. Pat. 19,505, Oct. 17, 1895.

The stoves, which may be applied to heat kitchen ranges, ovens, cauldrons, or for any other purpose, consist of:—1st. A reservoir containing the oil the vapour of which is to be burned at a greater or less distance therefrom. 2nd. A communication between the reservoir and the burner or burners, consisting of a tube of small diameter, or of several such tubes enclosed within a flexible sheath or covering, or twisted together as a cable. 3rd. A vaporising tube in which the liquid is vaporised. 4th. A stove or burner varying in shape according to requirements. 5th. A heater, transmitting to the vaporiser the amount of heat necessary for the vaporisation of the liquid.—R. S.

Distilling [Tarry Matters], Impts. in Means or Apparatus for; also applicable for Enriching Gases by Means of Hydrocarbons. P. Dvorkovitz, London. Eng. Pat. 18,877, Oct. 8, 1895.

See under III., page 706.

Coal-Gas, Enriching; Impts. in the Method and Means of. R. G. Shadbolt, Grantham, and J. W. Broadhead, Elland. Eng. Pat. 5051, March 6, 1896.

The inventors, making use of the property of the lighter vapours in gas of absorbing the heavier illuminating constituents, return some 10 per cent. of the partly purified gas into the crude gas at a point between the retorts and the condenser—the exact position of the delivery varying according to circumstances—at a temperature of between 120° and 130° F. The result is that the accession of purified gas prevents the deposition of some of the heavier vapours (which would otherwise be lost to the gas), its illuminating power being thereby increased. Provision is made for heating the returned gas when necessary (e.g., in cold weather).—C. S.

Illuminating and Heating, New or Improved System [Mixing and Burning] and Means of, applicable with Gas and Mineral Oils. P. G. de Schodt, Namur, Belgium. Eng. Pat. 8509, April 22, 1896.

The essential portions of the apparatus consist of three parts: an impeller, a mixer, and a burner. 1st. Taking the case of gas, it receives an impulse to "make it capable of attaining" high temperatures, by the use of a pump having two cylinders, the pistons moving in cylinders alternately placed in communication with the motor gas supply and with the atmosphere. The power required for working the pump mechanism to give the impulse or "momentum" referred to, may be derived from tubes containing liquefied carbonic acid, and is automatically distributed to the two cylinders by a slide-valve arrangement regulated by a pendulum or balancing lever having a tube containing mercury attached to it, such mercury, as it becomes displaced, forming a counter-balancing weight alternately at either end of the pendulum. The illuminating or heating gas then passes to a pressure reducer or regulator. Or a motor cylinder and a compressing cylinder may be mounted one over the other, the motor cylinder having a working piston, above and below which the motor gas is alternately caused to act, whereby the required impulse is given through the medium of the piston of a large compressing cylinder. 2nd. The mixer consists of one or more injectors, the orifices of which are situated so as to face one or more cylindrical or truncated nozzles, producing vortices, while there is also a thin plate, perpendicular or at right angles to the direction of the currents, and a contracted tubular portion of a paraboloid segment. 3rd. One or more burners are fitted on the mixing tube, and have the form of an inverted truncated cone, carrying one or more incandescence caps or mantles. When a number of

burners is employed, the gas first passes into an expansion cone beneath them. The products of combustion are caused to pass round the mixer, and the flame is deflected downwards to act upon a sleeve or mantle, which is shaped as a mushroom and is surrounded by a light structure or basket of platinum, thereby acting as a recuperator or light-restoring device. The compressing apparatus may be used for imparting to air the momentum necessary for carburetting it, by carrying it through hydrocarbons or mineral oil. The carburetted air passes through the same apparatus as above.—R. S.

Vapour or Gas, Injecting into Furnaces [Fuel], Impts. in Apparatus for. P. M. Justice, Chancery Lane, London. From H. F. Atkinson, Rochester, U.S.A. Eng. Pat. 15,757, July 16, 1896.

For preventing the production of smoke in furnaces, an arrangement is provided whereby, upon opening the furnace door, a blast of steam or of air, or of mixed air and steam, is turned on and distributed over the fire space, which blast continues after the stoking is finished and the furnace door shut, for the space of time for which the apparatus is set. The injector nozzle has a depending tubular cup connected thereto, placed within the furnace, into which water flows from a supply tank, and wherein it boils, thus preventing the nozzle being damaged by the direct heat of the furnace. —R. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum in Oman, Borings for. A. Eyraud. Génie Civil, 29, [15], 235—237.

THE petroleum and bitumen springs in the neighbourhood of Ain Zeff appear along a line coinciding with the anticlinal axis of the mountain range, and indicating the existence of an important system of longitudinal fissures in the rock, through which the oil escapes, and, penetrating the superficial nearly detritus, makes its appearance at the surface.

At Ain Zeff, after three failures to obtain oil by boring, a fourth well encountered the oil sand at a depth of 416 m., in June 1895, and yielded 200 hectolitres of oil per diem, this quantity decreasing, however, to an average of 70 hectolitres at the time of the author's visit in November. The non-success of the other borings is attributed to their having been carried on in the upper strata of marl and gypsum and abandoned before arriving at the layer of oil sand.

At Sidi-Brahim a heading, 5 m. in length, has uncovered a permanent spring of oil and tar, yielding 29 litres per diem. Two wells have also been sunk, one of which had to be abandoned, through an accident, at 212·95 m., but the second well has reached a depth of 228·40 m., and is being sunk deeper. Traces of oil were met with at five different levels, and a vein of gas was struck at 184½ m.

Owing to the fact that the oil in the No. 1 well at Ain Zeff is derived from merely the surface of the oil sand, its composition is regarded as not representing the bulk. The Sidi-Brahim oil and that of the undeveloped sources at Taghria, are expected to yield 15 per cent. of burning oil, 28 per cent. of intermediate oil, 31 per cent. of lubricating oil, and 23 per cent. of paraffin, vaselin, &c.—C. S.

Benzene and Toluene, Purification of. A Method for Purifying, by means of Aluminium Chloride, Hydrocarbons containing Thiophene, its Homologues, and other Impurities. Haller and E. Michel. Bull. Soc. Chim. 15, 1896, 1065—1070.

WHEN preparing benzoylbenzoic acid by the Friedel and Crafts' method, it was observed that a much purer acid was obtained when, in place of using crystallised commercial benzene, the benzene employed was such as had been recovered, i.e., had already been subjected to a treatment by aluminium chloride. The method under discussion is based on this discovery. It is employed on a manufacturing scale at the St. Denis works, and also in several laboratories, including that at the Ecole de Chimie at Mulhouse. The hydrocarbon, rendered as free from water as possible, is

agitated with aluminium chloride, the quantity of which depends upon the amount of impurity in the benzene. The amount of thiophene can be approximately determined by means of the indophenine reaction. When small quantities only are present, isatin and sulphuric acid give a blue coloration, whilst with more of the impurity a dirty brown coloration is produced. For a tolerably pure benzene, 0·5 to 1 per cent. is sufficient, but in certain cases as much as 4—5 per cent. may be required. After agitation, when a reddish viscous product separates at the bottom of the vessel, the hydrocarbon is rectified either directly from the same vessel or after separation. Benzene thus purified, not only does not show the indophenine reaction, but also does not colour sulphuric acid even after several days' contact, and it freezes at 5·4° C. With regard to the yields obtained, 1 kilo. of benzene, purified by sulphuric acid, after purification with 5 grms. of aluminium chloride, gave 980 grms., or a yield of 98 per cent. The results obtained with toluene are inferior as regards yield to those obtained with benzene. Toluene, which contains thiotoluene, gives a violet coloration with sulphuric acid and phenanthraquinone. The experiments were carried out with a sample of toluene boiling at 109·5°—111° C., and giving a dark yellow coloration with sulphuric acid. After heating 2 kilos. of toluene with 2 per cent. of aluminium chloride on a sand bath for an hour, the product, after distillation, ultimately yielded 77·55 per cent. of pure toluene. The toluene thus purified is no longer coloured when shaken with sulphuric acid, and does not give the phenanthraquinone reaction. This process is the subject of the following patents:—Fr. Pat. 240,111 and Ger. Pat. 79,505, 1894.—T. A. L.

Thiophene in Benzol, Rapid Volumetric Estimation of. G. Denigès. Bull. Soc. Chim. 15, 1896, 1064.

See under XXIII., page 746.

Mineral Oil and Paraffin Industries. Krey. Chem. Rev. Fett- u. Harz Ind. 3, 174, 189, 198.

See under Trade Rep., page 754.

PATENT.

Distilling [Tarry Matters], Impts. in Means or Apparatus for; also applicable for Enriching Gases by means of Hydrocarbons. P. Dyckovitz, London. Eng. Pat. 18,877, Oct. 8, 1895.

THE apparatus consists of two or more closed chambers (preferably three), superimposed, each of which is fitted with a heating coil and a capped outlet for drawing off the distillation residues into the vessel next below. When used for carburetting gases, the gas to be enriched is introduced above the surface of the tarry matter employed, and the action may be increased by passing a current of air, or of the gas itself, through the tar by means of perforated pipes provided for that purpose.—C. S.

IV.—COLOURING MATTERS AND DYES.

Triphenylmethane Dyestuffs, The Influence of the Position of the Sulphonic Group on the Shade and Fastness of. T. Sandmeyer. J. Soc. of Dyers and Colourists, 12, [9], 154.

A SERIES of experiments have led the author to conclude that the greenish-blue shade and fastness to alkalis of Patent Blue and other dyestuffs of this class, prepared by condensing *m*-oxybenzaldehyde with alkylated aromatic amines, sulphonating the resulting leuco compounds and then oxidising the same, are due to the presence and position of the sulphonic group, and that the employment of the meta-oxy compounds is not essential, as has been supposed.

By condensing tetramethyldiamidodiphenylcarbinol with metanilic acid, eliminating the amido group of the resulting leuco compound by means of the reactions of Griess, and subsequent oxidation, the author has succeeded in preparing the hitherto unknown orthosulphonic acid of Malachite Green. The result fully justified his conclusion, inasmuch as the resulting dyestuff was fast to alkali, and of a beautiful blue shade.

It is thus shown that triphenylmethane colouring matters can be converted by the introduction of the sulphonic group in the ortho position to the methane carbon, into colouring matters which are bluer in shade and fast to alkali.

The preparation of benzaldehyde orthosulphonic acid is also described.

o-Chlorobenzaldehyde is heated with a neutral solution of sodium sulphite in autoclaves for 10 hours at 190–200° C. The solution of the sulphonic acid thus obtained, is acidulated and boiled, to destroy excess of sulphite. This preparation in combination with ethylbenzidine gives a beautiful green dye, analogous to Acid Green.—I. S.

Meldola's Base (p-Amidobenzene-azo-amido- α -naphthalene).

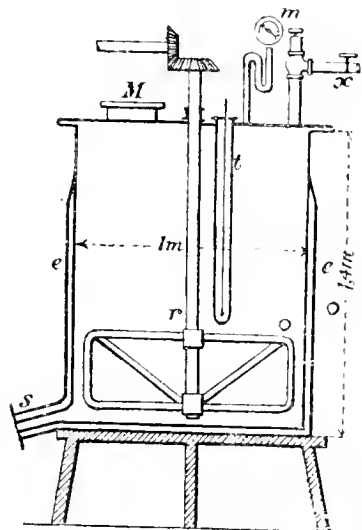
L. Paul. Zeits. für ang. Chem. 1896, 520–524.

As to the preparation of Meldola's base, the following details are given:—

I. *Preparation of the Nitro-amido Base.*—14 kilos. of *p*-nitraniline are dissolved in 86 kilos. of hydrochloric acid (12° B.) by blowing in steam, the solution being filtered through a small flannel filter into a 2,300-litre vat, provided with an agitator, and containing about 1,000 litres of water, the residue being boiled up with water (2 buckets full) and 10 kilos. of hydrochloric acid. After cooling to 5° C. by adding ice, 6–7 kilos. of sodium nitrite as a 25 per cent. solution are quickly added, and the resulting diazo solution, containing a slight excess of nitrite, is only faintly turbid. In the meantime, 14 kilos. of α -naphthylamine are dissolved in about 500 litres of water and 11–12 kilos. of hydrochloric acid (20° B.), and mixed with another 500 litres of cold water. The solution, when quite cold, is filtered into a 4,000-litre vat fitted with an agitator, into which the diazo solution is also run. The combination is complete in about an hour, when 45–50 kilos. of soda lye (10° B.) are added and the nitro-base is filter-pressed, giving about 230–240 kilos. of cake.

II. The reduction is carried out in a steam-jacketed iron vessel represented in the accompanying figure.

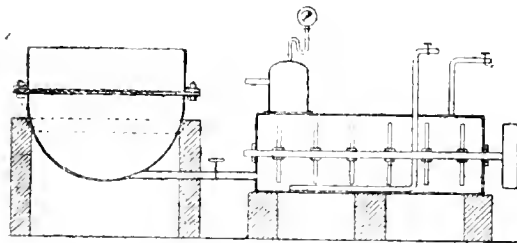
Fig. 1.



It contains about 1,320 litres, and is provided with steam-jacket *e*, discharge pipe *s*, an agitator *r*, manhole *M*, thermometer tube *t*, pressure-gauge *m*, and blow-off valve *x*. About 500 litres of alcohol are put into the vessel and well mixed with the press-cakes from the preceding operation and 60 kilos. of crystallised sodium sulphide. The temperature is then raised by means of the steam jacket to 60° C., and the pressure, which rises to half an atmosphere, is reduced by opening the valve *x*. At 75° C. the steam is shut off, and the temperature rises spontaneously from 78° to 80° C., the pressure being half an atmosphere. The apparatus is kept for about five hours at this temperature, and next day,

when cooled to 30°–35° C., the solution is filtered to remove iron sulphide, and run into a 1,500-litre vat containing 585 litres of water and 100 kilos. of ice. The temperature rises to 10° C., and the volume is 1,200 litres. After two hours' agitation the base is completely precipitated, and, having been filtered off, is twice washed with water. The alcoholic solution is run into a horizontal boiler (see figure 2), and, after

Fig. 2.



previous neutralisation with lime, the alcohol is distilled off. The yield is 15.5 kilos., whilst an experiment on a smaller scale gave 19 kilos. Since the sulphate is insoluble, this salt may be used for quantitative determinations of the base.

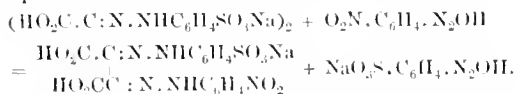
III. When 5 kilos. (= 750 grms. dry) of the nitro-amido paste obtained under I. is treated with 15 kilos. of sodium bisulphite (35° B.) and 1.5 litres of water at 80°–90° C. in a lead-lined vessel for 6–7 hours, a sulphonic acid is obtained, which dissolves easily in water and dyes wool and silk in presence of bisulphite and tartar emetic or cotton mordanted with alumina, a sulphur yellow, but it is not suitable for printing. The colouring matters, however, have no technical value, and are only of interest from the fact that they are turned blue on the fibre by alkalis, and orange by acids. The action of alkalis on the nitrosulphonic acid forms a red nitroso sodium sulphonate. This or the yellow sodium nitrosulphonate, on reduction with sodium sulphide at 60°–70° C. and precipitation with hydrochloric acid, when the melt turns violet, yields a monosulphonic acid, which, however, cannot be diazotised, and also appears to be unstable. The same reactions can be carried out with the azo colouring matters obtained from 1,4'-amidonaphthol in place of α -naphthylamine, but the products have no technical interest.

IV. *Preparation of Nyanza Black.*—8 kilos. of diamine base (= 2.9 kilos. solid) are dissolved in so much water at 50°–60° C. and 6 kilos. of hydrochloric acid (12° B.), that the total volume amounts to 210 litres. After filtration and titration of a sample with nitrite, the residue being twice treated with 0.5 kilo. of hydrochloric acid and 25 litres of water, 9 kilos. of hydrochloric acid are added and so much ice that the temperature is reduced to 8°–10° C., the total volume then being 300 litres. This is diazotised (only one amido group reacts) by adding 3.76 kilos. of a 25 per cent. nitrite solution, and the whole, after about 10 minutes, is run into a solution containing 3.29 kilos. of amidonaphthol sulphonic acid G (47 kilos. of a 7 per cent. solution), and 7.4 kilos. of sodium carbonate (equivalent to 5 mols. of hydrochloric acid, 12° B.). After 12 hours' agitation the whole is boiled up, when the colouring matter separates in a granular form. On filter-pressing and drying, 6.3 kilos. of strong colour are obtained, which, after dilution with 66½ per cent. sodium sulphate, is sent into the market as Nyanza black.—T. A. L.

Tartrazine, Action of Diazo Compounds on. R. Grehm and L. Benda. Ber. 29, 2017–2019.

By combining *p*-nitrodiazobenzene with an alkaline solution of Tartrazine, a considerable quantity of nitrogen is disengaged, and, after neutralisation with dilute hydrochloric acid, there results a reddish-brown precipitate, which dissolves in hot water with an orange-yellow colour, and separates in yellow needles. Sodium carbonate colours the aqueous solution red, whilst concentrated caustic soda added to the solid substance colours the latter reddish-brown to violet, and, on warming, a very small quantity is

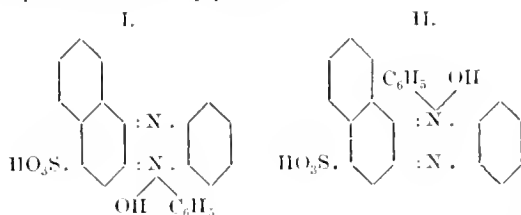
dissolved with a violet colour; when the solution is diluted the reddish colour is produced, which is obtained directly with sodium carbonate. Wool is dyed orange from an acid bath, the shades being very fast to light. The course of the reaction appears to be represented by the following equation:—



The *p*-diazobenzene sulphonic acid which is split off decomposes at once with evolution of nitrogen. This view is supported by the analytical data and also by the fact that a substance identical with the above is obtained by combining equimolecular proportions of dioxytartaric acid, *p*-nitrophenylhydrazine and *p*-phenylhydrazine sulphonic acid. Some volumetric data are quoted with regard to the amount of nitrogen evolved, which approximates to 2N. It is proposed to investigate other Tartrazines and diazo compounds in the same manner.—T. A. L.

Azonium Compounds from β-Naphthoquinone Sulphonic Acid and Phenyl-o-Phenylene Diamine. F. Kehrman and E. Locher. Ber. 29, 2072—2075.

The condensation of 1,2,4-naphthoquinone sulphonic acid and phenyl-*o*-phenylene diamine yields the two azonium compounds theoretically possible:—



One molecular proportion of the potassium salt of naphthoquinone sulphonic acid is dissolved in just sufficient water at 20° C., acidified with sulphuric acid, and nearly one molecular proportion of phenyl-*o*-phenylene diamine hydrochloride in an aqueous solution is gradually added. A crystalline precipitate separates out, which, after half an hour, is filtered off, washed with water and alcohol, and then heated with acetic acid in the proportion of 50 c.c. to every 2 grms. of precipitate. After cooling, the whole is filtered, when a light yellow crystalline powder of I. remains behind, whilst the filtrate on standing deposits dark brown prisms of II. Both compounds can be purified by crystallisation from 70 per cent. acetic acid. The compound I. forms brownish-yellow crystals, melting at 302°—304° C., tolerably soluble in dilute alcohol and acetic acid, with a yellow colour and a greenish-yellow fluorescence. A trace of aniline added to the alcoholic solution colours it carmine (formation of Phenylrosinduline). The sulphuric acid solution is magenta-coloured. The analytical results point to the substance being constituted as above, but the authors consider it still possible that an inner condensation may have taken place between the sulphonic acid group and the hydroxyl. In the case of compound II. such a condensation has undoubtedly taken place, the substance crystallising from 70 per cent. acetic acid in reddish-brown prisms, which melt above 360° C. The solutions in alcohol or acetic acid are reddish-yellow and non-fluorescent, and whilst I. is almost tasteless, II. has a very sweet taste and dissolves in sulphuric acid with a dirty purple-red coloration. By boiling the alcoholic solution with aniline or dimethylamine, it turns violet-blue and deposits bronzy crystals. The condensation of β naphthoquinone with phenyl-*o*-phenylene diamine has also been carried out, and the compound obtained in the form of its well-crystallised iron double salt. The preparation of this compound is of especial interest, since it is the parent substance of Rosinduline and Isorosinduline, and experiments are in progress to eliminate the amido group from these compounds with a view of proving their azonium structure. In conclusion, reference is made to Kehrman's paper (Annalen, 290, 247 *et seq.*;

this Journal, 1896, 536), again pointing out that Fischer's arguments (Ber. 29, 1870; this Journal, 1896, 646) against the azonium formula are fallacious, and that the author's views still best express the relationship between the Safranine bases and their salts.—T. A. L.

PATENTS.

Salts of Aniline and its Alkyl Derivatives and of all its Homologues, Process for Producing the. A. Welter, Crefeld, Germany. Eng. Pat. 15,836, Aug. 22, 1895.

The process consists essentially in evaporating the aniline base, after neutralisation with an acid, in a vacuum pan, at a comparatively low temperature (60° C.). Important advantages are claimed. In the first place, the whole of the base employed is obtained as anhydrous crystalline salt, this being the case even with the salts of certain bases (alkyl derivatives of aniline, &c.) hitherto known only as syrups. Volatile impurities, such as hydrocarbons, &c., are expelled; and as regards the salts of volatile acids, the excess of acid is driven off, and perfectly neutral preparations obtained. Mixed salts, homogeneous in composition, may be produced straight away, by operating on a mixture of the corresponding bases. Finally, the decompositions and changes incidental to drying at high temperatures (e.g., the transformation of aniline nitrate into nitraniline) are entirely prevented.—H. T. P.

Sulpho Acids of the Naphthalene Series, and of Colouring Matters [Red to Violet] derived therefrom, Impt. in the Manufacture of. H. H. Lake, London. From "Farbwerk Mühlheim," Mühlheim-on-the-Maine, Germany. Eng. Pat. 19,253, Oct. 14, 1895.

The 1,1',3-amidonaphthol sulphonic acid is of no technical value, but on sulphonation it yields 1,1',3,4'-amidonaphthol disulphonic acid, which possesses valuable properties. The constitution of the new acid has been determined on the one hand by boiling it with dilute sulphuric acid at 110° C., when one sulphonic acid group is split off, the original acid being regenerated; whilst if it be fused with caustic alkalis, the amido group is replaced by the hydroxyl group, and a dihydroxynaphthalene disulphonic acid is obtained identical with that of Eng. Pat. 17,141C of 1893 (this Journal, 1894, 878). In order to produce the new acid, 1 kilo. of powdered monosulphonic acid is dissolved in 5 kilos. of concentrated sulphuric acid. The disulphonic acid gradually separates in a crystalline form, and the whole melt is then poured into ice water, boiled up, and the disulphonic acid is salted out. The new acid is to be employed as a dyestuff component in the usual manner, and if two molecular proportions are combined, for example, with one molecular proportion of tetrazoditoly, in a concentrated alkaline solution, the intermediate compound first formed is gradually transformed into the tetrazo dyestuff, which gives blue shades on unmordanted cotton. Diazotised *p*-nitraniline sulphonic acid gives, on combination in an alkaline solution, a colouring matter dyeing deep red shades, whilst *p*-nitraniline gives a reddish-violet, and aniline disulphonic acid (by sulphonating metaniline acid) gives a scarlet. A green for unmordanted cotton is obtained by first combining diazotised sulphanilic acid with one molecular proportion of the new acid in a slightly acid aqueous solution. The mono-azo dyestuff thus produced is dissolved in an excess of sodium carbonate and mixed with one molecular proportion of the intermediate compound from tetrazoditoly and salicylic acid. After the combination is complete, the dyestuff is isolated in the usual manner.

—T. A. L.

Azo Dyestuffs [Yellow to Red] from New m-Nitraniline Sulphonic Acid, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst a. M., Germany. Eng. Pat. 20,313, Oct. 28, 1895.

The specification describes the preparation of azo colouring matters from the *m*-nitraniline sulphonic acid of Eng. Pat. 14,382 of 1895 (this Journal, 1896, 539). The following is a typical example of the method employed:—2.18 kilos. of *m*-nitraniline sulphonic acid mixed with 1.2 kilos. of

hydrochloric acid and sufficient water to form a thin paste are diazotised at the ordinary temperature by adding a solution of 0.69 kilo. of sodium nitrite. The diazo compound formed is run into 2.39 kilos. of amidonaphthol sulphonic acid G, stirred up with water to form a thin paste. The liquid turns an intense red, and, after stirring some time, is neutralised with soda and the dye-stuff is salted out. It forms a brown powder, easily soluble in water to a red solution, which dyes wool a bluish-red in even shades very fast to alkalis. The range of colours, according to the dye-stuff component employed, varies from yellow to red.

—T. A. L.

Colouring Matters [Violet or Blue Tetrazo]. *Impts. in the Manufacture of.* H. H. Lake, London. From K. Ochler, Offenbach-on-the-Maine, Germany. Eng. Pat. 20,530, Oct. 30, 1895.

THESE colouring matters are obtained from *o*- and *p*-hydroxyquinolines and their homologues by employing them for combination with the intermediate compounds produced for instance, by combining equimolecular proportions of benzidine and 1.1'.3.3'-amidonaphthol disulphonic acid, of which the following may be taken as an example as to the quantities employed:—10.6 kilos. of tolidine are converted into the tetrazo derivative and combined with 17 kilos. of the acid sodium salt of 1.1'.3.3'-amidonaphthol disulphonic acid. The intermediate compound thus obtained is poured into an alkaline solution of 7.5 kilos. of *o*-hydroxyquinoline. After standing some hours, the mixture is heated and the colouring matter is salted out, filter-pressed, and dried. The dyestuff has a greyish-green metallic lustre and dissolves in water to a violet-brown solution which dyes cotton a dark violet shade. In place of tolidine, benzidine or dianisidine may be employed, the shades obtained varying from violet to red li-b-blue. They are said to be distinguished by their clearness and fastness to light.—T. A. L.

Nitrotoluene, Impts. [Separation of Isomerides] in the Treatment of Technical. A. G. Green, Heaton Moor, and H. Benfey, Manchester. Eng. Pat. 20,941, Nov. 5, 1895.

THE object of this invention is the production from technical nitrotoluene (which contains the ortho- and para-isomers) of *p*-toluidine and *o*-nitrotoluene. This is effected by fractional reduction with any suitable soluble sulphide, advantage being taken of the fact that *p*-nitrotoluene is more readily reducible than the ortho-compound. A special feature is the use of Leblanc alkali waste as reducing agent.—H. T. P.

Trisazo Colouring Matters, Manufacture of New. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Hoechst-am-Main, Germany. Eng. Pat. 21,342, Nov. 11, 1895.

THE dihydroxynaphthalene sulphonic acid S of Ger. Pat. 67,829 will combine with two molecular proportions either of the same or of different diazo compounds. If the second diazo compound in the above combination be replaced by a molecular proportion of a tetrazo compound, a derivative is obtained which will further combine with amines, phenols, naphthols, or their sulphonic or carboxylic acids. The colouring matters thus obtained dye wool and cotton in shades fast to light and soap. Moreover, those combinations which contain a diazotisable group may be further diazotised on the fibre, and when developed give very fast shades of violet to deep black. One molecular proportion of dihydroxynaphthalene sodium sulphonate S and three molecular proportions of sodium carbonate are dissolved in water to a 10—15 per cent. solution, mixed with one molecular proportion of diazonaphthionic acid, and stirred for six hours. About four molecular proportions of sodium carbonate are then added, and afterwards one molecular proportion of tetrazodiphenyl at 0° C. After standing 1—2 hours, the intermediate compound is poured, with constant agitation, into a solution containing one molecular proportion of amidonaphthol disulphonic acid II and 2—3 molecular proportions of sodium carbonate, in a small quantity of water. The formation of the colouring matter is complete in about 12 hours, when it is separated and purified in the

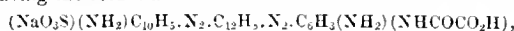
usual manner. The operation can also be carried out in such a way that equimolecular proportions of tetrazodiphenyl and amidonaphthol disulphonic acid II are combined to form an intermediate compound, which is then combined with the mono-azo colouring matter from naphthionic acid and dihydroxynaphthalene sulphonic acid S. Another modification consists in combining one molecular proportion of tetrazodiphenyl with one molecular proportion of dihydroxynaphthalene sulphonic acid S and one molecular proportion of amidonaphthol disulphonic acid II in an alkaline solution. The product thus obtained is then further treated in an alkaline solution with one molecular proportion of diazonaphthionic acid. A large number of instances of the various combinations are quoted, but no further details are given as to the shades of the colours produced.—T. A. L.

Sulpho Acids of the Naphthalene Series and of Colouring Matters derived therefrom, Impts. in the Manufacture of. H. H. Lake, London. From Farbwerk Mühlheim, Mühlheim a. M., Germany. Eng. Pat. 21,919, Nov. 18, 1895.

THE amidonaphthol disulphonic acid B (Eng. Pat. 19,253 of 1895; see page 708), produced by sulphonating 1.1'.3-amidonaphthol sulphonic acid (obtained by fusing 1.3.1'-naphthylamine disulphonic acid with alkalis), yields, by the action of caustic alkalis, 1.1'.4.3'-dihydroxynaphthalene disulphonic acid identical with that described in Eng. Pat. 17,141 of 1895 (this Journal, 1894, 878). The azo colouring matters derived from the acid B can also be transformed into the corresponding dihydroxy dyestuffs either by the action of alkalis or mineral acids. For the production of the new acid, 5 kilos. of the disulphonic acid B, dissolved in 10 kilos. of caustic soda lye (40 B.) and 40 litres of water, are heated for 10 hours in an autoclave to 220°—240° C. The reaction is complete when a sample diluted with water, made acid with hydrochloric acid, and treated with sodium nitrite, yields a yellow solution which does not turn violet when made alkaline with sodium carbonate. The whole solution is then acidulated with hydrochloric acid and the new acid precipitated with salt. As an example of the production of a dihydroxy colouring matter, 1 kilo. of the dyestuff obtained from diazosulphanilic acid and acid B in a slightly acid solution, is added to 8 kilos. of caustic soda lye (40 B.), and the solution is boiled until ammonia is no longer evolved. The melt is then diluted and acidulated with hydrochloric acid, when the dihydroxy dye-stuff separates in a crystalline condition and dyes wool bright red shades. By substituting other aromatic amido acids for the sulphanilic acid, shades varying from yellowish-red to claret can be obtained. The conversion by means of a mineral acid is carried out by boiling 3 kilos. of the dye-stuff (from *p*-nitrodiazobenzene and acid B in a slightly acid solution) with 10 kilos. of concentrated hydrochloric acid and 100 litres of water under an inverted condenser until a bluish-red solution is obtained and a dyeing on wool shows no further increase in purity of shade. The dihydroxy dye-stuff crystallises out on cooling, and dyes wool deep red shades.—T. A. L.

Disazo, and Polyazo Colouring Matters with Phenylene and Tolylen-aramic Acid, Manufacture of. O. Imray, London. From P. Remy, Farbwerk Friedrichsfeld, Mannheim, Germany. Eng. Pat. 22,114, Nov. 20, 1895.

THE specification refers to the employment of phenylene and tolylene oxamic acids as dyestuff components, the combinations being carried out in the usual manner. Thus a solution of 26.4 kilos. of benzidine sulphonic acid in 500 litres of water, with the necessary quantity of alkali, is converted into the tetrazo compound with 14 kilos. of sodium nitrite and added to 38.8 kilos. of tolylene oxamic acid in 1,000 litres of water containing 50 kilos. of sodium carbonate. After salting out the colouring matter, it is filter-pressed, washed, and dried. It dyes unmoderated cotton brown. In place of employing two molecular proportions of the oxamic acid, the second one may be replaced by some other dyestuff component. For instance, the dyestuff having the formula—



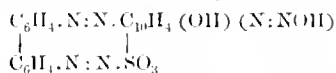
and obtained by combining tetrazodiphenyl with sodium naphthionate and phenylene oxamic acid, dyes unmordanted cotton scarlet. All these colouring matters may be further diazotised and combined on the fibre, giving shades fast to acids, alkalis, washing, and light. The conversion into polyazo colouring matters can also take place outside the fibre in the usual manner, giving as a rule dark shades.

By the employment of *m*-nitrobenzidine and the corresponding tolidine derivative in the above combinations, valuable wool dyestuffs are obtained, fast to washing, felling, acids, alkalis, and sulphur. In all the combinations the oxalyl group can be split off by boiling the dyestuff with dilute hydrochloric acid (about 5° B.). No material difference appears to be made in the shade by this treatment, but the derivatives obtained are capable of further diazotisation and combination. The following example illustrates this method:—A solution containing 40 kilos. of the hydrolysed product, obtained from equimolecular proportions of dionisidine, 1,4-naphthol sulphonic acid, tolylene oxamic acid, and *m*-tolylene diamine, in 1,600 litres of water, is diazotised with 8 kilos. of nitrite and 32 kilos. of hydrochloric acid (20° B.), and after half an hour is stirred into 600 litres of water containing 20 kilos. of R salt and 16 kilos. of calcined sodium carbonate. The colouring matter is salted out, and dyes unmordanted cotton blue. In the specification, tables are given of the various combinations which can be effected and the shades produced.

—T. A. L.

Colouring Matters [Reddish-Brown to Bluish-Violet]. Process for the Manufacture of Intermediate Compounds containing Two Diazo Groups and suitable for the Production of. M. Lange, Amsterdam, Holland. Eng. Pat. 17,293, Aug. 5, 1896.

By reacting with one molecular proportion of a tetrazo compound on one molecular proportion of a diazotised amidonaphthol or its sulphonic acid in a neutral or alkaline solution, there result intermediate compounds which, on combination with aromatic amines, phenols, and amidonaphthols, yield colouring matters dyeing from reddish-brown to bluish-violet shades. The formation of one of these intermediate compounds having the formula—



is obtained as follows:—18.4 kilos. of benzidine are converted into the tetrazo compound in an aqueous solution with 50 kilos. of hydrochloric acid and 13.8 kilos. of nitrite. The diazo compound from 23.9 kilos. of amidonaphthol sulphonic acid G is also prepared with 25 kilos. of hydrochloric acid, and the two diazo derivatives are mixed, a solution of soda being then added until the whole is strongly alkaline. The intermediate compound separates out as a blue crystalline precipitate, and is nearly insoluble in water.

—T. A. L.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Jute. Bleaching of. Grothie. Papier Zeit. 76, 1896, 2453.

The author says many materials can be bleached perfectly white if previously treated with a solution of silicate of soda ("Water-glass"), which cannot be done if the material has been simply boiled with soda. If jute be soaked and agitated for 15–20 minutes in a solution of 6–8 kilos. of water-glass in 10 litres of water at 85°–100°C., and then be washed in water, first warm and then cold, the material may be bleached a good white with a solution of bleaching powder.—S. P. E.

Chromium Fluoride for Wool-chroming. Textile Colourist, 18, [212], 230. (See also this Journal, 1888, 433; 1889, 982; 1890, 60, 732; 1891, 763; 1892, 365.)

Chromium fluoride is steadily displacing potassium bichromate, says the author, for mordanting wool. With chromium fluoride the green colour of the wool is seen from the beginning, and the wool is not oxidised; whereas

with bichromate this result can only be obtained after protracted boiling, the wool fibre being at the same time oxidised. Wool mordanted with chromium fluoride behaves generally with the alizarins like that mordanted with potassium bichromate, and in some cases, particularly with Alizarin Cyanines and Anthracene Blue, gives fuller shades with a finer greenish tone.

A special advantage of chromium fluoride is that it can be applied as a mordant for "topping" the lightest shades of indigo-dyed bottoms, since it has no oxidising action on the Indigo.—I. S.

Aniline Black on Wool with Ammonium Persulphate. T. Skawinski. Färber Zeit. 1896, 7, [22], 345.

A good full black, which rubs off but very little, may be produced on wool by the aid of ammonium persulphate ($\text{NH}_4)_2\text{S}_2\text{O}_8$. The wool (100 parts) is worked for 1½ hours in a cold solution of ammonium persulphate (5–10 parts) in water (4,000 parts). After removing surplus liquor, and without drying, the goods are padded in a solution of 120 grms. of aniline salt, 45 grms. of sodium chlorate, and 80 grms. of potassium ferrocyanide per litre, dried, steamed for ½ hour without pressure, washed, and soaped. For printing on wool the process has not so far given satisfactory results.—I. S.

Aniline Black, White and Coloured Resists on. L. Bloch and Ch. Schwartz. Bull. Soc. Ind. de Mulhouse, 1896, July, 301–303.

ALUMINATE of soda resists Aniline Black very well, and if care be taken when removing the thickening after the passage through the Mather-Platt apparatus, sufficient alumina remains fixed on the cloth to dye those parts with alizarins: red, yellow, fancy shades, and other colours. In this way white, and single-colour or two-colour effects on black grounds may be produced. The process is as follows:—

Pad the goods with aniline solution, print on a white resist consisting of sodium citrate and acetate, and then aluminate of soda. Pass through the Mather-Platt apparatus, remove thickening, dye at a low temperature (alizarins being applied in the usual manner), wash, dry, oil, steam, and soap.

The authors have obtained similar effects with albumin colours by using as a resist stannous sulphocyanide, which resists Aniline Black very well. But the albumin coagulates superficially, and the colours give way easily during soaping. Good results may be obtained, however, by using, along with this resist, certain of the basic colouring matters which resist the action of stannous sulphocyanide during steaming, such as Rhodamine 6 G, Methyl Violet, Victoria Blue, Malachite Green, &c. For the fixation of the colouring matter, a suitable antimony salt and tannin are added to the printing composition at the same time.

A white resist is made by dissolving 2.1 kilos. of barium sulphocyanide in 3.7 litres of warm water, to which are added 1.75 kilos. of tin salt and 4 kilos. of British gum. For coloured resists, 2.1 kilos. of barium sulphocyanide are dissolved in 1 litre of warm water, and to the solution 1.75 kilos. of tin salts are added, and the whole is stirred into a paste consisting of 2.5 litres of colour solution (50 grms. of a basic colouring matter in 0.5 litre of water and 0.5 litre of acetic acid) and 4 kilos. of British gum. When cold, 0.5 kilo. of tannin and 0.3 litre of acetic acid of 6° B. are added, and lastly 0.25 litre of antimony solution, made by dissolving 140 grms. of tartar emetic in 1 litre of calcium chloride solution of 8° B.—I. S.

Aniline Black, White and Coloured Resists on. (Note on preceding Article.) A. Romann. Bull. Soc. Ind. Mulhouse, 1896, July, 304–305.

The use of sodium citrate and acetate as a resist for Aniline Black, and the simultaneous employment of sodium aluminate to serve as a mordant for subsequent dyeing, have long been known. The process is of easy application, but has been abandoned on account of its inutility. The same effects may be produced by using albumin colours along with the resists in common use.

The author has repeated the process of Bloch and Schwartz, who employed stannous sulphocyanide, obtained from tin salt and a soluble sulphocyanide, as a white resist, and can confirm their results. Since the opening of their sealed note in which this process was made public, Bloch and Schwartz have published a modification of their formula, consisting of an addition of zinc sulphate and raw starch to their former mixture. The zinc sulphate reserves the albumin colours much better, but, on account of its acidity, it does not resist the aniline black so well, whilst the starch merely increases the viscosity of the mixture, necessitating a further increase of the proportion of sulphocyanide in order to obtain a good white. The author has shown by trials that the resists in common use—sodium carbonate, acetate, or citrate—produce a better white than stannous sulphocyanide.

The new formula of Bloch and Schwartz is stated to be as follows:—3.5 kilos. of tin salt and 2.8 of potassium sulphocyanide are dissolved in 7.5 litres of water, and thickened with 8 kilos. of British gum. To this mixture are added 1 kilo. of starch, 0.5 litre of water, and 2.5 kilos. of zinc sulphate.—I. S.

Indigo Substitutes for Cotton Yarns, Basic Dyestuffs as.
S. Freund. *Färber Zeit.* 7, [24], 378.

No substitute has yet been discovered which could replace Indigo as perfectly as, for instance, Alizarin does Madder in Turkey-red dyeing. Some of the basic colouring matters, however, so closely approximate Indigo in shade, fastness to light and soaping, that they are successfully applied as substitutes for that dyestuff.

Indoim Blue B B and Naphthindone B B appear to be the most suitable for this purpose. The properties of both are similar, the only difference being that the former is sold as a paste and the latter as a dry powder. The dyes with these colouring matters closely resemble those of Indigo, and all the usual shades of the latter can be produced; with Naphthindone even the copper shade of dark Indigo appears.

As a special advantage in the case of these two colouring matters as compared with other basic dyestuffs, the author mentions their great tinctorial powers, $1\frac{1}{2}$ to $2\frac{1}{2}$ per cent. giving full blues, whilst 3 per cent. is sufficient, it is stated, for the darkest shades. Great care is necessary, however, in order to obtain even dyeing. Calcareous water should be corrected by the addition of acetic acid, alum, or aluminium sulphate. Sumach is to be preferred to tannic acid in the mordanting, as it gives fuller shades.

The following proportions of sumach, antimony, and dyestuff are recommended:—

Dyestuff.	Sumach.	Double Salt of Antimony.
Per Cent.	Per Cent.	Per Cent.
1	7	$\frac{1}{2}$
$1\frac{1}{2}$	10	1
2	15	$1\frac{1}{2}$
$2\frac{1}{2}$	19	2

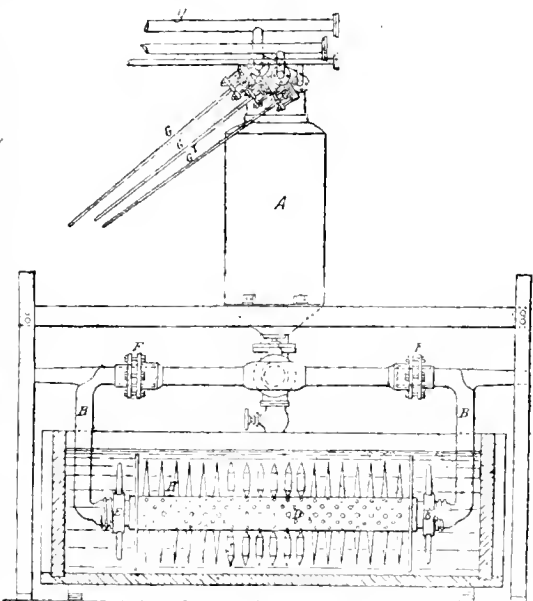
The sumach bath should be acidulated by adding to the same $\frac{1}{2}$ litre of acetic acid (30 per cent.) for every 50 kilos. of yarn, and the dye-bath by the addition of 3 per cent. of alum or 2 per cent. of aluminium sulphate. The colour is dissolved with the addition of $\frac{1}{2}$ litre of 30 per cent. acetic acid and is then added to the bath. Enter the mordanted goods at 50° C., work 20 minutes, lift, raise the temperature to 75° C., and work another 20 minutes. If the bath is not exhausted, add to it a decoction of 1 to 2 lb. of sumach, and work the goods for another 15 minutes. This second sumaching at the same time assists in the better fixation of the colour.

—I. S.

Dyeing Apparatus, Improved, for Yarns and Cloth. U.S.
Consular Reports, Sept. 1896, 52, [192], 152—155.

The drum A rests on suitable framework, and is connected by steam pipes with the hollow and perforated cylinder D.

Into this cylinder from 1,500 to 2,000 hollow and perforated spikes H may be screwed, on which latter the cops J are placed. By means of the thumb-screws E the cylinders can be quickly inserted into or removed from the arms B. The



joint F admits both of raising and dipping the cops carrier from or into the movable vat. The drum A is provided with a vacuum chamber and a compressed air cylinder, which are connected with a reversible air pump by pipes H, and are controlled by the valve handles G. A pipe from A leads to the tank containing the reserve dyes.

The dyeing is performed in the following manner:—A vacuum is created, whereby the liquor is sucked through the cops, the perforated spikes, and the cylinder into the drum A, where it is brought up to strength by a concentrated solution drawn in at the same moment and by the same force from a reserve tank. Then steam is admitted, and the liquor contained in the drum A is pressed outward. All operations of dyeing, washing, steaming, &c., both on cops or piece-goods, may be performed with this apparatus.—I. S.

Silk Warps, Printing of. Report of the Zürich Silk-Weaving School. *Textile Colorist* (U.S.), 18, [213], 267.

BEFORE the warps are delivered to the printer, a few picks are shot through at distances of 35—40 mm., forming a kind of woven portion, 7—15 mm. in length. It is advisable to weave at the beginning about 20 cm. of the stuff, and to shoot in several picks on either side of the lease-cord, to keep it in position.

For printing, the warp is stretched upon a table about 20 m. long, covered with cloth, and the colours are applied by means of blocks as is usual in hand-printing. When the whole length upon the table has been printed, 20 m. more of the warp are pulled on to it, whilst the printed part is placed upon a higher platform. When the entire length has been printed, the warp is hung up in a box, and is there exposed for 40—50 minutes to the action of very hot, dry steam to fix the colours. After steaming the warp is put into a bag, and agitated or "whipped" in water by two men, to remove adhering impurities; it is then "whizzed" in a hydro-extractor, and hung up in loops until dry. The warp is then again beamed, and whilst running on to the beam, is exposed to the action of the brush, whereby the threads are again neatly placed side by side. Designs may also be printed in this manner on dark dyed warps by discharge.—I. S.

Silk Pongees and Foulards, Printing of. Report of the Zürich Silk Weaving School. Textile Colorist (U.S.), 18, [213], 267.

A PECULIAR kind of block printing and treatment is applied to silk pongees and foulards, which are woven of raw silk. The dots and small designs on these goods, which are mostly of a light colour on dark ground, are produced as follows:—The material is first dyed a light colour for the design, and is then printed over with a cement-like mass (mastique). The printed parts are sprinkled over with finely-powdered pipe-clay to prevent these parts from sticking together, and the cloth is hung up to dry. The silk is then dyed a dark shade for the ground. The cement is subsequently removed with benzene, leaving a light design on a dark ground.—I. S.

PATENT.

Producing Print Patterns in Colours on Cotton Fabrics by the Aid of Safranine-Azo Dyestuffs. R. Michel, Vienna, Austria. Eng. Pat. 19,444, Oct. 16, 1895.

IN order to obtain red patterns on a blue ground, the cotton fabric, after having been dyed with a colouring matter derived from diazosafranine and a dyestuff component, is printed with a tin-acetate discharge, steamed, and washed, when the desired effect is obtained. For instance, the dyestuff produced from diazosafranine and β -naphthol in acetic acid solution, and known as naphthindone, is dyed on cotton cloth mordanted with tannin and tartar emetic. A discharge is then printed on, consisting of 2 litres of acetate of tin (42° Tw.), 200 grms. of wheat starch, and 150 grms. of white dextrin. The goods are then steamed and washed, when a bluish-red design appears on a dark blue ground. The shade of the former can be modified by printing with the discharge, non-reducible dyestuffs, such as Thioflavine T, or Eosine, &c. The process may also be reversed, the discharge being first printed as a resist. Moreover, the employment of a mordant is not in all cases necessary, since certain of the safranine-azo colouring matters dye unmordanted cotton.

—T. A. L.

VII.—ACIDS, ALKALIS, AND SALTS.

Salt in the Isle of Man. W. B. Dawkins. Proc. British Association, Chemical Section, 1896.

THE author states that salt was found from a boring made at the Point of Ayre. The salt set in at 500 ft. below the surface, and the total thickness of the rock salt was 33 ft. 6 ins., the two thickest beds being respectively 20 ft. and 9 ft. 6 ins. Besides these, a brine run, 2 ft. 6 ins. in depth, occurred at a depth of 615 ft. 5 ins. from the surface. The depth of the salt-field remained unproved.—A. S.

Tartaric Acid, The Manufacture of. V. Hölbling. Mitt. k.k. Tech. Gew. Museums in Wien, 1896, 6, 133—141.

THE source of the tartaric acid of commerce is the juice of the wine grape, in which it occurs in the form of acid potassium tartrate and calcium tartrate.

During and after the fermentation of the grape juice, part of the tartrates is deposited on the walls of the tun as argol, and part is contained in the sediment known as lees. The lees are used for the manufacture of tartaric acid, either in the moist condition or after being dried. The moist, pasty lees are removed from the tuns into sacks, and pressed. They then contain varying amounts of acid potassium tartrate and calcium tartrate, with some alcohol and higher esters. They are mixed with water and distilled, the distillate yielding the so-called Lager brandy and wine oil or Cognac oil. The residue, which is used for the manufacture of tartaric acid, contains from 1 to 8 per cent. of that acid. Lees containing a higher percentage of tartaric acid, which only occurs after the first stage of the fermentation, are well pressed and dried, usually by the heat of the sun, and sold as dried wine lees.

To obtain the tartaric acid from the crude materials (argol and wine lees), the only method suitable for technical purposes is the precipitation of the acid potassium tartrate

as calcium tartrate, and subsequent preparation of the tartaric acid from the latter. The methods of obtaining the calcium tartrate vary according to the nature of the crude material. A suitable method of obtaining it from argol is to mix the argol, preferably in the form of powder, with water, and boil, after the addition of some hydrochloric acid, the best proportions being 1—5 eb. m. of water with 110—120 kilos. of crude hydrochloric acid (20°—22° B.) to about 500 kilos. of argol. Milk of lime is then added to the boiling mass until this is nearly neutral, when calcium tartrate is precipitated and neutral potassium tartrate and calcium chloride left in solution. The neutral potassium tartrate is decomposed either by boiling with a sufficient quantity of calcium sulphate or by adding calcium chloride solution, an excess of the precipitant being avoided in either case. The small amount of acid potassium tartrate purposely left in the liquid, when treating the latter with milk of lime, is decomposed with pure precipitated calcium carbonate. The object of not adding the milk of lime to the neutral point or in excess is to avoid the precipitation of iron oxide and alumina. The solution must still remain perceptibly acid after the addition of the calcium carbonate. When cooled to about 40° C., the liquid is filtered with the aid of a suction pump, and the residue washed with water. The dark brown filtrate was formerly treated to recover the calcium chloride and potassium sulphate, but owing to the expense of the process of recovery and purification it is now a waste product.

In the oldest methods of obtaining calcium tartrate from wine lees the latter were boiled with water and hydrochloric acid, the clear solution removed, and the residue treated with more water. As the extraction was very incomplete, these methods have not been employed for the last 30 years. When filtration of the lees was first attempted it was found that the pores of the filter became clogged, and that even under a pressure of 4 or 5 atmospheres no liquid would pass through. This difficulty was overcome by the process of Dietrich and Schnitzer, in which the albuminoid substances are coagulated by heating for about six hours under a pressure of 4 or 5 atmospheres. This method has been in general use for about 30 years. Wet lees, when thus treated, can be readily filtered. Dried lees are crushed, stirred in a tank with water, and heated by steam for some time, until air is completely expelled, before being heated in the pressure boiler. According to the author's experience, preliminary boiling for more than half an hour is superfluous.

Dietrich and Schnitzer's pressure boiler consists of a tightly covered wrought-iron cylinder, with a manhole and charging opening in the cover, through which passes a copper steam-tube with a worm at the bottom, and having small openings at the top of the bend, so that the steam is regularly distributed throughout the entire mass. There is also a tube of copper, through which the lees are forced when the heating is finished. The dimensions of an average-sized cylinder, holding about 1,500 kilos. of lees, are 4 m. in length and about 1.4 m. in diameter. The tubes, which are of copper, and the interior of the boiler, require constant inspection to avoid the danger of an explosion, and every six months the boiler is subjected to a pressure test $1\frac{1}{2}$ times in excess of the maximum normal pressure, since the iron is rapidly corroded. To avoid this danger, and to obviate the drawback of having a considerable amount of iron taken up, which is troublesome in the further stages of the manufacture, experiments have been made to find a substitute for iron as the material for the boiler. Copper is undoubtedly the most suitable metal, but its high price, and the fact that it is not absolutely unattacked, have stood in the way of its adoption. Lining the interior of the cylinder with lead is useless, since the metal is rapidly attacked by the sulphuretted hydrogen liberated from the heated albuminoid matters, and rapidly peels off. The most effective means of protecting the iron is to line the boiler with cement. The most suitable dimensions for a boiler intended to be thus lined are 2 m. in diameter and 2 m. in height.

During the process of heating the lees, the steam passing from the apparatus carries with it volatile empyrenematic products derived from the decomposed albuminoids.

These have a very offensive odour, and should be conveyed into a factory chimney of sufficient height, so that the evil-smelling vapours are drawn up and decomposed by the furnace gases.

When the heating is finished, the steam-outlet pipe is opened and the pressure allowed to fall from 1 to $\frac{1}{2}$ atmosphere, this pressure being required to force the lees from the boiler into a tank, which may be suitably constructed of wood. Here they are mixed with water, which has previously been put into the tank, and the requisite quantity of crude hydrochloric acid (21° – 22° B.). Experience has shown that for every 100 parts by weight of argol in the lees, 100 parts of the acid are required. Too little acid causes deposition of argol in the cloths of the filter-press, whilst too much destroys the cloths, and more lime is required to neutralise the filtrate. If the conditions are right, the filtered liquid should have a specific gravity of about 6° B.

The acidified lees are pressed and washed, the washings being used instead of pure water for mixing with the next charge of lees from the pressure boiler. The tartaric acid in the filtrate is precipitated with lime and calcium carbonate, and the remainder of the process is the same as in the case of argol, with the exception that there is no necessity to add calcium chloride or calcium sulphate.

The calcium tartrate obtained from wine lees is of a clear grey colour, and considerably purer than the dark grey or dark brown product from argol.—C. A. M.

Chlorine, History of the Manufacture of. Ludwig Mond. (President's Address, Chemical Section), Brit. Assoc. Meeting, 1896.

In endeavouring to fix upon a suitable theme for the address I knew to-day would be expected from me, I have felt that I ought to give due consideration to the interests which tie this magnificent city of Liverpool, whose hospitality we enjoy this week, to Section B. of the British Association.

I have therefore chosen to give a brief history of the manufacture of chlorine, with the progress of which this city and its neighbourhood have been very conspicuously and very honourably connected, not only as regards quantity—I believe this neighbourhood produces to-day nearly as much chlorine as the rest of this world together—but more particularly by having originated, worked out, and carried into practice several of the most important improvements ever introduced into this manufacture. I was confirmed in my choice by the fact that this manufacture has been influenced and perfected in an extraordinary degree by the rapid assimilation and application of the results of purely scientific investigations and of new scientific theories, and offers a very remarkable example of the incalculable value to our commercial interests of the progress of pure science.

The early history of chlorine is particularly interesting, as it played a most important rôle in the development of chemical theories. There can be no doubt that the Arabian alchemist Geber, who lived 1,100 years ago, must have known that "Aqua Regia," which he prepared by distilling a mixture of salt, nitre, and vitriol, gave off on heating very corrosive, evil-smelling, greenish-yellow fumes, and all his followers throughout 1,000 years must have been more or less molested by these fumes whenever they used "Aqua Regia," the one solvent of the gold they attempted so persistently to produce.

But it was not until 1774 that the great Swedish chemist Scheele succeeded in establishing the character of these fumes. He discovered that on heating manganese with muriatic acid he obtained fumes very similar to those given off by "Aqua Regia," and found that these fumes constituted a permanent gas of yellowish-green colour, very pungent odour, very corrosive, very irritating to the respiratory organs, and which had the power of destroying organic colouring matters.

According to the views prevalent at the time, Scheele considered that the manganese had removed phlogiston from the muriatic acid, and he consequently called the gas dephlogisticated muriatic acid.

When during the next decade Lavoisier successfully attacked, and after a memorable struggle completely upset

the phlogiston theory and laid the foundations of our modern chemistry, Berthollet, the eminent "father" of physical chemistry—the science of to-day—endeavoured to determine the place of Scheele's gas in the new theory. Lavoisier was of opinion that all acids, including muriatic acid, contain oxygen. Berthollet found that a solution of Scheele's gas in water, when exposed to the sunlight, gives off oxygen and leaves behind muriatic acid. He considered this as proof that this gas consists of muriatic acid and oxygen, and called it oxygenated muriatic acid.

In the year 1785 Berthollet conceived the idea of utilising the colour-destroying powers of this gas for bleaching purposes. He prepared the gas by heating a mixture of salt, manganese, and vitriol. He used a solution of the gas in water for bleaching, and subsequently discovered that the product obtained by absorbing the gas in a solution of caustic potash possessed great advantages in practice.

This solution was prepared as early as 1789, at the chemical works on the Quai de Javelle, in Paris, and is still made and used there under the name of "Eau de Javelle."

James Watt, whose great mind was not entirely taken up with that greatest of all inventions—his steam-engine—by which he has benefited the human race more than any other man, but who also did excellent work in chemistry—became acquainted in Paris with Berthollet's process, and brought it to Scotland. Here it was taken up with that energy characteristic of the Scotch, and a great stride forward was made when, in 1798, Charles Tennant, the founder of the great firm, which has only recently lapsed into the United Alkali Company, began to use milk of lime in place of the more costly caustic potash, in making a bleaching liquid; and a still greater advance was made when, in the following year, Tennant proposed to absorb the chlorine by hydrate of lime, and thus to produce a dry substance, since known under the name of bleaching powder, which allowed the bleaching powers of chlorine to be transported to any distance.

In order to give you a conception of the theoretical ideas prevalent at this time, I will read to you a passage from an interesting treatise on the art of bleaching published in 1799 by Higgings. In his chapter "On bleaching with the oxygenated muriatic acid, and on the methods of preparing it," he explains the theory of the process as follows:—

"Manganese is an oxyd, a metal saturated with oxygen gas. Common salt is composed of muriatic acid and an alkaline salt called soda, the same which barilla affords. Manganese has greater affinity to sulphuric acid than to its oxygen, and the soda of the salt greater affinity to sulphuric acid than to the muriatic acid gas; hence it necessarily follows that these two gases (or rather their gravitating matter) must be liberated from their former union in immediate contact with each other; and although they have but a weak affinity to one another, they unite in their nascent state, that is to say, before they individually unite to caloric, and separately assume the gaseous state; for oxygen gas and muriatic acid gas already formed will not unite when mixed, in consequence principally of the distance at which their respective atmospheres of caloric keep their gravitating particles asunder. The compound resulting from these two gases still retains the property of assuming the gaseous state, and is the oxygenated muriatic gas."

Interesting as these views may appear, considering the time they were published, you will notice that the rôle played by the manganese in the process and the chemical nature of this substance were not at all understood. The law of multiple proportions had not yet been propounded by John Dalton, and the researches of Berzelius on the oxides of manganese were only published 13 years later, in 1812. The green gas we are considering was still looked upon as muriatic acid, to which oxygen had been added, in contradistinction to Scheele's view, who considered it as muriatic acid, from which something, viz., phlogiston, had been abstracted.

It was Humphry Davy who had, by a series of brilliant investigations carried out in the Laboratory of the Royal Institution between 1808 and 1810, accumulated fact upon fact to prove that the gas hitherto called oxygenated

muriatic acid did not contain oxygen. He announced in an historic paper, which he read before the Royal Society on July 12, 1810, his conclusion that this gas was an elementary body, which in muriatic acid was combined with hydrogen, and for which he proposed the name "chlorine," derived from the Greek *χλωρος*, signifying "green," the colour by which the gas is distinguished.

The numerous communications which Humphry Davy made to the Royal Society on this subject form one of the brightest and most interesting chapters in the history of chemistry. They have recently been reprinted by the Alembic Society, and I cannot too highly recommend their study to the young students of our science.

Those who have followed the history of chemistry I need not remind how hotly and persistently Davy's views were combated by a number of the most eminent chemists of his time, led by Berzelius himself; how long the chlorine controversy divided the chemical world; how triumphantly Davy emerged from it; how completely his views were recognised; and how very instrumental they have been in advancing theoretical chemistry.

The hope, however, which Davy expressed in that same historic paper, "that these new views would perhaps facilitate one of the greatest problems in economical chemistry, the decomposition of the muriates of soda and potash," was not to be realised so soon. Although it had changed its name, chlorine was still for many years manufactured by heating a mixture of salt, manganese, and sulphuric acid in leaden stills, as before.

This process leaves a residue consisting of sulphate of soda and sulphate of manganese, and for some time attempts were made to recover the sulphate of soda from these residues, and to use it for the manufacture of carbonate of soda by the Le Blanc process. On the other hand, the Le Blanc process, which had been discovered and put into practice almost simultaneously with Berthollet's chlorine process, decomposed salt by sulphuric acid, and sent the muriatic acid evolved into the atmosphere, causing a great nuisance to the neighbourhood.

Naturally, therefore, when Mr. William Gossage had succeeded in devising plant for condensing this muriatic acid, the manufacturers of chlorine reverted to the original process of Scheele, and heated manganese with the muriatic acid thus obtained. Since then the manufacture of chlorine has become a by-product of the manufacture of soda by the Le Blanc process, and remained so till very recently.

For a great many years the muriatic acid was allowed to act upon native ores of manganese in closed vessels of earthenware or stone, to which heat could be applied, either externally or internally. These native manganese ores, containing only a certain amount of peroxide, converted only a certain percentage of the muriatic acid employed into free chlorine, the rest combining with the manganese and iron contained in the ore, and forming a brown and very acid solution, which it was a great difficulty for the manufacturer to get rid of. Consequently, many attempts were made to regenerate peroxide of manganese from these waste liquors, so as to use it over again in the production of chlorine.

These, however, for a long time remained unsuccessful, because the exact conditions for super-oxydising the protoxide of manganese by means of atmospheric air were not yet known.

Meantime, viz., in 1845, Mr. Dunlop introduced into the works created by his grandfather, Mr. Charles Tennant, at St. Rollox, a new and very interesting method for producing chlorine, which was, in a certain measure, a return to the process used by the alchemists.

Indeed, the first part of this process consisted in decomposing a mixture of salt and nitre with oil of vitriol—a reaction that had been made use of for so many centuries! The chlorine so obtained is, however, not pure, but a mixture of chlorine with oxides of nitrogen and hydrochloric acid, which Mr. Dunlop had to find means to eliminate.

For separating the nitrous oxides, Mr. Dunlop adopted the method introduced 20 years before by the great Gay-Lussac in connection with vitriol-making, viz., absorption by sulphuric acid, and the nitro-sulphuric acid thus formed he also utilised in the same way as that obtained from the

towers which still bear Gay-Lussac's illustrious name, viz., by using it in the vitriol process in lieu of nitric acid. He then freed his chlorine gas from hydrochloric acid by washing with water, and so obtained it pure. This process possessed two distinct advantages—(1) it yielded a very much larger amount of chlorine from the same amount of salt, and (2) the nitric acid, which was used for oxidising the hydrogen in the hydrochloric acid, was not lost, because the oxides of nitrogen to which it was reduced answered the purpose for which the acid itself had previously been employed. But this process was very limited in its application, as it could only be worked to the extent to which nitric acid was used in vitriol-making.

The process has been at work at St. Rollox for over 50 years, and, as far as I know, is there still in operation; but I am not aware that it has ever been taken up elsewhere.

Within the last few years, however, several serious attempts have been made to give to this process a wider scope by regenerating nitric acid from the nitro-sulphuric acid and employing it over and over again to convert hydrochloric acid into chlorine. Quite a number of patents have been taken out for this purpose, all employing atmospheric air for reconvertng the nitrous oxides into nitric acid, and differing mainly in details of apparatus and methods of work, and several of these have been put to practical test on a fairly large scale in this neighbourhood, and also in Glasgow, Middlesbrough, and elsewhere. As I do not want to keep you here the whole afternoon, I have to draw the line somewhere as to what I shall include in this brief history of the manufacture of chlorine, and have had to decide to restrict myself to those methods which have actually attained the rank of manufacturing processes on a large scale. As none of the processes just referred to have attained that position, you will excuse me for not entering into further details respecting them.

Mr. Dunlop's process only produced a very small portion of the chlorine manufactured at that time at St. Rollox, the remainder being made, as before, from native manganese and muriatic acid, leaving behind the very offensive waste liquors I have mentioned before, which increased from year to year, and became more and more difficult to get rid of. The problem of recovering from these liquors the manganese in the form of peroxide Mr. Dunlop succeeded in solving in 1855.

He neutralised the free acid and precipitated the iron present by treating these liquors with ground chalk in the cold and settling out, and, in later years, filter-pressing the precipitate, which left him a solution of chloride of manganese, mixed only with chloride of calcium. This was treated with a fresh quantity of milk of chalk, but this time under pressure in closed vessels provided with agitators and heated by steam, under which conditions all the manganese was precipitated as carbonate of manganese. This precipitate was filtered off and well drained, and was then passed on iron trays mounted on carriages through long chambers, in which it was exposed to hot air at a temperature of 300° C., the process being practically made continuous, one tray at the one end being taken out of these chambers, and a fresh tray being put in at the other end. One passage through these chambers sufficed to convert the carbonate of manganese into peroxide, which was used in place of, and in the same way as, the native manganese.

The whole of the residual liquors made at the large works at St. Rollox have been treated by this process with signal success for a long number of years. For a short time the process was discontinued in favour of the Weldon process (of which I have to speak next); but after two years Dunlop's process was taken up again, and, to the best of my knowledge, it is still in operation to this day. It has, however, just like Mr. Dunlop's first chlorine process, never left the place of its birth (St. Rollox), although it was for a period of over 10 years without a rival.

In 1866 Mr. Walter Weldon patented a modification of a process proposed by Mr. William Gossage in 1837 for recovering the manganese that had been used in the manufacture of chlorine. Mr. Gossage had proposed to treat the residual liquors of this manufacture by lime, and to oxidise the resulting protoxide of manganese by bringing it into frequent and intimate contact with atmospheric air.

This process—and several modifications thereof subsequently patented—had been tried in various places without success. Mr. Weldon, however, did succeed in obtaining a very satisfactory result, possibly—even probably—because, not being a chemist, he did not add the equivalent quantity of lime to his liquor to precipitate the manganese, but used an excess. However, Mr. Weldon, if he was not a chemist at that time, was a man of genius and of great perseverance. He soon made himself a chemist, and having once got a satisfactory result, he studied every small detail of the reaction with the utmost tenacity until he had thoroughly established how this satisfactory result could be obtained on the largest scale with the greatest regularity and certainty.

He even went further, and added considerably to our theoretical knowledge of the character of manganese peroxide and similar peroxides by putting forward the view that these compounds possess the character of weak acids. He explained in this way the necessity for the presence of an excess of lime or other base if the oxidation of the precipitated protoxide of manganese by means of atmospheric air was to proceed at a sufficiently rapid rate. He pointed out that the product had to be considered as a manganite of calcium—a view which has since been thoroughly proved by the investigations of Goergen and others; and it is only fair to state that Weldon's process is not only a process for recovering the peroxide of manganese originally used, but that he introduced a new substance, viz., manganite of calcium, to be continuously used over and over again in the manufacture of chlorine.

Mr. Weldon had the good fortune that his ideas were taken up with fervency by Colonel Gamble, of St. Helens, and that Colonel Gamble's manager, Mr. F. Bramwell, placed all his experience as a consummate technical chemist and engineer at Mr. Weldon's disposal, and assisted him in carrying his ideas into practice. The result was that a process which many able men had tried in vain to realise for 30 years became in the hands of Mr. Weldon and his coadjutors within a few years one of the greatest successes achieved in manufacturing chemistry.

The Weldon process commences by treating the residual liquor with ground chalk or limestone, thus neutralising the free acid and precipitating any sulphuric acid and oxide of iron present. The clarified liquor is run into a tall cylindrical vessel, and milk of lime is added in sufficient quantity to precipitate all the manganese in the form of protoxide. An additional quantity of milk of lime, from one-fifth to one-third of the quantity previously used, is then introduced, and air passed through the vessel by means of an air-compressor. After a few hours all the manganese is converted into peroxide; the contents of the vessel are then run off; the mud, now everywhere known as "Weldon mud," is settled, and the clear liquor run to waste. The mud is then pumped into large closed stone stills, where it meets with muriatic acid, chlorine is given off, and the residual liquor treated as before.

You note that this process works without any manipulation, merely by the circulation of liquids and thick magnas which are moved by pumping machinery. As compared to older processes it also has the great advantage that it requires very little time for completing the cycle of operations, so that large quantities of chlorine can be produced by a very simple and inexpensive plant. These advantages secured for this process the quite unprecedented success that within a few years it was adopted, with a few isolated exceptions, by every large manufacturer of chlorine in the world; yet it possessed a distinct drawback, viz., that it produced considerably less chlorine from a given quantity of muriatic acid than either native manganese of good quality or Mr. Dunlop's recovered manganese. At that time, however, muriatic acid was produced as a bye-product of the Le Blanc process so largely in excess of what could be utilised that it was generally looked upon as a waste product of no value. Mr. Weldon himself was one of the very few who foresaw that this state of things could not always continue. The ammonia-soda process was casting its shadow before it. Patented in 1838 by Messrs. Dyar and Hemming it was only after the lapse of 30 years (during which a number of manufacturing chemists of the highest

standing had in vain endeavoured to carry it into practice) that this process was raised to the rank of a manufacturing process through the indomitable perseverance of Mr. Ernest Solvay of Brussels, and his clear perception of its practical and theoretical intricacies. A few years later, in 1872, Mr. Weldon already gave his attention to the problem of obtaining the chlorine of the salt used in this process in the form of muriatic acid. He proposed to recover the ammonia from the ammonium chloride obtained in this manufacture by magnesia instead of lime, thus obtaining magnesium chloride instead of calcium chloride, and to produce muriatic acid from this magnesium chloride by a process patented by Clemm in 1860, viz., by evaporating the solution, heating the residue in the presence of steam and condensing the acid vapours given off.

Strange to say, this same method had been patented by Mr. Ernest Solvay within 24 hours before Mr. Weldon lodged his specification. It has been frequently tried with many modifications, but has never been found practicable. Soon afterwards Mr. Weldon, with the object of reducing the muriatic acid required by his first process, proposed to replace the lime in this process by magnesia, and so to produce a manganite of magnesia. After treating this with muriatic acid and liberating chlorine, he proceeded to evaporate the residual liquors to dryness, during which operation all the chlorine they contain would be disengaged as hydrochloric acid and collected in condensers, while the dry residue, after being heated to dull redness in the presence of air, would be reconverted into manganite of magnesia.

This process was made the subject of long and extensive experiments at the works of Messrs. Gamble at St. Helens, but did not realise Mr. Weldon's expectations. It, however, led to some further interesting developments, to which I shall refer later on.

Those of you who were present at the last meeting of the British Association in this city will remember that this Section had the advantage of listening to a paper by Mr. Weldon on his chlorine process, and also to another highly interesting paper by Mr. Henry Deacon, of Widnes, "on a new chlorine process without manganese." And those of you who came with the then President of the Section (Professor Roscoe) to Widnes to visit the works of Messrs. Gaskell, Deacon, and Co., will well remember that at these works they saw side by side Weldon's process and Deacon's process in operation, and no one present will have forgotten the thoughtful, flashing eyes and impressive face of Mr. Deacon when he explained to his visitors the theoretical views he had formed as regards his process.

Mr. Deacon had made a careful study of thermochemistry, which had been greatly developed during the preceding decade by the painstaking, accurate, and comprehensive experiments of Julius Thomsen and of Berthelot, and had led the latter to generalisations, which, although not fully accepted by scientific men, have been of immense service to manufacturing chemistry.

Mr. Deacon came to the conclusion that if a mixture of hydrochloric acid with atmospheric air was heated in the presence of a suitable substance capable of initiating the interaction of these two gases by its affinity to both, it would to a very great extent be converted into chlorine with the simultaneous formation of steam, because the formation of steam from oxygen and hydrogen gives rise to the evolution of a considerably larger quantity of heat than the combination of hydrogen and chlorine. Mr. Deacon found that the salts of copper were a very suitable substance for this purpose, and took out a patent for this process in 1868. He entrusted the study of the theoretical and practical problems connected with this process to Dr. Ferdinand Hurter, who carried them out in a manner which will always remain memorable and will never be surpassed, as an example of the application of scientific methods to manufacturing problems, and which soon placed this beautiful and simple process on a sound basis as a manufacturing operation.

In the ordinary course of manufacture the major part—about two-thirds—of the hydrochloric acid is obtained mixed with air and a certain amount of steam, but other-

wise very little contaminated. Instead of condensing the muriatic acid from this mixture of gases by bringing it into contact with water, Mr. Deacon passed it through a long series of cooling pipes to condense the steam, which of course absorbed hydrochloric acid, and formed a certain quantity of strong muriatic acid. The mixture of gases was then passed through an iron superheater to raise it to the required temperature, and thence through a mass of broken bricks impregnated with sulphate or chloride of copper contained in a chamber or cylinder called a decomposer, which was protected from loss of heat by being placed in a brick furnace kept sufficiently hot. In this apparatus from 50 to 60 per cent. of the hydrochloric acid in the mixture of gases was burnt to steam and chlorine. In order to separate this chlorine from the steam and the remaining hydrochloric acid, the gases were washed with water and, subsequently, with sulphuric acid. The mixture now consisted of nitrogen and oxygen, containing about 10 per cent. of chlorine gas, which could be utilised without any difficulty in the manufacture of bleach liquors and chlorate of potash, and which Mr. Deacon also succeeded in using for the manufacture of bleaching powder, by bringing it into contact in specially constructed chambers with large surfaces of hydrate of lime. Within recent years this latter object has been attained in a more expeditious and perfect manner by continuous mechanical apparatus (of which those constructed by Mr. Robert Hasenclever and Dr. Carl Langer have been the most successful), in which the hydrate of lime is transported in a continuous stream by single or double conveyors in an opposite direction to the current of dilute chlorine, and the bleaching powder formed delivered direct into casks, thereby avoiding the intensely disagreeable work of packing this offensive substance by hand.

Mr. Deacon's beautiful and scientific process thus involves still less movement of materials than the very simple process of Mr. Weldon, because in lieu of large volumes of liquids he only moves a current of gas through his apparatus, which requires a minimum of energy. The only raw material used for converting hydrochloric acid into chlorine is atmospheric air, the cheapest of all at our command. The hydrochloric acid which has not been converted into chlorine by the process is all obtained, dissolved in water, as muriatic acid, and is not lost, as in previous processes, but is still available to be converted into chlorine by other methods, or to be used for other purposes.

In spite of these distinct advantages, this process took a long time before it became adopted as widely as it undoubtedly deserved. This was mainly due to the fact that the economy in the use of muriatic acid which it effected was at the time when the process was brought out, and for many years afterwards, no object to the majority of chlorine manufacturers, who were still producing more of this commodity than they could use. Moreover, there were other reasons. The plant required for this process, although so simple in principle, is very bulky in proportion to the quantity of chlorine produced, and as I have pointed out, the process only succeeded in converting about one-third of the hydrochloric acid produced into chlorine, the remainder being obtained as muriatic acid, which had in most instances to be converted into chlorine by the Weldon process; so that the Deacon process did not constitute an entirely self-contained method for this manufacture. This defect, of small moment as long as muriatic acid was produced in excessive quantities, was only remedied by an invention of Mr. Robert Hasenclever a short number of years ago; when by the rapid development of the ammonia-soda process the previously existing state of things had been completely changed, and when, at least on the Continent, muriatic acid was no longer an abundant and valueless by-product, but, on the contrary, the alkali produced by the Le Blanc process had become a by-product of the manufacture of chlorine. Mr. Hasenclever, in order to make the whole of the muriatic acid he produces available for conversion into chlorine by the Deacon process, introduces the liquid muriatic acid in a continuous stream into hot sulphuric acid contained in a series of stone vessels, through which he passes a current of air. He thus obtains a mixture of hydrochloric acid and air, well

adapted for the Deacon process, the water of the muriatic acid remaining with the sulphuric acid, from which it is subsequently eliminated by evaporation. In this way the chlorine in the hydrochloric acid can be almost entirely obtained in its free state by the simplest imaginable means, and with the intervention of no other chemical agent than atmospheric air. Since their introduction the Deacon process has supplanted the Weldon process in nearly all the largest chlorine works in France and Germany, and is now also making very rapid progress in this country.

Mr. Weldon, when he decided to give up his manganite of magnesia process, by no means relaxed his efforts to work out a chlorine process which should utilise the whole of the muriatic acid. While working with manganite of magnesia he found that magnesia alone would answer the purpose with out the presence of the peroxide of manganese. He obtained the assistance of M. Pechiney, of Salindres, and, in conjunction with him, worked out what has become known as the "Weldon-Pechiney" process, which was first patented in 1834.

This process consists in neutralising muriatic acid by magnesia, concentrating the solution to a point at which it does not yet give off any hydrochloric acid, and then mixing into it a fresh quantity of magnesia so as to obtain a solid oxychloride of magnesium. This is broken up into small pieces, which are heated up rapidly to a high temperature without contact with the heating medium, while a current of air is passing through them. The oxychloride of magnesium containing a large quantity of water, this treatment yields a mixture of chlorine and hydrochloric acid with air and steam, the same as the Deacon process, and this is treated in a very similar way to eliminate the steam and the acid from the chlorine. The acid condensed is, of course, treated with a fresh quantity of magnesia, so that the whole of the chlorine which it contains is gradually obtained in the free state.

The rapid heating to a high temperature of the oxychloride of magnesium without contact with the heating medium was an extremely difficult practical problem, which has been solved by M. Pechiney and his able assistant, M. Boulouvard, in a very ingenious and entirely novel way.

They lined a large wrought-iron box with fire-bricks, and built inside of this vertical fire-brick walls with small empty spaces between them, thus forming a number of very narrow chambers, so arranged that they could all be filled from the top of the box, and emptied from the bottom. These chambers they heated to a very high temperature by passing a gas flame through them, thus storing up in the brick walls enough heat to carry out and complete the decomposition of the magnesium oxychloride, with which the chamber was filled when hot enough.

Mr. Weldon himself called this apparatus a "baker's oven," in which trade certainly the same principle has been employed from time immemorial; but to my knowledge it had never before been used in any chemical industry. This process has been at work at M. Pechiney's large alkali works at Salindres, and is now at work in this country at the chlorate of potash works of Messrs. Albright and Wilson at Oldbury, a manufacture for which it offers special advantages. Mr. Weldon and M. Pechiney had expected that this process would become specially useful in connection with the ammonia-soda process by preparing, in the way proposed by Mr. Solvay and Mr. Weldon in 1872, a solution of magnesium chloride as a by-product of this manufacture; but instead of obtaining muriatic acid from this solution by Clenn's process, to treat it by the new process, so as to obtain the bulk of the chlorine at once in the free state. But M. Pechiney did no more succeed than his predecessors in recovering the ammonia by means of magnesia in a satisfactory way.

Quite recently, however, it has been applied to obtain chlorine in connection with the ammonia-soda process by Dr. Pick, of Czakowa, in Austria. He recovers the ammonia, as usual, by means of lime, and converts the solution of chloride of calcium, obtained by a process patented by Mr. Weldon in 1869, viz., by treatment with magnesia and carbonic acid under pressure, into chloride of

magnesium with the formation of carbonate of lime. The magnesium-chloride solution is then concentrated and treated by the Weldon-Pechiney process.

I have repeatedly referred during this brief history to the great change which has been brought about in the position of chlorine manufacture by the development of the ammonia-soda process, and have pointed out that the muriatic acid which for a long time was the by-product of the Le Blanc process, without value, thereby became gradually its main and most valuable product, while the alkali became its by-product.

I have told you how, very early in the history of this process, Mr. Solvay and Mr. Weldon proposed means to provide for this contingency, and how Mr. Weldon continued to improve these means until the time of his death. Mr. Solvay, on his part, also followed up the subject with that tenacity and sincerity of purpose which distinguishes him; his endeavours being mainly directed to producing chlorine direct from the chloride of calcium running away from his works by mixing it with clay and passing air through the mixture at very high temperatures, thus producing chlorine and a silicate of calcium, which could be utilised in cement making. The very high temperatures required prevented, however, this process from becoming a practical success.

I have already told you what a complicated series of operations Dr. Pick has lately resorted to in order to obtain the chlorine from this chloride of calcium. Yet the problem of obtaining chlorine as a by-product of the ammonia-soda process presents itself as a very simple one.

This process produces a precipitate of bicarbonate of soda and a solution of chloride of ammonium by treating natural brine or an artificially made solution of salt, in which a certain amount of ammonia has been dissolved, with carbonic acid. In their original patent of 1838, Messrs. Dyar and Hemming proposed to evaporate this solution of ammonium chloride, and to distil the resulting dry product with lime to recover the ammonia. Now all that seemed to be necessary to obtain the chlorine from this ammonium chloride was to substitute another oxide for lime in the distillation process, which would liberate the ammonia and form a chloride, which on treatment with atmospheric air would give off its chlorine and reproduce the original oxide. The whole of the reactions for producing carbonate of soda and bleaching powder from salt would thus be reduced to their simplest possible form; the solution of salt, as we obtain it in the form of brine direct from the soil, would be treated with ammonia and carbonic acid to produce bicarbonate, and subsequently monocarbonate of soda, the limestone used for producing the carbonic acid would yield the lime required for absorbing the chlorine, and produce bleaching powder instead of being run into the rivers in combination with chlorine in the useless form of chloride of calcium, and both the ammonia used as an intermediary in the production of soda and the metallic oxide used as an intermediary in the production of chlorine would be continuously recovered.

The realisation of this fascinating problem has occupied me for a great many years. In the laboratory I obtained soon almost theoretical results. A very large number of oxides and even of salts of weak acids were found to decompose ammonium chloride in the desired way; but the best results (as was to be clearly anticipated from thermo-chemical data) were given by oxide of nickel.

When, however, I came to carry this process out on a large scale, I met with the most formidable difficulties, which it took many years to overcome successfully.

The very fact that ammonium chloride vapour forms so readily metallic chlorides when brought in contact at an elevated temperature with metals or oxides or even silicates, led to the greatest difficulty, viz., that of constructing apparatus which would not be readily destroyed by it.

Amongst the metals we found that platinum and gold were the only ones not attacked at all. Antimony was but little attacked, and nickel, used for valves and taps, resisted very well if not exposed to too high a temperature, so that it could be, and is being, used for such parts of the plant as are not directly exposed to heat. The other parts of the apparatus coming in contact with the ammonium chloride vapour I ultimately succeeded in constructing

of cast and wrought iron, lined with fire-bricks or Doulton tiles, the joints between these being made by means of a cement consisting of sulphate of baryta and waterglass.

After means had been devised for preventing the breaking of the joints through the unequal expansion of the iron and the earthenware, the plant so constructed has lasted very well.

Oxide of nickel, which had proved the most suitable material for the process in the laboratory, gave equally good chemical results on the large scale, but occasionally a small quantity of nickel chloride was volatilised through local over-heating, which, however, was sufficient to gradually make up the chlorine conduits. We therefore looked out for an active material free from this objection. Theoretical considerations indicated magnesia as the next best substance, but it was found that the magnesium chloride formed was not anhydrous, but retained a certain amount of the steam formed by the reaction, which gave rise to the formation of a considerable quantity of hydrochloric acid on treatment with hot air. In conjunction with Dr. Eschellman (who carried out the experiments for me), I succeeded in reducing the quantity of this hydrochloric acid to a negligible amount by adding to the magnesia a certain amount of chloride of potassium, which probably has the effect of forming an anhydrous double chloride.

This mixture of magnesia and potassium chloride is, after the addition of a certain quantity of china-clay, made into small pills in order to give a free and regular passage throughout their entire mass to the hot air and other gases with which they have to be treated. In order to avoid as far as possible the handling and consequent breaking of these pills, I vaporise the ammonium chloride in a special apparatus, and take the vapours through these pills, and subsequently pass hot air through, and then again ammonium chloride vapour, and so on, without the pills changing their place.

The vaporisation of the ammonium chloride is carried out in long cast-iron retorts lined with thin Doulton tiles, and placed almost vertically in a furnace, which is kept by producer gas at a very steady and regular temperature. These retorts are kept nearly full with ammonium chloride, so as to have as much active heating surface as possible. From time to time a charge of ammonium chloride is introduced through a hopper at the top of these retorts, which is closed by a nickel plug. The ammonium chloride used is very pure, being crystallised out from its solution as produced in the ammonia soda manufacture by a process patented by Mr. Gustav Jarmay, which consists in lowering the temperature of these solutions considerably below 0° C. by means of refrigerating machinery. The retorts will therefore evaporate a very large amount of ammonium chloride before it becomes necessary to take out through a door at their bottom the non-volatile impurities which accumulate in them. The ammonium chloride vapour is taken from these retorts by cast-iron pipes lined with tiles and placed in a brick channel, in which they are kept hot, to prevent the solidification of the vapour to large upright wrought-iron cylinders, which are lined with a considerable thickness of fire-bricks, and are filled with the magnesia pills, which are, from the previous operation, left at a temperature of about 300° C. On its passage through the pills the chlorine in the vapours is completely retained by them, the ammonia and water vapour formed pass on and are taken to a suitable condensing apparatus. The reaction of the ammonium chloride vapour upon magnesia being exothermic, the temperature of the pills rises during this operation, and no addition of heat is necessary to complete it. The temperature, however, does not rise sufficiently to satisfactorily complete the second operation, viz., the liberation of the chlorine and the re-conversion of the magnesium chloride into magnesium oxide by means of air. This reaction is slightly endo-thermic, and thus absorbs a small amount of heat, which has to be provided in one way or another. I effect this by heating the pills to a somewhat higher temperature than is required for the action of the air upon them, viz., to 600° C., by passing through them a current of a dry inert gas free from oxygen heated by a Siemens-Cowper stove to the required temperature. I use for this purpose the gas leaving the carbouating plant of the ammonia-soda process.

This current of gas also carries out of the apparatus the small amount of ammonia which was left in between the pills. It is washed to absorb this ammonia, and, after washing, this same gas is passed again through the Siemens-Cowper stove, and thus constantly circulated through the apparatus, taking up the heat from the stove and transferring it to the pills. When these have attained the required temperature, the hot inert gas is stopped and a current of hot air passed through, which has also been heated to 600° C. in a similar stove. The air acts rapidly upon the magnesium chloride, and leaves the apparatus charged with 18 to 20 per cent. of chlorine and a small amount of hydrochloric acid. The chlorine comes gradually down, and when it has reached about 3 per cent., the temperature of the air entering the apparatus is lowered to 350° C. by the admixture of cold air to the hot air from the stove; and the weak chlorine leaving the apparatus is passed through a second stove, in which its temperature is raised again to 600° C., and passed into another cylinder full of pills which are just ready to receive the hot-air current. A series of four cylinders is required to procure the necessary continuity for the process.

The chlorine gas is washed with a strong solution of chloride of calcium, which completely retains all the hydrochloric acid, and is then absorbed in an apparatus invented by Dr. Carl Langer, by hydrate of lime, which is made to pass by a series of interlocked transporting twin-screws in an opposite direction to the current of gas, and produces very good and strong bleaching powder, in spite of the varying strength of the chlorine gas. The hydrochloric acid absorbed by the solution of calcium chloride can be heated this solution be readily driven out and collected.

This process has now been in operation on a considerable scale at our works at Warrington for several years, with constantly improving results, notably with regard to the loss of ammonia, which has gradually been reduced to a small amount. The process has fully attained my object, viz., to enable the ammonia soda process to compete, not only in the production of carbonate of soda, but also in the production of bleaching powder, with the Le Blanc process.

Nevertheless, I have hesitated to extend this process as rapidly as I should otherwise have done, because very shortly after I had overcome all its difficulties, entirely different methods from those hitherto employed for the manufacture of chlorine were actively pushed forward in different parts of the globe, for which great advantages were claimed, but the real importance and capabilities of which were and are up to this date very difficult to judge. I refer to the processes for producing chlorine by electrolysis.

During the first decade of this century, Humphry Davy had by innumerable experiments established all the leading facts concerning the decomposing action of an electric current upon chemical compounds. Amongst these he was the first to discover that solutions of alkaline chlorides, when submitted to the action of a current, yield chlorine. His successor at the Royal Institution, Michael Faraday, worked out and proved the fundamental law of electrolysis, known to everybody as "Faraday's Law," which has enabled us to calculate exactly the amount of current required to produce by electrolysis any definite quantity of chlorine. Naturally, since these two eminent men had so clearly shown the way, numerous inventors have endeavoured to work out processes based on these principles for the production of chlorine on a manufacturing scale, but only during the last few years have these met with any measure of success.

It has taken all this time for the classical work of Faraday on electro-magnetism to develop into the modern magneto-electric machine, capable of producing electricity in sufficient quantity to make it available for chemical operations on a large scale; for you must keep in mind that an electric installation sufficient to light a large town will only produce a very moderate quantity of chemicals.

In applying electricity to the production of chlorine various ways have been followed, both as to the raw materials and as to the apparatus employed. While most inventors have proposed to electrolyse a solution of chloride of sodium, and to produce thereby chlorine and caustic soda, I am not aware that up to this day any quantity of

caustic soda made by electrolysis has been put on to the market.

Only two electrolytic works producing chlorine on a really large scale are in operation to-day. Both electrolyse chloride of potassium, producing as a by-product caustic potash, which is of very much higher value than caustic soda, and of which a larger quantity is obtained for the same amount of current expended. These works are situated in the neighbourhood of Stassfurt, the important centre of the chloride of potassium manufacture. The details of the plant they employ are kept secret, but it is known that they use cells with porous diaphragms of special construction, for which great durability is claimed. There are at this moment a considerable number of smaller works in existence, or in course of erection in various countries, intended to carry into practice the production of chlorine by electrolysis by numerous methods, differing mainly in the details of the cells to be used; but some of them also involving what may be called new principles. The most interesting of these are the processes in which mercury is used alternately as cathode and anode, and salt as electrolyte. They aim at obtaining in the first instance chlorine and an amalgam of sodium, and subsequently converting the latter into caustic soda by contact with water, which certainly has the advantage of producing a very pure solution of caustic soda. Mr. Hamilton Castner has carried out this idea most successfully by a very beautiful decomposing cell, which is divided into various compartments, and so arranged that by slightly rocking the cell the mercury charged with sodium in one compartment passes into another, where it gives up the sodium to water, and then returns to the first compartment, to be re-charged with sodium. His process has been at work on a small scale for some time at Oldbury near Birmingham, and works for carrying it out on a large scale are now being erected on the banks of the Mersey, and also in Germany and America.

Entirely different from the foregoing, but still belonging to our subject, are methods which propose to electrolyse the chlorides of heavy metals (zinc, lead, copper, &c.) obtained in metallurgical operations or specially prepared for the purpose, among which the processes of Dr. Carl Hoepfner deserve special attention. They eliminate from the electrolyte immediately both the products of electrolysis, chlorine on one side and zinc and copper on the other, and thus avoid all secondary reactions, which have been the great difficulty in the electrolysis of alkaline chlorides.

All these processes have, however, still to stand the test of time before a final opinion can be arrived at as to the effect they will have upon the manufacture of chlorine, the history of which we have been following, and this must be my excuse for not going into further details. I have endeavoured to give you a brief history of the past of the manufacture of chlorine, but I will to-day not attempt to deal with its future! Yet I cannot leave my subject without stating the remarkable fact that every one of these processes which I have described to you is still at work to this day, even those of Scheele and Berthollet, all finding a sphere of usefulness under the widely varying conditions under which the manufacture of chlorine is carried on in different parts of the world.

Let me express a hope that a hundred years hence the same will be said of the processes now emerging and the processes still to spring out of the inventor's mind. Rapid and varied as has been the development of this manufacture, I cannot suppose that its progress is near its end, and that Nature has revealed to us all her secrets as to how to procure chlorine with the least expenditure of trouble and energy. I do not believe that industrial chemistry will in future be diverted from this Section and have to wander to Section A. under the agis of applied electricity. I do not believe that the easiest way of effecting chemical changes will ultimately be found in transforming heat and chemical affinity into electricity, tearing up chemical compounds by this powerful medium, and then to recombine their constituents in such form as we may require them. I am sure there is plenty of scope for the manufacturing chemist to solve the problems before him by purely chemical means, of some of which we may as little dream to-day as a few

years ago it could have been imagined that nickel would be extracted from its ores by means of carbon-monoxide.

At a meeting of the British Association which brings before us an entirely new form of energy, the Röntgen rays, which have enabled us to see through doors and walls and to look inside the human body; which brings before us a new form of matter, represented by argon and helium, which, as their discoverers, Lord Rayleigh and Professor Ramsay, have now abundantly proved, are certainly elementary bodies, inasmuch as they cannot be split up further, but are not chemical elements, as they possess no chemical affinity and do not enter into combinations—at a meeting at which such astounding and unexpected secrets of Nature are revealed to us, who would call in doubt that, notwithstanding the immense progress pure and applied science have made during this century, new and greater and farther-reaching discoveries are still in store for ages to come?

Alkali and Chlorine. W. Borchers. Zeits. f. Elektrochem. 1896, 3, 114—116.

An article setting forth the practical working cost of electrolysing solutions of alkaline salts.

Bleaching Solutions, Electrolytic Production of. Dingler's Polyt. J. 301, [10], 234.

KELLNER-HALLEIN'S apparatus for the electrolysis of brine, which was described and discussed before the meeting of the German Electro-Chemical Society, Stuttgart, June 25—27, is designed to meet the two requirements necessary for the successful commercial introduction of electrolytic bleaching solutions, namely, that the plant used in their production shall be capable of being worked by currents of the potential ordinarily supplied from central stations, thus obviating the necessity for special dynamos; and, secondly, that the cost of the installation shall be low. Dr. Kellner employs a single-ebonite tank, in which as many bi-polar electrodes are placed in series as the working potential will allow of. These electrodes are made of plates of ebonite provided with brush-like projections of platinum, which arrangement allows of the use of a high current density for a small weight of plate, and the brushes of the first and last electrodes are connected to the conductors supplying the current. The brine is admitted to the tank from below, and, passing between the electrodes, it leaves by two channels in the upper part of the tank, and after being cooled is returned to the vessel. The circulation is regulated so that the amount of active chlorine formed on the passage of the solution through the apparatus is 0.05 per cent., and the process is continued until the amount reaches 1 per cent. The apparatus is fully described in the Leipziger Monatschr. für Textilind. 9, 1895.—G. H. R.

Sulphoxyarsenates. Le Ray, W. McCay. Chem. Zeit. 1896, 20, 722.

THE author prepares the tertiary sodium salt of orthomono-sulpho-arsenic acid by melting an intimate mixture of equal parts of arsenious acid and sulphur in a large porcelain crucible at a gentle heat for 8—10 minutes. The melt is finely powdered, and digested for 24 hours at 0° with a solution of 1 part of sodium hydroxide in 7 parts of water. The insoluble residue is filtered off, and the filtrate slowly poured into an equal volume of 95 per cent. alcohol. Sodium sulphyarsenate immediately separates as a light yellow oil, which becomes crystalline when kept at 0° for some time; it is washed with a small quantity of 50 per cent. alcohol, pressed, and dried. The ammonium and potassium salts have also been prepared; the latter, however, could not be obtained in a crystalline condition. The barium and strontium salts were isolated by dropping a cold aqueous solution of Bouquet and Cloez's salt into the alkaline hydroxide, whilst $\text{Ba}_2\text{Na}_2(\text{AsO}_3\text{S})_2 + 17\text{H}_2\text{O}$ and the corresponding strontium compound were formed by adding the alkaline hydroxide to Preiss's salt.—J. L. B.

Alkali and Vitriol Works, Analytical Methods for. P. Dobriner and W. Schrauz. Zeits. f. ang. Chem. 1896, 453.

See under XXIII., page 743.

Boric Acid, Volumetric Determination of. M. Hönig and G. Spitz. Zeits. für ang. Chem. 1896, 549.

See under XXIII., page 742.

The Anglo-Sicilian Sulphur Trust. U.S. Consular Reps., Sept. 1896, 227.

See under Trade Rep., page 751.

Chlorate of Potash, Production of, at Niagara Falls.

See under Trade Rep., page 753.

PATENTS.

Chlorates, Impts. in the Manufacture of, and in Means and Appliances therefor. J. Hargreaves, Farnworth-in-Widnes. Eng. Pat. 16,257, Aug. 30, 1895.

To obtain sodium chlorate, hydrated sodium carbonate is exposed to the action of chlorine in an absorbing tower in which lixiviation of the products is also conducted, the solid salts being supported by prismatic bearing pieces arranged to form inverted cones in the lower part of the tower. The chlorine enters at the side of these pieces, and is led around and through their interstices, and passes upwards through the charge above. Provision is made for draining off the liquid into a compartmented tank, one compartment of which contains pieces of soda resting on a grid. The chlorate liquor thus saturated is pumped to a tank on the top of the tower, whence it is allowed to flow down in a regulated manner on to the charge below. The salt (chiefly sodium chloride) removed from the tower is washed with steam and water in a centrifugal hydro-extractor. After the sodium chlorate liquor has passed through a series of lixiviating vessels kept at a high temperature, any suspended sodium chloride crystals are removed in a hydro-extractor, and the solution is concentrated to obtain crystallised sodium chlorate.

Potassium chlorate is preferably obtained from the chloride, a pasty mixture of which with lime or magnesia is chlorinated in an apparatus similar to that above described; but the treatment in lixiviating the chlorinated products is modified, very cold water or even ice being used in the process, owing to the greater solubility of the calcium or magnesium chlorides formed over the alkali chlorate at low temperatures. An economical method of constructing and bracing an absorbing tower is shown, and modifications of the described processes are given.—E. S.

Bleaching Liquid, Impts. in the Electrolytical Manufacture of [Cooling]. C. Kellner, Vienna, Austria. Eng. Pat. 17,525, Sept. 19, 1895.

By means of a pump, an 8 to 10 per cent. solution of sodium chloride is passed through the electrolytic vessel, so that 0.05 per cent. of chlorine is formed during each passage of the electrolyte through the apparatus. The electrolyte is passed into a vessel, where it is cooled in any convenient manner, and thence is returned to the decomposing cell, and so on, until the requisite concentration is reached, say, 1.5 per cent. of chlorine = 15 grms. per litre. The pipe connected with the cooling vessel is now closed, and the solution is passed by means of another pipe into the bleaching vessel; or by a suitable modification of the plant the action is made continuous, fresh salt solution passing into the decomposing cell as the bleaching solution is drawn off.—G. H. R.

Plates, Bricks, and Pipes for Filtering and like Purposes, Impts. in the Manufacture of Porous, Hard, and Acid-resisting. W. Schuler, Isny, Württemberg, Germany. Eng. Pat. 18,573, Oct. 4, 1895.

See under IX., page 729.

Carbonic Acid Gas, Impts. in the Manufacture of, by the Utilisation of Waste Product produced in Making Calcium and other Carbides. H. S. Elworthy, Bandra, Bombay, and P. D. Henderson, London. Eng. Pat. 19,445, Oct. 16, 1895.

When limestone and carbon are intensely heated, as in an electric furnace, to obtain calcium carbide, a large

quantity of carbon monoxide gas is evolved, which, under the present invention, is collected and passed over a suitable heated metallic oxide, such as cupric oxide. The carbonic acid gas thus produced is stored for utilisation, and the reduced copper or other metal is re-oxidised by heating in contact with air.—E. S.

Metallic Fluorides, Impts. in Manufacturing. W. Mills, London. Eng. Pat. 20,377, Oct. 29, 1895.

AMMONIUM fluoride is sublimed from a mixture of powdered fluorspar and ammonium sulphate heated to about 350° C. in a cast-iron retort, lined with calcium sulphate, and provided with an inverted cone-shaped lead cover or top, the concavity of which is kept full of water. To obtain the alkaline and earthy fluorides, it is preferred to treat a solution of the chloride first with gaseous ammonia and then with hydrofluoric acid gas. Sodium fluoride thus precipitated is anhydrous; but a hydrated and more soluble fluoride is obtained if aqueous H_2F be used. "Generally, when anhydrous fluorides are required, the thermal conditions of the reactions by which they are produced must be somewhat high." Sodium and potassium fluorides may also be obtained by similar treatment of their sulphates. To obtain the fluorides of metals, the salts of which are precipitable by ammonia, such as aluminium, chromium, magnesium, manganese and zinc, ammonium fluoride is added to a solution of the chloride or sulphate of the metal; or hydrofluoric acid is first added and then ammonia. Compound fluorides may also be prepared by precipitating in like manner solutions of mixed salts. Thus, cryolite may be obtained by treating the chlorides or sulphates of aluminium and sodium with ammonium fluoride. In some cases one of the salts is added in a dry state to the solution of the salt to be decomposed.—E. S.

Ammonia from Waste Nitrogenous Lyes or Gases, Impts. in or relating to the Production of. [From Sugar or Molasses Spirit.] H. H. Lake, London. From L. Sternberg, Jersey, New Jersey, U.S.A. Eng. Pat. 7002, March 31, 1896.

A CRUDE potassium aluminate is obtained by moulding into bricks a moistened mixture of bauxite (or clay) with lime and black ash, and after drying, crushing into pieces and heating to redness. This material is fed into an upright retort until the latter is nearly full. Another portion of the crude aluminate is incorporated with lye resulting from the extraction of sugar, at a density of 40° B., and with a stated proportion of bauxite, and when stiff, the mixture is pressed into blocks, which are dried, broken up, and then fed into the retort on the top of the previous charge of aluminate. The retort being heated, the gases given off from the lye compost are conducted downward through the glowing aluminate, which transforms the nitrogenous organic matters in the gases into ammonia, which is collected. As the process goes on the material is gradually removed from the bottom of the retort to make room for additions at the top of more of the lye compost, which, as it chars, replaces the removed aluminate and acts in the same manner, in aiding the production of ammonia. Nitrogenous gases from other sources may be similarly treated. A description is given of methods of utilising the by-products.—E. S.

Seaweed, an Improved Method of Treating, to obtain Valuable Products [Alginic Acid, "Tang Acid"] therefrom. A. Krøfting, Christiania, Norway. Eng. Pat. 11,538, May 27, 1896.

A process for preparing alginic acid (or as the inventor names it "tang acid") from seaweed. Seaweed is soaked, first of all, in dilute sulphuric acid (1 to 6 per cent.), which serves to decompose the intercellular binding material, and is then treated with sufficient of a solution of an alkali or alkaline carbonate to convert the whole into a kind of thin soup. The disintegration of the seaweed fibres takes place almost immediately. The liquid is then filtered and the tang acid precipitated therefrom by the addition of sulphuric acid. The product thus obtained, is free from nitrogen.—H. T. P.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Quartz Slate. Eng. and Mining J. 1896, 274.

See under Trade Rep., page 752.

PATENTS.

Plates, Bricks, and Pipes for Filtering and like Purposes, Impts. in the Manufacture of Porous, Hard and Acid-resisting. W. Schuler, Isny, Germany. Eng. Pat. 18,573, Oct. 4, 1895.

EQUAL parts of calcined Kieselguhr, powdered quartz and silicate of soda, are mixed in as dry a state as possible, moulded and pressed. After the product has hardened in air, it is burned at a temperature slowly rising to a clear red heat. The resulting brick or plate is porous and suitable for filtering. Organic material, such as sawdust, may be added to the mass before firing to increase the porosity of the finished article.—B. B.

Building Materials for Architectural and other Purposes, New or Improved Manufacture of Compositions suitable for Use as. J. Wilkinson, London. Eng. Pat. 9838, May 8, 1896.

A MIXTURE of glue, linseed oil, hydrochloric acid, sulphuric acid, plaster of Paris and lime, and another of zinc oxide, zinc chloride, sulphate of iron, borax and sal-ammoniac, as well as sundry dressings for the bricks to which these compositions are to be applied, are patented.—B. B.

Artificial Stone, Impts. in or relating to the Manufacture of. A. J. Boulton, London. From M. Thys, Brussels, Belgium. Eng. Pat. 12,169, June 3, 1896.

FOUR parts of sand and two of Portland cement are stirred together with glue, and the product is coloured by the addition of a second mixture consisting of 2 parts of cement and 1 part of colouring matter. The mass is pressed into tiles or similar objects, which are moistened every 2 or 3 hours for 3 or 4 days after pressing, and are finally kept in water for 4 days.—B. B.

Hydraulic Gypsum, Proceeding for the Production of Quick-setting (Hardening) Mortar of. L. Mack, Stuttgart, Germany. Eng. Pat. 12,125, June 6, 1896.

GYPSUM dead-burnt to anhydrous calcium sulphate may be caused to set within a reasonable time by the addition of sulphates of the alkali metals, caustic alkalis, magnesium sulphate or ammonium sulphate. As an example the use of 400 grams. of anhydrous sodium sulphate to 100 kilos. of calcined gypsum is quoted. The product is said to be more easily and cheaply manufactured than Keene's cement and to be suitable for general building purposes when the structure is not immersed in water.—B. B.

X.—METALLURGY.

Matte Smelting [Copper, Gold, and Silver] in California. H. Lang. Eng. and Mining J. 1896, 62, 78—79; 103—104.

A DESCRIPTION is given of the smelting works at Keswick, which were constructed for the purpose of reducing the ores of the Iron Mountain Mine. The process consists of three operations, viz.:—(1) Pyrites smelting; (2) Air conversion of the matte [bessemerising]; and (3) Electrolytic refining. The ores are of two kinds, viz., "oxides" and sulphides. The former are principally composed of ferric oxide containing a little silica and alumina, along with copper, but their chief value is in silver and gold, which amounts to several dollars per ton. The sulphides are richer in copper and poorer in gold and silver than the oxides. The copper in some parts of the mine runs to 10 per cent. Full details of the composition of the charges and of the plant are given, but it is expected that better results will be forthcoming. Present experience, however, shows that the protosulphate of iron slag is the best, and the nearer it approaches to this composition the

more favourable is the smelting. The introduction of clay or magnesia as silicate is prejudicial, and a quartz flux containing these substances diminishes the rate of concentration and decreases the fusibility of the charge. A clean white quartz or pure sandstone is the proper flux to use. The addition of lime, generally considered essential in pyritic smelting, is not practised at Keswick, where its introduction to the very basic ores of the district would necessitate the addition of a further quantity of silica, and so disturb the economy of the work.—A. W.

Gold, On the Liquefaction of Certain Alloys of. E. Matthey. Proc. Roy. Soc. 1896, 60, [359], 21—35.

THE author states that lead is far more effective as an agent of liquefaction than zinc, and that silver is undoubtedly the best solvent for the base metals, zinc and lead, when they are alloyed with gold.

He draws the following conclusions from his experiments:—

(1.) Alloys of gold with base metals, notably with lead and zinc, have the gold concentrated towards the centre and lower portions, which renders it impossible to ascertain their true value with even approximate accuracy.

(2.) When silver is also present, these irregularities are greatly modified. The "freezing-points" are very different when silver is present and when it is absent from the alloy.

(3.) This fact naturally leads to the belief that if the base metal present does not exceed 30 per cent, silver will dissolve it and form an uniform alloy with the gold. This conclusion is sustained by experiments described and illustrated in the paper.—A. S.

Iron Ores, The Roasting of, with the View to their Magnetic Concentration. H. Wedding. Iron and Steel Institute, Autumn Meeting, 1896. The Ironmonger, 423—428.

THE author first reviews the advantages *pro* and *con* of roasting the different kinds of iron ores in view of their subsequent reduction, and deals with the several equations representing the changes amongst the various oxides of iron which take place during such roasting. It is advisable that iron carbonates should be roasted before they pass to reduction in the blast furnace, as the heat required to drive off the carbon dioxide is produced and utilised more cheaply outside the furnace. Roasting carried out in the blast furnace is disadvantageous, because the reduction of the ores will take place in zones considerably deeper than after a preliminary roasting, and consequently an increased consumption of fuel is necessary. Akerman concludes that reduction by the roasting of a non-carboniferous ore, can never be of real advantage in the blast furnace, and that it is non-injurious where sintering does not occur after the de-oxidation, and the ore is not rendered more compact. The fact that oxide of iron ores can be more readily reduced after a slight preliminary roasting follows from the change in their physical condition. In the case of magnetites an oxidising roasting is always of advantage, especially in the case of those iron ores which are accompanied by so-called dark gangue stuffs, such as silicates containing ferrous oxides. The roasting of oxides, however, is not always of advantage viewed in the light of their facility for subsequent reduction, but it may be of much benefit when it is a question of preparing from a poor or impure ore, a richer and purer product by magnetic treatment.

The author next deals with the ores under five headings in respect to their preparation for this object. (1.) Magnetites do not need to be roasted for magnetic purposes. Such treatment, however, may be necessary to alter their physical state or to eliminate the sulphur; but they only lose their natural magnetic properties very slowly, whether the roasting is oxidising or reducing in character, except when they are maintained for a long time at a medium red heat with excess of air. The magnetic properties, however, come back on heating to a higher temperature. (2.) Spathic iron ores by suitable roasting yield the magnetic oxide direct. By roasting in a neutral atmosphere the "ignition" magnetic oxide Fe_3O_4 is obtained and in a moderately oxidising atmosphere the magnetic oxide Fe_2O_3 . If, however, the carbon dioxide is once

eliminated, both these oxides pass readily under the action of the oxygen of the air into the non-magnetic ferric oxide Fe_2O_3 . Success therefore depends, as to the production of the magnetic oxide, upon roasting the carbonates with exclusion of air, or, if this be impossible, with a minimum quantity thereof. (3.) Red hematites may be converted into magnetic oxide in two different ways—(a) By heating strongly in the absence of air, and (b) By heating under the action of reducing gases; hydrogen is the most suitable at low temperatures, and carbon monoxide at high temperatures. (4.) Brown iron ores require the water of hydration to be eliminated before reduction. The residue then behaves as a red hematite would, but the reduction proceeds far more readily under the influence of the reducing gases, owing to the more porous character of the dehydrated ore. (5.) Pyritic ores must first be deprived of their sulphur contents, and then the resulting oxide behaves as a red hematite, except that it is a little more difficult to reduce. However, pyrites is only used in practice when it contains copper, and the purple ore resulting from the extraction of the copper is pure enough to dispense with any magnetic separation. The size of the ore and the requirements of the furnaces to be used for these purposes with the different kinds of material are briefly discussed.—A. W.

Steel, Presence of Fixed Nitrogen in. F. W. Harbord and T. Twynam. Iron and Steel Institute, Autumn Meeting, 1896. The Ironmonger, 433—434.

NITROGEN appears to exist in steel in two conditions, since, on solution of the steel in a suitable solvent, or by boring under water or mercury, a far larger amount of nitrogen is obtained than can be found when the fixed nitrogen only is estimated. It appears probable that this nitrogen is merely mechanically occluded in the metal, whilst the fixed nitrogen exists in combination with some other element present, either iron, manganese, or carbon, but probably the first named. With a view to ascertain if the nitrogen could indicate the cause of failure, the authors have examined samples of steel which have failed under varying conditions, when neither analytical nor mechanical tests would do so. They have, however, failed to trace any connection between the amount of nitrogen and the good or bad quality of the steel, and therefore conclude that nitrogen, in the proportion in which it is found in commercial steel, has no detrimental effect.

Analyses of two tubes of Swedish steel, one bad and the other good, showed the latter to contain more nitrogen than the former. The results of the analyses of other kinds of steel show the percentages of nitrogen to range from 0.007 to 0.027. It was also thought that the well-defined nitride of manganese, Mn_3N_2 , might be the cause of the beneficial action of manganese in steel, but in this case also, the results did not lead to any positive conclusions.—A. W.

Carbon, A Note on "the Missing." T. W. Hogg. Iron and Steel Institute, Autumn Meeting, 1896. The Ironmonger, 437—439.

THE "Missing Carbon" is the term used to denote that portion of the carbon in water-quenched steel which is found by taking the difference between Eggertz' test in the normal or annealed steel, and in the same steel in its hardened condition. Its precise nature has yet to be discovered, but the author has for some time used it as a rough measure of the quantity of the carbon which effects the hardening. On treating steel with an excess of nitric acid of moderate strength, the freshly liberated or nascent carbon or carbide enters into combination with the gases evolved at the same time. A nitro-carbon compound is thus formed, which passes into solution upon the application of heat, with the well-known brown colour. A continued heating causes the complete destruction of this colouring matter, with the slow evolution of carbon dioxide, small quantities of cyanogen compounds, and a colourless viscid decomposition product. Nitro-carbon compounds obtained from the same steel in its cast and annealed conditions by treating the borings with a large excess of cold

nitric acid (1·2 sp. gr.) gave the following figures on analysis:—

	Annealed.	Cast.
	Per Cent.	Per Cent.
Iron.....	73·73	2·54
Carbon.....	8·43	10·41
Water.....	7·26	22·46
Nitrogen.....	3·20	8·25
Oxygen (by diff.).....	7·38	17·40

In these analyses the water obtained in the combustion has not been calculated to hydrogen which might be present to a considerable extent not in combination with oxygen. The nitro compounds gradually decompose, even at the ordinary temperature, and this is shown by a series of experiments, wherein a current of pure dry air was passed over them for a definite period at different low temperatures, and the resulting gases absorbed in calcium chloride and potash tubes. The increase in weight in the tubes was in each case greater than the loss, but not sufficient to represent the complete oxidation of the elements. The potash contained small quantities of cyanogen, and only a portion of the total is due to the carbon dioxide. Most of the absorption is evidently due to gradual evolution of nitrogen oxides.

The results of treating steel with nitric acid of the test strength are sufficiently distinctive in character to be classified into four divisions, as follows:—(a) amorphous carbon, which is black and insoluble; (b) normal carbide, which is black, magnetic, and insoluble; (c) dissolved carbide, a brown, insoluble nitro-carbon compound; and (d) unknown carbide, which either is immediately decomposed as CO_2 , or forms a colourless compound. The nitro-compounds are very unstable. The black magnetic substance (b) is decomposed by hot nitric acid; the iron passes into solution, and the brown nitro-carbon compound thus formed dissolves. The carbide (c), when dissolved in the steel, forms at once the brown nitro-carbon compound with the cold acid. The unknown carbide (d) is that which is considered identical with the so-called hardening carbon. Analyses of the total carbon and the carbon by colour test in a series of hardened steels varying in percentage from 0·10 to 6·50 total carbon, show that "the missing carbon" can attain as much as 58·33 per cent. of the whole amount present. With the highest carbon steel there was none. It would appear that the steels which seem to be able to retain the larger proportion of their carbon in this condition are, with one or two exceptions, those which lie between 0·70 and 1·00 per cent., the quantity in all these cases being above 50 per cent.—A. W.

Alumina, Manufacture of [for Aluminium]. J. Sutherland. Inst. Mech. Eng. 1896. Through Engineering, 1896, 62, 291—292.

This is an account of the application of Bayer's process at the Factory at Larnie Harbour. The raw material is bauxite from County Antrim, with an average of 56 per cent. of alumina, 3 per cent. of ferric oxide, 12 per cent. of silica, 3 per cent. of titanic acid, and 26 per cent. of water. The ore is crushed in a disintegrator to $\frac{1}{2}$ -in. cubes, and is riddled through a $\frac{3}{4}$ -in. mesh; that which passes the sieve is delivered into a calciner in which all organic matter is burned off, so that it may not interfere with the subsequent precipitation of alumina from its solution in caustic soda. An excessive temperature must, however, be guarded against, lest the material should be rendered too insoluble. The calciner is of the Oxland and Hocking type, and consists of an iron tube 33 ft. long and 3½ ft. in diameter, lined with fire-brick, and mounted on rollers so that it may be revolved. It is inclined at an angle of 1 in 25, and is heated by a fireplace at the lower end, from which the hot gases pass through the tube to a chimney at the upper end. The ore is fed continuously into the tube at the upper part and, as the tube revolves, passes slowly to the other end where it is discharged upon a plate with a hole just large enough to allow the particles to pass. From thence it is conducted by a shoot to a revolving cooling tube, 30 ft. long and

2½ ft. in diameter, which is placed below, and inclined in the opposite direction to, the calcining tube. Here it is cooled by means of a current of cold air from a fan. A spiral conveyor conducts the cold ore to a second crusher where it is broken down so that it all passes a sieve of 30 meshes per linear inch, and is stored for use.

The crushed alumina is treated in pressure kiers with caustic soda solution of 1·45 sp. gr. The kiers are constructed of mild steel plates $\frac{1}{2}$ in. thick, and are 11 ft. long and 5 ft. in diameter, with a 3-in. horizontal shaft passing through stuffing boxes in the end walls. The shaft is provided with eight 16 in. × 9 in. paddles, which serve as agitators. The kier has charging and discharging openings, and its jacket has a safety-valve, a steam inlet, and a water outlet connected with a steam trap. The soda solution is first introduced in the proper proportion, and the ore (usually 3 tons) is slowly added by means of an elevator, the paddles being kept at work throughout this time to ensure thorough admixture. After closing the charging opening, steam is turned on into the jacket, and the pressure is slowly raised to 70—80 lb., at which it is maintained for two or three hours, until decomposition is complete. The discharge cock is then opened and the red mud is blown out by the pressure in the kiers into tanks at the top of the building. Here water is added to reduce the specific gravity of the liquid to 1·23, and the solution of aluminate of soda is separated by filter-presses from the red deposit that is left. The cakes are washed before removal from the filter press, and are then carried away; no use has yet been found for them. The filtrate is now filtered again through wood pulp contained in lead-lined vats with sloping sides 10 ft. long × 6 ft. broad × 3 ft. deep, with a ledge round the inside, 6 in. from the bottom, on which is placed a frame carrying a sieve of $\frac{1}{8}$ -in. mesh. Two of these filters are superposed; about 50 lb. of wood pulp is boiled with water to a thin pulp, and is run on to the sieve in each filter. It soon settles down, and is ready to receive the filtrate, from which it separates the fine solid matter which it contains. This second filtration is necessary for the production of pure aluminate of soda.

The aluminate solution was formerly decomposed by carbonic acid, but this involved a subsequent regeneration of the soda from the carbonate. By the Bayer process the aluminate is run into circular decomposing tanks 13 ft. in diameter and 20 ft. high, provided with agitators. The precipitation of the aluminium hydroxide is effected by the addition of an excess of the same material. A sufficient quantity of the hydroxide is left in the decomposer, the aluminate of soda is introduced, agitation is commenced, and within 36 hours 70 per cent. of the alumina in combination with the soda will have been precipitated from the solution. The agitation is stopped, the hydroxide is allowed to settle, and the liquor with its undecomposed portion is run off to the weak-liquor tanks. When as much as possible of the clear liquor has thus been decanted, the hydrate mud is filter-pressed, sufficient being left, however, in the decomposer to accomplish the precipitation of the next batch of liquid. The filtrate is conveyed to the weak-liquor tanks. The pressed cakes are washed free from soda *in situ*, and compressed air is then forced through them to expel as much water as possible. The air-compressors deliver the air at a pressure of 80 lb. per sq. in. The pressed alumina is conveyed mechanically to calcining furnaces. This furnace has a bed 20 ft. by 6 ft., and is fired by Dowson gas produced in generators placed outside the main building. The products of combustion pass between an arch over the hearth and a drying tray above, on which the cakes of alumina receive a preliminary drying before they are admitted to the hearth. It is necessary that the product shall be perfectly dry, if it is to be used for the manufacture of aluminium in the electric furnace. A low temperature would suffice for this; but the alumina is usually heated up to 2,000° F., so that it may become crystalline, in which state it is less prone to reabsorb moisture from the air subsequently. After calcination, the alumina is spread upon a tiled floor to cool.

The weak liquors from the decomposers have a specific gravity of 1·2, and must be concentrated in a triple-effect evaporator to the specific gravity of 1·45 before they can be used to attack the calcined bauxite. The water evaporated

from the solution has a temperature of 180° F., and, being pure, is used for washing the hydroxide and for feeding the boiler. All the drainage of the factory is collected in a concrete tank placed in the yard, and is pumped back to be used for washing the red mud, for dissolving soda, &c., so that any soda or aluminate that may have leaked away is recovered.—W. G. M.

Blende, Examination of the Reactions Occurring in the Metallurgical Treatment of. E. Prost. Bull. de l'Assoc. Belge des Chim., 10, [5], 212–225.

HOWEVER carefully the roasting process may be performed, the sulphur which always remains behind depends upon the initial proportion of calcium and magnesium carbonates, and lead sulphide in the blende, as well as on the silica present, the latter favouring the liberation of the sulphur combined with the lead. Both zinc and iron sulphides are almost completely converted into oxides, lead sulphide becomes sulphate or silicate, and lime is largely changed into gypsum.

The author examined several samples of roasted blende, by extracting the soluble sulphates with cold water and estimating the sulphuric acid, zinc, calcium, and magnesium in the solution. The results tend to show that only a small portion of the zinc (e.g., 0.20 per cent. out of 57.80 per cent. in the blende) is in the state of sulphate, whereas nearly the whole of the lead (5.02 out of a total 5.60 per cent.) is in that condition.

That the oxide of zinc enters into combination with iron oxide in the roasting furnace (chiefly forming ZnFe_2O_4) is indicated by the results obtained when the roasted blende was heated with ammonium tartrate for the extraction of zinc, viz.:—

No.	Iron.	Zinc (Total).	Zinc extracted by Ammonium Tartrate.
	Per Cent.		
1	15.29	45.29	28.82 = 63.64 per cent. of the total Zn.
2	1.50	62.86	59.18 = 95.42
3	5.28	57.80	43.16 = 74.67

Some $2\frac{1}{2}$ to 3 per cent. of zinc remains in the residue after distillation, and attention was given to the state of combination in which this residual zinc exists. After removing the ferruginous matter from the residue by a magnet the remainder was attacked by increasingly concentrated acid solvents. It was found that out of the 4.76 per cent. of zinc present, 2.36 at least was in the condition of sulphide, thus confirming in some measure the statement of Voigt (Zeits. angew. Chem. 1889, 571) although the results did not entirely agree with his. The divergence, as also the occurrence of cases wherein the zinc in the residue is chiefly found as oxide, is probably attributable to variations in the composition of the ore, the state of the mixture, and the temperature of the furnace, &c.—C. S.

Mercury Ores, Treatment of, in the Asturias, Spain. Eng. and Mining J. 1896, 62, 149, 150.

THE new types of furnace which have been in use are the Livermore, the Rodriguez, and the Gasenc-Rodriguez. Descriptions and drawings of each of these furnaces are given, together with the charges employed in them. Careful trials with the last-named furnace showed that the average quantity of the quicksilver obtained was 96.88 per cent. of that in the ore. The necessity for the careful treatment of the ore is shown by the fact that the average percentage of quicksilver in it is as low as 0.7.

The arsenical product which condensed with the quicksilver in the condensers on working a charge of ore in the Gasenc-Rodriguez furnace, has the following approximate composition:—Mercury, 14.0; sulphate of mercury, 0.87; arsenious acid, 62.78; arsenious sulphides, 0.45; volatile oils, 2.0; water, 1.5; carbon, 1.5; and mineral matters, 16.9 per cent. This is mixed with lime, washed with a flowing stream of water, mixed with 0.3 per cent. of both coke and clay, made into briquettes, and again distilled. The product then condensed has the following composition:—Arsenious

acid, 90.73; sulphuric acid, 0.27; mercury, 8.61; lime 0.17; and carbon, 0.22 per cent. After forming into briquettes, this is again distilled with a higher percentage of coke and a sufficiently high proportion of arsenic to enable it to be made into orpiment, when the condensed product contains only a trace of quicksilver (the bulk having run off to the proper receptacles). The assay of the ores is carried out by the electrolytic process, since the lowness of their grade renders it difficult to obtain exact results with the old amalgamation process.—A. W.

Pure Molybdenum, Preparation and Properties of. H. Moissan. Eng. and Mining J. 1896, 99.

THE author prepared metallic molybdenum in fused masses, practically free from carbon, by the following method:—Pure ammonium molybdate, finely powdered, is heated in quantities of 1 kilo., in a covered clay crucible for $1\frac{1}{2}$ hours in a Perrot gas furnace. The ammonia is volatilised, leaving in the crucible, molybdic oxide (MoO_3) as a bluish-gray powder, the yield being 76 to 78 per cent. of the weight of the salt treated. The oxide so obtained is mixed with sugar-charcoal in quantity insufficient for complete reduction; 300 of oxide to 30 of charcoal. The mixture is packed into a carbon crucible and subjected to the calorific action of the arc produced by a current of 600 amperes at 60 volts for a period of six minutes, care being taken to keep a layer of solid material in contact with the crucible, which would be rapidly attacked if the charge was completely fused. Under these conditions more than 1 kilo. may be easily obtained in an hour.

Molybdenum, thus obtained, is a tolerably soft metal, does not scratch glass, can be easily filed and polished, and is malleable when hot, and its specific gravity is 9.01. If a fragment be embedded in charcoal and heated for several hours at about 1500° C., cementation ensues, a small quantity of carbon is taken up and the metal becomes harder than glass. The resulting metal, when heated to 300° C. and chilled in cold water, becomes brittle and so hard that it scratches quartz. The metal itself is but slightly oxidisable in the air at temperatures below a dull red heat, and becomes coloured on the surface like steel. At about 600° C. it begins to oxidise and is converted into molybdic acid. The action of oxygen is similar but more rapid, so that combustion takes place with vivid incandescence.

When the reduction of the oxide in the electric furnace is effected with excess of carbon, substances containing carbon, both in combined and graphitic condition, as in cast iron, are readily obtained. Their density varies from 8.6 to 8.9. When saturated with carbon, the metal is more fusible than pure molybdenum and is intensely hard; but when the proportion is only 2.5 per cent., it is difficult to break with a hammer. The point of saturation seems to correspond to 5.88 per cent. or the formula Mo_3C . This runs very liquid and may easily be cast into ingots weighing from 8 to 10 kilos. The liquid metal dissolves carbon very readily, but the excess above this quantity separates out on solidification as graphite. The carburised metal, like cast iron, may be rendered superficially malleable by closely covering it with powdered oxide of molybdenum and heating for several hours; this produces a skin of the pure metal.

The author considers that the volatility of its oxide is likely to render molybdenum of value as a deoxidising agent in steel works in the place of manganese or aluminium, for although the latter is an energetic agent, it has the inconvenience of giving a solid and infusible oxide, whilst the molybdenum oxidising would produce a stirring action in the bath, leaving nothing behind, or if in slight excess, it would have no effect on the malleability and tempering properties of the steel. For this purpose, however, the solid metal would be necessary, as that in a powdered form produced by reduction of the oxide with hydrogen, is useless, merely burning to waste on the surface of the bath without affecting the metal below.—A. S.

Phosphorus, Insoluble; Estimation in Iron Ores. C. T. Mixer. Eng. and Mining J. 62, 1896, 4.

See under XXIII., page 743.

Palladium, its Separation from Platinum. Cohn and Fleissner. Monatsb. f. Chem. **17**, 361.

See under XXIII., page 714.

Quicksilver, Production of, in California.

See under Trade Rep., page 752.

Tin Plates in the United States. Eng. and Mining J. 1896, 289.

See under Trade Rep., page 752.

PATENTS.

Bluestone and other Sulphurised Ores [Separation by Ferric Chloride], Impts. in the Treatment of. J. C. Butterfield, London. Eng. Pat. 9052, May 7, 1895.

THE finely ground ores are treated in tanks with a hot solution of ferric chloride, by which means the copper, lead, antimony, &c. are dissolved, whilst the sulphur, gold, and gangue are left as insoluble residues. The solution is then drawn off into settling tanks. In the first series, part of the lead chloride is deposited and the remainder in the second series. From the clear liquors, the copper, antimony, &c. are precipitated on metallic iron and may be separated by any known methods. The solution is then heated and regenerated by blowing air through it. To lessen the "frothing" during the blowing, a little petroleum is added. The ferric hydrate produced in this operation is then removed by filtration through asbestos, and after thorough washing, may be converted into pigments by known methods. The filtrate is employed for lixiviating a new portion of ore.

The insoluble residues are dried and heated to dull redness in retorts so as to separate and condense the arsenic and sulphur. The earthy residue containing the gold is then mixed with lime or other suitable fluxing material, and with sulphate or sulphide of lead and smelted to a regulus which is washed, ground, and treated as before with ferric chloride solution to separate lead as chloride. The residue from this operation is distilled as before but this time yields a button of lead containing all the gold (and silver), which may be recovered by cupelling.

The sulphate of lead required for the process is made from the chlorides deposited from the various liquors.—J. H. C.

Copper, The Extraction of, from Sulphuretted Ores or Compounds; An Improved Process for. C. James, Swansea. Eng. Pat. 15,159, July 8, 1896.

A PORTION of the ore is converted into a matte of from 70—75 per cent. of copper, which is then crushed and calcined. Three parts of this calcined product are then mixed with 2 parts of raw sulphuretted ore—more or less, as may be determined by assay,—and treated in the furnace as in Eng. Pat. 18,898 of 1890, so as to produce a "purple" or "blister" copper.—J. H. C.

Argentiferous and Auriferous Copper-Ores, Mattes, or Compounds, An Improved Process [Partial-Oxidation] for the Reduction of. C. James, Swansea. Eng. Pat. 14,957, July 6, 1896.

PART of the ores, &c. are calcined or oxidised by adding a highly oxidising salt to the charge, another part is added in an uncalcined condition, the proportions being predetermined by assay. The precious metals are concentrated in the metallic copper produced by the mutual reaction while in the furnace, as described in Eng. Pat. 18,898 of 1890, and may be subsequently separated by electrical or other known methods. Silica is added when lead is present, so as to remove it in the form of a slag which is free from the precious metals. This slag after being freed from lead, is again employed in the earlier stages of the process.—J. H. C.

Precious Metals, Impts. [Cyanides and Electricity] in Obtaining, from Solutions. J. S. MacArthur, Pollockshields. Eng. Pat. 16,634, Sept. 5, 1895.

THE improvements refer chiefly but not exclusively to cyanide solutions. The metals are precipitated by means of an electric current applied in connection with anodes and cathodes of iron or steel plates coated with graphite, lead oxide or other suitable substance.—J. H. C.

Metal Sheets, Impts. in Preparing for the Purpose of Galvanizing them, or otherwise Coating them with Metal or Metallic Alloy. Davies Bros. and Co., Lim., E. A. Davies, and S. T. Thomas, all of Wolverhampton. Eng. Pat. 17,932, Sept. 25, 1895.

THE sheets are first passed through a furnace so as to raise a scale upon their surfaces. The scale is then removed by means of revolving metallic brushes or rolls and the plates are finally pickled in the usual way. Reference is made to a previous patent (see this Journal, 1895, 973).—J. H. C.

Calcining Furnaces [Desulphurising], Impts. in. A. H. Wetley Butte, Montana. Eng. Pat. 9560, May 5, 1896.

A SERIES of roasting hearths placed one above another, are connected in such a manner as to form a continuous chamber for the passage of the ore and the heated gases, which move in opposite directions. The hearths are provided with rakes or stirring devices, and these are operated through longitudinal slots in the sides of the furnaces.—J. H. C.

Roasting Furnaces, Impts. in. B. T. Lacy, San Francisco. Eng. Pat. 15,682, July 15, 1896.

THE improvements relate to mechanical furnaces and chiefly to the travelling rables, and are purely mechanical.—J. H. C.

Precious Metals, A Process for Extracting from Refractory Ores. J. Woodford, London. Eng. Pat. 12,129, June 3, 1896.

THE crushed ore, whether raw or roasted, is intimately mixed with antimony oxides and pulverised fuel, and then fused in a cupola or other suitable furnace, so as to form an alloy of antimony and gold, which is tapped off and treated in an oxidising furnace, having a bed glazed with a mixture of borax and sulphate of soda. The antimony passes away as fume, while the precious metal remains on the furnace bed. The operation is repeated until the bed is sufficiently charged.

The fume is drawn off, condensed by water-spray, and used over again after drying.—J. H. C.

Desilverisation of Lead [Squeezing out Unalloyed Lead], Impts. in and relating to. W. H. Howard, Pueblo, U.S.A. Eng. Pat. 15,542, July 14, 1896.

THE zinc crusts produced in the Parkes process are subjected to pressure whilst still hot, whereby the unalloyed lead is squeezed out before it has time to cool and harden. The resulting alloy is considerably reduced in weight and bulk, and becomes consequently much richer in silver.—J. H. C.

Iron Blast-Furnace Gases, Impts. in Apparatus for Rendering Available for Working Gas-Motor Engines. B. H. Thwaite and F. L. Gardner, London. Eng. Pat. 15,684, July 15, 1896.

A DOUBLE valve is connected to the bell-hopper of the furnace, so as to control the gases in their passage to a receiver, and to prevent the formation of explosive mixtures by admixture of air. The gases are led to dust-depositing chambers containing obliquely-placed screens of wire gauze, which are moved rapidly up and down by means of eccentrics or cranks, so that the dust deposited in the meshes may be shaken off. The valve-stems, screen-roads, and other working parts are "sealed" with mercury or other liquid where required. The deposit of dust may be assisted by electric discharges.

From the dust chambers the gases are drawn, by means of a fan, through washing and filtering apparatus, and finally to an automatic gas-regulator.

An automatic electrical signalling apparatus for informing the attendant when the pressure in the furnace varies beyond certain limits is also provided.—J. H. C.

Magnetic Oxide of Iron, Impts. in the Process of converting Ferric Oxide into. R. H. Peak, Florida, U.S.A. Eng. Pat. 15,965, July 18, 1896.

The ferric oxide is finely ground, heated in an air-tight vessel, and then allowed to cool without access of air.

—J. H. C.

Ferro-Sodium Fluxes [Iron and Steel], Impts. in. W. J. May, Kingston-on-Thames. Eng. Pat. 17,901, Sept. 25, 1896.

CAST-IRON or steel is melted and poured on to beds composed of iron or steel borings, intimately mixed with a sodium salt, and immediately covered with a sufficient thickness of a similar mixture. The claim does not include the use of chloride of sodium.—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

Cement and Concrete, On the Electrical Conductivity of. Dr. St. Lindeck. Elektrotech. Zeits. 1896, 180; Proc. Inst. Civil Eng. 1896, [3], 66.

THE author refers to the leakage of current upon electrical railways where the rails are used as the return circuit, and, after alluding to the damage done to metal pipes laid underground, and also to the disturbance occasioned to electrical laboratories in the neighbourhood, discusses means whereby such leakage may be prevented or materially diminished.

He quotes Dr. Ulbricht and Dr. Kallmann as considering that the rails should be insulated as well as possible from the earth, and cites the fact that the American practice of fixing the rails either upon longitudinal sleepers or cross sleepers, in each case of creosoted wood, appears to give better results than the German practice of laying the rails in concrete.

Cement and Cement-Concrete.—Experimental blocks were used, 15.75 ins. long by 3.94 ins. square, and sheet-iron electrodes with holes in were fixed in these while in a soft state. At least two blocks were used of each kind; and neat cement, as well as various classes of concrete, were tested.

The results are calculated in the original for a cubic decimetre of the material, and from the data it appears that, while the resistance per cubic foot of the pure cement blocks dry is about 144 ohms, this falls as low as 43 ohms after immersion for 22 hours in water, and rises to 820 ohms after being exposed to a heat of 212° F. The greater the admixture of sand or gravel, the higher the resistance becomes, until, with 1 of cement to 7 of gravel, the resistance, dry, reaches about 1,800 ohms, after immersion falls to 72 ohms, and, after exposure at 212° F., rises to about 2,000,000 ohms for a time.

It is obvious, therefore, that such a concrete rail-bed favours the escape of current to earth, especially if the surface of the road consist of asphalt, which prevents the concrete from drying.

The retention of water by the concrete is clearly shown with the test pieces, made with 1 part of cement to 7 parts of gravel. These gave in an air-dried state a resistance of 5,000 ohms, while after exposure to a heat of 212° F. in an oven the same pieces gave a resistance of from 6 megohms to 7 megohms.

If the highest result obtained for air-dried concrete be taken at about 1,670 ohms per cubic foot, an insulation resistance of about $\frac{1}{2}$ ohm per mile of road is obtained.

Asphalt-Concrete.—Ulbricht also drew attention to the so-called "asphalt-concrete," which has been used for building purposes in Dresden. This consisted of 50 per cent. of broken stone, 20 per cent. of coarse gravel free from loam and sand, 12 per cent. of asphalt, 8 per cent. of coal-tar pitch, and 10 per cent. of German coal-tar. The results obtained were so high that it was doubtful whether the current passed through the material or leaked over the surface.

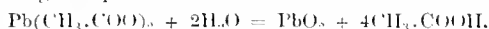
One cubic decimetre block made with syenite gave when dry an insulation resistance of 280,000 megohms. It was then immersed in water for two hours, and 2½ hours afterwards gave an insulation resistance of 160,000 megohms; while, after six weeks' immersion, it gave 170,000 megohms, and similar results were obtained with the other blocks. The author therefore believes that, if this asphalt-concrete be used, the leakage of current would be very trifling, and the cost could be kept down by using merely a thin layer of this material over the ordinary concrete.

Lead Accumulators, Theory of. W. Löb. Zeits. für Elektrochem. 1896, 3, 100–101.

THE author criticises a theory of the lead secondary cell propounded by Professor Elbs. In electrolysis a solution of lead diacetate under certain definite conditions, Elbs succeeded in observing the formation of lead tetra-acetate, the acid residue which was left after the deposition of lead uniting with the salt present:—



The tetra acetate thus produced is decomposed by water, forming lead peroxide and acetic acid:—



Thus the tetra-acetate can only be obtained when no water is present; in aqueous solution all that is observed is a separation of lead peroxide. This Elbs regards as a secondary process, whereas Liebenow and Löb regard it as a primary phenomenon.

Elbs' theory requires that lead and lead peroxide should be produced in corresponding quantities in the cell. But this is not in accordance with experience; for, if we electrolyse with a large anode, by far the greater part of the lead present appears as lead peroxide. The fact that tetra-acetate is formed in the absence of water does not justify us in drawing conclusions as to the nature of the reactions which occur when water is present.—D. E. J.

Conversion of Nitriles into Amines by Electrolysis.

F. B. Ahrens. Zeits. für Elektrochem. 1896, 3, 99–100.

AN attempt to reduce nitriles electrolytically to amines, in accordance with the equation $\text{R.CN} + 2\text{H}_2 = \text{R.CH}_2\text{NH}_2$, which represents the usual mode of reduction by sodium amalgam or sodium and alcohol. It was found that in acid solution there occurred, together with the reduction of the nitrile, a saponification of it, with formation of acid, in accordance with the equation—



The lower the molecular weight of the nitrile the larger was the proportion of ammonia produced. Acetonitrile yielded only ammonia; propionitrile a fair proportion of *n*-propylamine, in addition to ammonia; and benzonitrile yielded only benzylamine. After electrolysis, the solution was treated with ether, to extract any unaltered nitrile; it was then made alkaline with soda, and the bases were driven off with steam. The distillate was neutralised with hydrochloric acid, evaporated down, and the salt extracted with absolute alcohol. Sal-ammoniac remained behind, while the hydrochloride of the amine went into solution, and was identified as chloro-platinate. Attempts to reduce nitriles electrolytically in alkaline solution were less successful, for practically nothing but ammonia was obtained.—D. E. J.

Blanching Solutions, Electrolytic Production of. Dingler's Polyt. J. 301, [10], 234.

See under VII., page 719.

Alkali and Chlorine. W. Borchers. Zeits. f. Elektrochem. 1896, 3, 114–116.

See under VII., page 719.

PATENTS.

Electrodes for Voltaic Batteries, Impts. in the Manufacture of. [Alkaline Paste.] L. Epstein, Twickenham. Eng. Pat. 16,569, Sept. 4, 1895.

ELECTRODES rendered porous by the treatment described in Eng. Pat. 350, 1890 (this Journal, 1890, 812), or in any

other suitable manner, are coated with a paste formed of any of the oxides of lead in a saturated solution of caustic alkali, in such proportions that at least one-half the lead oxide is dissolved in the alkali. These plates are converted into negatives by connecting them to the negative pole of a source of electric supply whilst immersed in an electrolyte consisting of dilute sulphuric acid, or a solution of a suitable salt, such as a soluble sulphate or sulphite of an alkali or an earth. It is preferable to reduce all the plates first, and then to convert some of them into positives by drying them and connecting them to the positive source of supply; but the plates intended for positives may be first neutralised by dipping them in a bath of sulphuric acid, sulphurous acid, or other suitable solution, such as magnesium sulphate, drying them, repeating the process several times, and then forming them as before.—G. H. R.

Blanching Liquid, Impts. in the Electrolytical Manufacture of. [Cooling.] C. Kellner, Vienna, Austria. Eng. Pat. 17,525, Sept. 19, 1895.

See under VII., page 719.

Ozone, Impts. in Apparatus for the Production of. [Hollow Electrodes.] E. Andreoli, London. Eng. Pat. 10,372, May 14, 1896.

The ozoniser is connected at one end or at the bottom with an air-chamber provided with baffles, so that the air or gas to be treated is divided evenly between the electrodes, whilst at the top or at the other end is a receiver into which the gas passes as it is treated. There are two sets of electrodes, which are formed of shallow metal boxes, which may be provided externally with points, as in Eng. Pat. 17,426, 1891 (this Journal, 1893, 452). Water or other liquid is circulated through these hollow electrodes, so as to keep them cool, and they are so placed between the air and ozone chambers that no space is left on their active surfaces which is not in contact with the air forced into the apparatus.—G. H. R.

(B).—ELECTRO-METALLURGY.

Lead, Electrolytic Desilverisation of Argentiferous.
D. Tommasi. Comptes rend. 122, 1476—1477.

THE argentiferous lead is cast into suitable anodes; the cathodes are discs of a metal which is not attacked by the bath. The latter may be copper, aluminium bronze, or even sheet iron, but cast iron would precipitate metallic lead from the bath. The electrolyte is a double acetate of lead and sodium, or of lead and potassium. Under the action of the current, the lead is removed from the anodes and deposited in the form of spongy crystals upon the cathode; while the silver contained in the anode, being insoluble in the bath, falls into a perforated receiver at the bottom. The silver is washed, dried, fused in a crucible with sodium nitrate and a little borax, and cast into ingots. The fusion with sodium nitrate converts any antimony and arsenic (which may have been precipitated with the silver) into antimoniate and arsenate, whilst the silver remains in the metallic state. The lead is detached from the discs, washed, and submitted to great pressure. It is then fused in a crucible with two or three per cent. of carbon and cast into ingots.—D. E. J.

Mercury, Arsenic, and Antimony; Extraction from their Sulphides. L'Eclairage électrique, 1896, 276.

THE sulphides of these metals form double compounds with the sulphides and sulphhydrates of the alkaline earths. Upon this property is based the Siemens process for extracting from the sulphides, sulphur and the corresponding metal, without the formation of useless by-products. For example, when a solution of antimony sulphide in calcium sulphhydrate is electrolysed, antimony separates out at the cathode and calcium sulphide at the anode; no diaphragm is needed. By treatment with carbon dioxide in presence of water, the calcium sulphide is converted into sulphuretted hydrogen, calcium carbonate, and sulphur. When the mixture of the last two is heated in absence of air, sulphur and carbon dioxide are evolved. The

sulphur is condensed and the carbon dioxide is utilised for treating a further quantity of calcium sulphide. The lime which is left behind after the heating is converted into calcium sulphhydrate by the sulphuretted hydrogen obtained in the second operation.—D. E. J.

PATENTS.

Amalgams, Electrolytic Production of, and their Utilisation. E. Andreoli and S. W. Andreoli, London. Eng. Pat. 15,024, Aug. 9, 1895.

THE apparatus described consists of two vessels, termed respectively the electrolyser and the amalgamator, which are each divided into three compartments by means of two porous partitions. In the electrolyser the two outer compartments contain iron or copper anodes, whilst the centre division contains mercury, which forms the cathode; and in order to reduce the quantity of mercury, this division is nearly filled with a block of cement, so that the mercury takes the form of thin vertical films between it and the porous partitions, thus giving a very large surface for a small weight of the metal. The outer compartments are filled with chloride of sodium solution, and on the passage of the current, chlorine is liberated in them, whilst sodium amalgam is formed in the centre compartment, and is drawn off into the centre compartment of the amalgamator, the outer divisions of which are filled with a concentrated solution of sodium chloride, and connected to the positive pole of the source of electric supply, the centre compartment being meantime connected with the negative. Thus, while the copper or other metal is being amalgamated in the centre compartment, the strength of the amalgam is maintained. The amalgamator may be used dry, or the mercury amalgam may be covered with water. Various forms of the apparatus are described.—G. H. R.

Gold and Silver, Electro-Deposition of. [Lead Peroxide Anodes.] E. Andreoli, London. Eng. Pat. 16,557, Sept. 4, 1895.

THE difficulty of obtaining insoluble anodes for use in the electro-deposition of gold or silver from cyanide solutions, is overcome by the use of peroxide of lead, as described in Eng. Pat. 11,752, 1895 (this Journal, 1895, 810). The cathodes may be made of zinc or any other metal, and both electrodes are preferably perforated and arranged transversely in the electrolytic vessel, so that the electrolyte flows through them; but they may be solid, in which case they are placed longitudinally.—G. H. R.

Electric Smelting, Impts. in. [Alternating Currents.] T. L. Willson, New York, U.S.A. Eng. Pat. 17,063, Sept. 12, 1895. (Under Internat. Convention.)

THE furnace employed is preferably a Siemens furnace with a vertical carbon pencil, to which one terminal of an alternating current dynamo is connected, while the other is connected to the crucible or carbon hearth. In the production of aluminium bronze, powdered alumina and crushed carbon, together with copper in suitable proportion to form the required alloy, are fed into the furnace, where they are drawn into the arc by its pulsating action, which makes the feed continuous and automatic; or the copper or other base metal may be introduced first, so that it forms a molten layer on the hearth. The alternating-current furnace may be employed for various smelting and metallurgical purposes—among others, for the production of calcium carbide, described in Eng. Pat. 15,360, 1895 (this Journal, 1896, 5-2). A current of about 1,500 ampères at 55 volts, with 120 alternations per second, has been found to give good results, and it is stated that the output with an alternating current is nearly double that obtained with a direct current.—G. H. R.

Ferro-Manganese, Ferro-Chrome, Ferro-Aluminium, Ferro-Nickel, and other Alloys having an Iron Base; Impt. in the Electrolytic Manufacture of. [Carbon and Lime Flux.] J. Heibling, Grenoble, France. Eng. Pat. 18,487, Oct. 3, 1895.

THE furnace, which is partly cylindrical and partly conical is constructed inside of carbon and outside of fire-bricks

and has at its bottom a movable bed-plate, preferably formed of fusible cast-iron, which is intended to be melted during the operation. This bed-plate rests on another, also movable, which is formed of carbon bricks, produced by baking a suitable mixture of pulverised coke, plumbago, and tar in closed cast-iron moulds. This furnace acts as a negative electrode, the positive consisting of a bar of carbon, the size of which depends on the depth of the furnace and the electrical energy available. The powdered ore or oxide to be treated is mixed with a quantity of carbon equivalent to the oxygen in the ore, and as a flux, has incorporated with it a variable quantity of powdered quicklime, together with a further proportion of carbon. If the nature of the ore admits of it, an oxide of iron is added, together with a quantity of carbon necessary to effect its reduction, so as to obtain the required alloy, the weight of the cast-iron plate being taken into account. If the silicon present be in excess of the normal amount, powdered fluorspar is added. On the passage of the current, the ore and oxide of iron are reduced, and calcium carbide is formed by the mutual action of the calcium and carbon dissolved in the iron alloy. To remove the product, the carbon bed-plate is lowered on one side by suitable mechanism. The carbide of silicon present in the calcium carbide slag renders the latter more proof against the action of moist air than would otherwise be the case. An excess of silica is to be avoided.—G. H. R.

Sheets or Strips, or other Form of Metal, by Electro-Deposition, Improved Means to be employed in the Production of. [Cathode of Al or Al Alloy.] S. O. Cowper-Coles, London. Eng. Pat. 29,073, Oct. 21, 1895.

ALUMINIUM, or an alloy not containing less than 50 per cent. of that metal, is used for the construction of the cathodes, as it is stated that from such cathodes the deposited metal can be easily removed. The removal should be effected whilst the cathodes are wet, or, if they have been allowed to dry, they should be immersed in a weak alkaline or acid bath. The metal may be stripped from the cathodes in the form of sheets, or may be removed by rubbing, which method is preferred in the case of the deposition of gold. The cathodes may be of any suitable form, such as plates or continuous bands traversing the electrolyte, or of drums revolving therein.—G. H. R.

XII.—FATS, OILS, AND SOAP

Fatty Acids, Liberation of, by Pulverisation. Rev. de Chim. Industr. 7, [80], 237—239.

THE conversion of fats into free acids and glycerin is carried out by three different processes in the stearin industry:—(1.) Aqueous saponification in an autoclave under pressure. (2.) Saponification in an autoclave with the assistance of a base, such as lime or magnesia; and (3.) Lime saponification, completed by sulphuric acid, and subsequent distillation of the fatty acids. The first two have the advantage of yielding a more solid product, whilst the oleic acid and glycerin are in a more refined state. The last gives a higher yield of stearic acid, but the expenses of manufacture are greater and the commercial value of the products less. Hence the profits derived from the different methods are said to be about equal.

In Emile Petit's process the two bodies are brought together in the finest state of division, so that the sulphuric acid acts immediately on every particle. (See this Journal, 1895, 167.)

By this process the liberation of the fatty acids is complete and instantaneous, and a single turbine can produce from 30 to 40 kilos. per minute. The solid acids, which are but slightly coloured, are well cooled, and pressed in the cold to remove oleic acid.—C. A. M.

Hazel-Nut Oil. A. Schöttler. Apoth. Zeit. 11, 533—534.

The expressed oil (yield 50 to 55 per cent.) has a specific gravity of 0.916, at 15° C. It gave the following numbers:

Hübl's iodine value, 87; saponification value, 187; Hehner's number, 95.5; Reichert-Meissl's value, 0.99. The fatty acids solidified at 19—20° C. The saponification showed that the hazel-nut oil chiefly consisted of liquid glycerides, and only contained a very small quantity of palmitin, thus bearing a great resemblance to almond oil.—A. S.

Linseed Oil for Varnish-making, Possibility of using Chloride of Sulphur for Thickening. Chem. Rev. Fett-u. Harz Ind. 3, [41], 147.

See under XIII. B., page 729.

Cocoa-Butter, the Iodine Number of. F. Filsinger. Zeits. anal. Chem. 1896, 35, [4 and 5], 517.

See under XXIII., page 747.

Californian Olive Oil. Chem. and Drug. 1896, 580.

See under Trade Rep., page 753.

PATENT.

Fish, Fish Offal, and the like, Impts. in or relating to the Treatment of [for Oil and Manure, &c.]. J. C. W. Staaley, London. Eng. Pat. 18,414, Oct. 2, 1895.

THE fish is boiled in a long, shallow tank, provided with a perforated plate near the top, and with a worm conveyor near the bottom. The fish is introduced by means of a hopper through an inlet near the bottom of the tank, and is gradually drawn by the conveyor into a second compartment, from which the solid matter is removed by means of buckets with perforated bottoms, attached to a chain. The material is subsequently treated as already recommended (this Journal, 1894, 165).

The oil rising to the surface of the water, through the perforated plate, overflows along with some water into a separate tank, from which the water is withdrawn from below, and re-delivered by pumping, to the cooking vessel; so that the same water is used over and over again. The oil is removed and purified by straining, or by filtering and washing, or by means of fuller's earth. The residue is used as manure, &c.—N. H. J. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

White-Lead Trade and the Merchandise Marks Act. Bd. of Trade J., Oct. 1896, 388.

See under Trade Rep., page 751.

PATENTS.

Lead Oxide [Air and Agitated Molten Lead], An Improved Method and Means of Producing. J. Noad, East Ham. Eng. Pat. 21,175, Nov. 8, 1895.

THE patentee describes an apparatus for the manufacture of lead oxide by the action of a blast of air on molten lead maintained in a state of violent agitation by suitable stirrers. The surface of the metal is covered with a thin layer of sand, and a spray of water is also introduced to assist in the operation. The oxide, "in a cloud-like, impalpable, floury condition," is blown over into a number of hoppers, and finally into a condensing chamber. It may be obtained in any desired colour, from a pale straw to a deep red, by regulating the temperature of the metal—the shade of the product becoming darker as the heat of the bath rises.

—F. H. L.

"White Lead," *Impts. [Ammonium Acetate Process in the Production of Basic Carbonate of Lead or]*. O. Hamilton, Northfleet, Kent. Eng. Pat. 22,460, Nov. 25, 1895.

This is an improved form of the regular "precipitation" process for the manufacture of white lead. The special improvements consist—(1) in the use of a 5 per cent. solution containing the acetates of lead and ammonium in molecular proportion, 9,000 galls. of which are capable of dissolving 35 to 40 cwt. of litharge; and (2) in the employment of "litharge (preferably made by oxidation of refined lead on bone-ash tests, as in cupellation of silver) which has been powdered in such a manner as to convert it into the red variety"—a form in which it is more soluble. Towards the end of the process, the liquid should be heated to 80° C., the oxide should only be added as fast as it dissolves, and the finished solution should have a gravity of 14° to 16° T. After carbonation the residual liquor should be about 4° or 5° T., and possess approximately the same composition as the original. The white lead is washed first with sodium carbonate to remove adhering acetate, and, after drying, it is passed under edge runners to roll out the air, thus rendering it more convenient to handle. The use of apparatus described in Eng. Pats. 11,243, 1892 (this Journal, 1893, 741), and 4,969, 1894, is recommended.—F. H. L.

White Lead, Impts. in the Manufacture of. W. P. and W. Tatham, Philadelphia, U.S.A. Eng. Pat. 13,886, June 23, 1896.

This is also a process for the manufacture of white lead by precipitation, the improvement here consisting in submitting the basic acetate to the action of the carbonic acid gas in a solid condition, whereby practically the whole of the litharge employed is converted into pigment and the proportion of "idle" lead is greatly reduced. The original solution should contain about 13 per cent. of lead acetate, and 2.25 times as much litharge should be added as the amount existing in the normal salt. This addition is made in two portions, about 60 per cent. of it being introduced without grinding in one vessel, the whole being then transferred to another, heated to 70° C., and the remaining 40 per cent. of oxide in fine powder stirred in until crystallisation begins. The resulting mass is treated with carbonic acid, and, after the white lead has been filtered off, the filtrate is ready to dissolve fresh litharge as before.—F. H. L.

(B.)—RESINS, VARNISHES.

Driers, Contributions to our Knowledge of. M. Weger. Zeits. für ang. Chem. 1896, 531—536.

SO-CALLED "soluble driers," the manganese and lead soaps of rosin, linoleic, oleic, and stearic acids, which for the last 10 years have gradually replaced materials like litharge, red lead, peroxide, hydrated oxide, and borate of manganese, possess also the advantage that they are perfectly soluble at comparatively low temperatures in linseed oil or turpentine. For the preparation of varnishes they can be added directly to the linseed oil at about 120° C., or dissolved in turpentine and mixed cold as "liquid driers" with the linseed oil. A considerable saving is effected in time, fuel, and labour, a boil-over or conflagration is entirely avoided, and in consequence of the low temperature a lighter varnish can be obtained. In spite of these advantages, however, the older methods were only gradually superseded, but at the present time the larger varnish factories in Germany and other countries employ almost exclusively soluble driers, which are in every respect superior to the old make. For the preparation of varnishes, driers should satisfy the following requirements:—1. The linseed oil must not be perceptibly darkened. 2. The driers must not cause either turbidity or deposit. 3. The linseed oil must dry quickly, certainly in 12 hours, generally in eight hours or less. Up to the present, driers only are known which satisfy two of the foregoing requirements. The author has carried out a number of experiments on the influence of various conditions or of the materials in the preparation of soluble driers. These are not yet complete, but in no case has a varnish been found which, after setting, has again become tacky. Driers containing lead occasionally lose their power, and this has also

been noticed in the lead-manganese linoleate, although manganese resinate does not show it. It has, however, been conclusively proved that with equal weights of metal a varnish which has been heated, does not dry more quickly than one prepared cold. Referring to recent papers by Amsel (this Journal, 1895, 605 and 814), the author points out, apart from certain criticisms as to the employment of soluble driers, that the question as to the suitability of a certain drier cannot be determined from a purely analytical standpoint. He considers that the saponification number for the ordinary kinds of rosin is about 170, for linseed oil about 190, and for linoleic acid, *i.e.*, the mixture of acids from linseed oil, about 198. Taking these numbers, 100 parts of resin would combine with 8.3 or 5.5 parts of manganese as a manganous or manganese salt, or with 31.4 parts of lead, which in percentages amount to 7.7, 5.3, and 24.0. For the corresponding salts of linoleic acid the percentages are 8.9, 6.1, and 26.9. According, however, to the method of preparation, the driers can contain manganese salts in different states of oxidation, or else basic salts, so that an empirical standard must be accepted. A soluble drier must contain its metal chemically combined with the organic acid, and not partially suspended as oxide. For the purpose of analysis, anhydrous ether is made use of, or in the case of lead resinate, chloroform. The solubility of the soaps in ether or chloroform is equal to that in linseed oil, so that anything insoluble in either of these two solvents in the cold, will be insoluble in warm linseed oil. Only lead and manganese compounds have drying properties, and the addition of zinc, copper, calcium, barium, or iron salts is of no value, although copper soaps are occasionally made use of for painting ships and as a rust preventative. The presence of uncombined oil is also prejudicial, and the larger the proportion of soluble lead or manganese the more valuable the sample, since less is required to be added to the oil to produce a varnish. Soluble lead driers alone are not employed, and only four compounds in general use are described more in detail, *i.e.*, the manganese and lead-manganese soaps of resin and of linoleic acid. "Fused manganese resinate" seldom contains more than 3.2 per cent. of soluble Mn, whilst precipitated manganous resinate only contains 6 or at most 7 per cent. Fused manganese linoleate contains 9—9.5 per cent., or in some cases nearly 11 per cent., probably owing to a decomposition or to the formation of a basic salt. Precipitated manganese linoleate is not a commercial article. With regard to the mixed soaps, the best proportion of lead to manganese appears to be 5:1, and the best samples show 8—9 per cent. of soluble lead, and 1.5—2 per cent. of soluble manganese. If larger quantities of soluble soaps be found, they are always accompanied by insoluble metallic compounds giving turbid varnishes. It is also possible for insoluble oxides and free resin or linoleic acid to exist side by side, and in most products this is the case. The following percentage of driers is required for the preparation of a good varnish, the amount of soluble metal being approximately that given above; fused manganese or lead-manganese resinate 2—3 per cent., precipitated manganese resinate 4—4½ per cent., and manganese linoleate 1 per cent. The addition is best made by dissolving 1 part of the driers in 2 parts of linseed oil at 120° C., and stirring this solution into the rest of the linseed oil. The latter can be heated before or subsequent to the addition of the driers for from 2—5 hours. A light varnish is obtained by the use of lead-manganese resinate, whilst fused manganese resinate gives one free from deposit. For the preparation of a varnish in the cold, fused manganese resinate, linoleate, or lead-manganese linoleate is dissolved in turpentine in the proportion of 1:2 or 2:3. As regards the analytical determinations, after burning off the organic matter, the lead and manganese can be estimated, the latter volumetrically. If calcium be present in any quantity, after removing the lead, the manganese and calcium are determined gravimetrically as carbonate, and the manganese having been estimated as above, the calcium is found by difference. The total lead and manganese having been found, the insoluble portion is determined by extraction with ether or chloroform. The soluble manganese is determined from the difference, and can be confirmed by determination in an aliquot part of the ethereal extract.

The soluble lead can only be determined from the difference, since chloroform is only driven off completely from the rosin solution at a red heat when the greater part of the lead as chloride volatilises also.—T. A. L.

Linseed Oil for Varnish-making, Possibility of Using Chloride of Sulphur for thickening. Chem. Revue Fett-u. Harz Ind. 3, [44], 147—149.

It is proposed to treat linseed oil for varnish in a parallel manner to that pursued in the production of caoutchouc substitutes, *viz.*, by the action of warm chloride of sulphur. The intensity of this reaction varies with the kind of oil chosen, 20 per cent. of chloride of sulphur sufficing to solidify castor oil, whereas linseed oil requires 30 per cent., but when the oil has been oxidised about one-half the quantity will produce the same result. To produce a consistency suitable for lacquer less than 20 per cent. is required for raw linseed oil and not over 7 to 8 per cent. when the oil has been oxidised.

Provided the oil and reagent are carefully and rapidly mixed to prevent partial clotting, the operation is easy. In drying properties the product is not superior to boiled oil of the same consistency, but this may be improved by the addition of manganese sesquioxide to the finished varnish. Whether this addition will affect the durability, &c. of the varnish will have to be determined by experiments on a large scale.

According to Heinzerling, a solution of camphor in chloride of sulphur acts more effectively on oil than the latter reagent alone, but the high price of the former is prohibitory.—C. S.

Coloured Lacquer by Dipping, Process for Coating Metal, Bone, or Celluloid Articles with. J. Perl. French Pat. 233,727, Oct. 30, 1893. Chem. Rev. 1896, [42], 127.

HITHERTO the production of a satisfactory coating of coloured celluloid lacquers has been rendered difficult by the tendency of the lacquer to accumulate in the hollows of the ornamentation of the article, thus giving rise to irregularities of colour, and, moreover, the dyes employed lacked transparency and stability, fading when exposed to light.

These difficulties are overcome by the new process, which consists in applying a colourless covering of lacquer, and after drying for about half an hour at 60° C., heating the article strongly and dipping it in a solution of aniline or alizarin colours in strong alcohols (ethyl, methyl, or amyl alcohol). The amount of colour for the bath does not exceed $\frac{1}{10}$ to $\frac{1}{4}$ per cent., or about one-fifteenth the quantity of the transparent lacquers now in use. A brilliant permanent gold colour may be produced on copper by a bath containing 1 gram. of alizarin per litre. Darker colours may be made by adding a small quantity of an alkali soluble in alcohol to the bath.

The essential points to ensure success are perfect dryness of the article, which must also be well warmed and thoroughly clean; and the absence of all oily or fatty materials in the bath.—C. S.

PATENT.

[*Waterproof Varnish*], *Rendering Articles Waterproof or Airtight, or as a Cement or Varnish, or for other similar Purposes; New or Improved Compound applicable for.* A. Pulbrook, London. Eng. Pat. 14,839, Aug. 6, 1895.

THIS consists of a mixture of balata, or any other gum derived from the trees of the order Sapotaceæ except gutta percha, and indiarubber dissolved in equal proportions in any suitable volatile solvent or mixture of solvents. It may be applied by dipping or with a brush; and as a waterproofing varnish it is claimed to possess the advantages of vulcanised rubber as regards permanence, without the injurious action of the sulphur used in the preparation of that material.—F. H. L.

(C.)—INDIA-RUBBER, &c.

India-Rubber, New Industry in Lagos.

Kew Bulletin No. 111.

See under Trade Rep., page 751.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning Extracts, Manufacture and Valuation of.

F. Jean. Rev. Chim. Ind. 1896, 7, 269—271.

THE manufacture of tanning extracts now closely resembles the process for extracting sugar; the sliced wood is exhausted by diffusion in autoclaves under slight pressure, and the liquor is filter-pressed and evaporated in triple-effect apparatus which differ from those used at the sugar-works merely in being constructed entirely of copper and bronze, to the exclusion of iron, and in being worked at a higher vacuum than sugar-pans are. Most manufacturers decolorise the liquor before concentration, either by the addition of some metallic salt, or with albumin and bisulphite of soda; in the former case the acid of the salt remains in the extract, and in the latter sulphate of soda and non-coagulable albuminoids are retained, whilst in both cases tannin is necessarily precipitated. The presence of salts in tanning extracts is much to be deprecated, since they accumulate in the tan pits to the detriment of the leather.

Roy has shown that the so-called "decolorising processes" are beneficial to the extract, not because they eliminate colouring matters, for they do this in a very minor degree, the colour of the liquor after treatment being but slightly diminished if estimated on the basis of equality of tannin-content—but because they precipitate, together with the first portions of tannin, certain earthy and metallic bases, such as lime, magnesia, manganese, iron, and copper, derived from the wood and from the apparatus; it is these foreign matters which are taken up, combined with tannin, by the leather, imparting bad colour and harsh and brittle grain. By substituting an aqueous solution of potassium ferrocyanide for the precipitants previously used, Roy has succeeded in removing these metallic compounds without appreciably decolorising the extract, and finds that the leather produced by the treated extract is in every way comparable with that prepared with oak bark liquor made in the tan-yard.

It follows that tanning extracts must be examined for salts of the alkalis and alkaline earths, and for metallic compounds, and valued in accordance with their content of these, as well as with their content of tannin.—A. G. B.

Glue Making Industry in Germany. R. Kissling.

Chem. Zeit. 1896, 20, [72], 697.

DURING the past year manufacturers of leather glue have been very busy, and the price of their product has risen some 10 or 15 per cent. On the other hand bone glues have fallen in value, and most of the makers have been working at a loss.

Among new processes, Grillo and Schröder of Neumühl-Hamborn, have patented the use of liquid sulphurous acid to convert the tribasic phosphate of bones into the dibasic salt (citrate-soluble), with the object of rendering the material brittle, more easy to powder, and more completely acted upon by boiling water. Sulphurous acid, however, is not a convenient reagent to employ on the manufacturing scale; and it would involve considerable change in the extraction apparatus. German patents have also been taken out for allowing the finished glue solution to run on to cooled revolving cylinders; thus yielding endless bands of the substance, which may be brought up to the desired thickness afterwards by compressing two or more together.

As regards methods for the valuation of glue, Fahrion's saponification process, according to which the sample is split up into unsaponifiable matter, fatty acids, liquid and solid oxyacids, &c., by means of petroleum ether, may possibly throw some light on the constitution of gelatin; but it is not adapted for commercial work. Tests based on the consistency of the glue jelly are very difficult to carry out, and cannot be considered satisfactory; although the author's suggestion of determining the viscosity, after the manner of a lubricating grease, may perhaps lead to better results. A mixture of 1 part of glue and 3 of water should be examined at a temperature of 20° C. The amount of water any sample of glue will absorb is no criterion of its cohesive power.

The author holds that the odour of glue is one of the most important factors to be taken into consideration. In order to express this in figures, six different standard samples should be rasped to powder, and preserved in well stoppered bottles, for they will be found to preserve their characteristic smell unchanged for years. The colour of the specimen under examination may also be classed in a similar manner. To estimate the fat, 20 grms. of the glue are dissolved in a 200 c.c. cylinder in 140 c.c. of water and 10 c.c. of 1.19 hydrochloric acid. After heating three or four hours on the water-bath under an inverted condenser, the solution is cooled, 50 c.c. of petroleum ether added, the whole well shaken, and after standing till clear, a portion of the solvent is drawn off, and evaporated in the usual manner. Free and combined volatile acids may be determined, and sulphurous acid tested for by distillation in an atmosphere of hydrogen as previously described (Chem. Zeit. 1887, **11**, 691; this Journal 1887, 565—566).—F. H. L.

PATENTS.

Tanning, and Apparatus for that Purpose, Impts. in. E. Worms, Paris, France. Eng. Pat. 19,428, Oct. 16, 1895.

THE object of the invention is to hasten the tanning process by gradually and moderately heating the hides and the liquor within a closed vessel excluding air, and at the same time "expelling the water from the cells of the hides by electrically decomposing it." The hides are submerged in water in a rotating drum, and a tannin extract of 20 B is run in, in the proportion of 50 per cent. of the weight of the hides, together with a "vegetable solvent" amounting to "5 per cent. of such weight." The drum is closed and rotated. When the temperature has risen to 15° C., an electric current is passed through the liquor by means of a suitable circuit, the temperature being maintained by its means at 25°—30° C. When the process is half completed the circuit is broken and fresh tannin is introduced. Light hides are tanned in 24—48 hours, heavy hides in 60—105 hours.—A. G. B.

Artificial Fur [Beaver and Nutria], Impts. relating to the Manufacture of. J. Biermann, Berlin, Germany. Eng. Pat. 4062, Feb. 22, 1896.

LAMB skins are placed in a soap and water bath and then pressed out and brushed with a colour solution prepared by dissolving 1 part by weight of ursoil D (paraphenylenediamine), 2 parts by weight of ursoil P (paramidophenol), 1 part by weight of pyrogallol, 50 parts by weight of hydrogen dioxide, and 4 parts of ammonia in hot water and diluting to the desired tint with cold water. After drying, the hair of the skin is combed with a wire comb, and a silky gloss is produced by ironing with acid. Beaver and nutria imitations are thus prepared.—A. G. B.

Hides and Skins, Treating [with Carbonic Acid], for the Purpose of Removing Lime and other Undesirable Matters therefrom, and Preparing the Hides and Skins for being Immersed in or otherwise Treated by Tannin; An Improved Method for.—J. A. McIntosh, Newcastle-on-Tyne. Eng. Pat. 5644, Mar. 13, 1896.

After the hides and skins have been taken from the lime pits, they are suspended in an hermetically sealed receptacle into which is injected water containing carbonic acid under a pressure of about 30 lb. per square inch. The lime is thus removed and the skins are brought to a condition in which they can be quickly tanned.—A. G. B.

Leather [Tanning], Impts. in and Relating to the Manufacture of. F. E. Burlingame, Central Falls, Providence, Rhode Island, U.S.A. Eng. Pat. 15,044, July 7, 1896.

THE prepared hides are immersed in a bath containing "the liquid product of the destructive distillation of wood" and common salt, or other salt of the alkalis or alkaline earths. When the liquor has sufficiently penetrated the hides, they are partially dried and immersed in a saturated solution of common salt for from 1—10 hours; washing and the usual finishing process complete the manufacture.—A. G. B.

XV.—MANURES, Etc.

Thomas Slag, Citrate Solubility of. H. Dubbers. Zeits. f. ang. Chem. 1896, 468.

See under XXIII., page 744.

Chemical Manures in Brazil. Ch. of Commerce J., Sept. 1896, 167.

See under Trade Rep., page 752.

PATENTS.

Bones and Mineral Phosphates for Fertilizing Purposes, Impts. Relating to the Preparation and Treatment of. R. Silcock, Poulton-le-Fylde, Lancashire. Eng. Pat. 20,303, Oct. 28, 1895.

AFTER the phosphates have been treated with acid, the temperature of the semi-solid mixture is raised by means of superheated steam and hot air, first to about 300° C., and afterwards to about 400°—500° C. In this manner a powder practically free from moisture is obtained, ready for bagging and in a condition suitable for manurial purposes.

—N. H. J. M.

Chemical Manure Mixers and the like [Revolving, Corrugated Cylinder], Impts. in. E. Pater-Notte, Hammelmille, Belgium. Eng. Pat. 15,473, July 13, 1896.

THE apparatus consists of a cylinder, lined with corrugated iron to prevent the slipping of the substances to be mixed, and revolving on a fixed axis. Inside is a beater which consists of an axle, traversed by dash-boards, turning at the ends of rods fitted into the axis on which the cylinder turns. The beater is turned by means of a chain passing over a wheel fixed to the cylinder. The cylinder is provided with sliding doors for introducing the substances to be disintegrated, or mixed, and for emptying the apparatus. The beater can be turned into any desired position, and be fixed at any distance from the wall of the cylinder, according to the amount of substance to be mixed. As the cylinder turns, the substances are drawn to the height of the beater where they revolve and fall on the dash-boards, the motion of which is very rapid and in proportion to the rate at which the cylinder rotates.—N. H. J. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Cane, Carbohydrates of the. H. C. Prinsen-Geerligs. Chem. Zeit. 1896, 20, 721.

THE author concludes, from data furnished by optical and reducing powers before and after inversion, that the ratio between saccharose, dextrose, and levulose in the leaves from the unripe sugar-cane is 1:2:4. In the upper portion of unripe canes of six months' growth, the ratio was 1:1:1; three months later it became 3:2:1, whilst in the lower parts of canes nine months old the ratio found was 82.5:3:1. These figures show that the levulose diminishes as the cane ripens. This is borne out by the observations of Willey, who found levulose in the juice from ripe Louisiana canes, whilst Winter demonstrated its absence in canes grown in Java, the warmer climate of the latter place probably inducing a greater degree of ripeness in the cane.—J. L. B.

Sugar, Estimation of, in the Beetroot. H. Pellet. Rev. de Chim. Indust., 1896, 7, 233.

See under XXIII., page 746.

Starch and Starch Products, Manufacture of, in France. D. Saare. Zeits. für Spiritusind. 1896, 19, 295.

See under Trade Rep., page 754.

PATENT.

Ammonia, Impts. in or relating to the Production of, from Waste Nitrogenous Lyes or Gases [From Sugar or Molasses Spirit]. H. H. Lake, London. From L. Sternberg, Jersey, New Jersey, U.S.A. Eng. Pat. 7002, March 31, 1896.

See under VII., page 720.

XVII.—BREWING, WINES, SPIRITS, Etc.

Unfermented Wine. Müller. Apotheker Zeit. 11, 724.

The author has applied the principle of Pasteur's treatment of wine for the preservation of grape juice and other fruit juices without fermentation. He finds that when the freshly-expressed juice is heated in bottles to a temperature of 60–70 °C. for 15 minutes, the yeast cells and other fermenting agents are rendered inactive. The juice can then be kept in well-closed bottles for several years without fermenting. To obtain the juice clear, it must, however, be filtered, an operation which is easily carried out, as the heating will have coagulated the mucilaginous substances causing turbidity. Filtration may be carried out immediately after heating the juice, or after some time, but in any case, the filtered juice must be again heated in bottles to the same temperature originally applied.—A. S.

Barley, Colour of. Schonfeld. Wochenschr. für Branerei, 13, 1896, 966.

It is pointed out that in buying barley too much stress is often laid on lightness of colour of the corn. Rain often causes darkening in colour without materially affecting the value of the grain for brewing purposes. A thin and somewhat crinkled skin and a full and not too hard corn should be sought for.—L. T. T.

Invert Sugar. J. Heron. J. Fed. Inst. of Brewing, 1896, 2, 440–452.

THE author proposes the following scheme for the analysis of commercial invert sugar: (a.) The invert sugar is determined gravimetrically according to O'Sullivan's directions (J. Chem. Soc. 1876, 2, 130). (b.) The amount of cane-sugar, by determining, gravimetrically, the total reducing sugar after inversion, by means of Fehling's solution; from this the amount of reducing sugar, similarly determined before inversion, is subtracted, and the remainder multiplied by 0.95. (c.) The quantity of other carbohydrates is found by subtracting the sum of invert sugar and cane-sugar from the true amount of carbohydrates in solution, the specific gravity of the solution being corrected for the gravity due to ash before dividing by the 3.86 factor. (d.) The sulphated ash is considered to represent the percentage of mineral salts in the sample under examination. (e.) Owing to the decomposition of levulose when heated in the air or water-oven, the moisture is determined by difference.

—J. L. B.

d-Galactose, Fermentability of. A. Bau. Zeits. f. Spiritusinst. 19, 1896, 303–305 and 312.

As the statements of different workers as to the fermentability of galactose are so divergent, the author has carefully re-investigated the matter. The results of his researches definitely prove that *d*-galactose is fermentable under suitable conditions and with certain ferments, but is not as readily so as many of the other sugars.

The researches of himself and others may be summed up as follows:—

1. *d*-Galactose is not fermentable by *S. productivus*, *S. membranifaciens*, *S. apiculatus*, and *Schizosaccharomyces Pombe*. It is completely fermentable by *S. cerevisia*—both top and bottom forms of Saaz and Froberg types—by *S. Logos*, *S. Pastorianus* I., II., and III., *S. ellipsoideus* I. and II., *S. Marxianus*, milk-sugar yeast, and *Monilia candida*. As in other sugars and dextrinous solutions, *M. candida* only produces very sluggish fermentations.

2. *d*-Galactose is fermentable with more difficulty than *d*-glucose (dextrose), but it is still uncertain whether it is less readily fermentable than levulose. It is also still doubtful whether top-culture *S. cerevisia* is more active in its ferment action on galactose than bottom-culture yeast.

3. For the free fermentation of galactose it is necessary for the yeast to be in a healthy condition, and for suitable nutriment to be present.

Galactose does not seem to occur free in nature or in the materials generally used by the brewer. But in molasses it is often present, and, therefore, in spirit manufacture and yeast production, where molasses are employed, a know-

ledge of its action towards ferments is important, in order that it may be utilised for the production of alcohol and the formation of yeast cells.—L. T. T.

Isomaltose. H. Ost. Chem. Zeit. 1896, 20, 761–762.

THE author previously stated (this Journal, 1895, 877) that the disaccharide obtained by the action of acids on glucose yielded an osazone, which he believed to be maltosazone; this, however, is not the case, Fischer (*ibid.* 1896, 43), having shown that his isomaltose is unfermentable.

According to a method proposed by the author, isomaltose is now prepared by the action of 33 per cent. of sulphuric acid on glucose or maltose, for 4½ months, at the ordinary temperature. About 30 per cent. of an unfermentable product results, which is identical with isomaltose. It can be obtained only in the form of a slightly sweet syrup, having a specific rotatory power of $[\alpha]_D^{20} = +70$, and a reducing power ½ that of maltose. It forms an osazone soluble in water, but is most conveniently crystallised from 60 per cent. alcohol, from which it separates in yellow aggregates of needles, which melt at 130–145°, and have a specific rotation in Auer light of $[\alpha]_{\text{Auer}} = -20$.—J. L. B.

Di- and Polysaccharides, Action of Alkalis on the Phenyl-osazones of. C. J. Lintner. Chem. Zeit. 1896, 20, 763.

WHEN aqueous solutions of the osazones of maltose, galactose, melibiose, and one of the achroo-dextrins, but not glucose, are boiled with caustic soda or potash, glyoxalosazone separates in small crystals. The result is not affected by an excess or otherwise of alkali. The glyoxalosazone may be purified by repeated crystallisation from hot alcohol, or by precipitating a solution in ether or benzene with ligroin (petroleum spirit). It separates either as light yellow plates or deep yellow prisms, the latter being the more soluble. When heated in an alcoholic solution with fuming hydrochloric acid, both modifications yield a yellowish-red, crystalline hydrochloride.—J. L. B.

Yeast, Influence of Oxygen on Fermenting. R. Rapp. Ber. 1896, 29, 1983–1985.

According to Chudiakow (this Journal, 1895, 14, 290), a current of air passed through a solution of sugar in process of fermentation, has a retarding influence on the action of the yeast, and will in fact nearly stop the fermentation in the course of a few hours. On the other hand, hydrogen passed through in proportion to the carbon dioxide produced, is almost without action. The author has repeated these experiments under similar conditions, but with greater refinements, and he finds that suppression of fermentation does not result, as stated by Chudiakow. If, however, the quantity of yeast present be considerable, and the rapidity of the air current be increased to from 4–5 l. per hour, fermentation is certainly retarded, but under similar conditions hydrogen will produce the same effect. This result is in fact to be attributed, not to the chemical nature of the gas employed, but to the mechanical action of the current. In fact, it is shown that vigorous agitation alone will reduce the fermentative action of yeast to a minimum. The author contends, therefore, that whilst oxygen is necessary for the multiplication of yeast, it is without influence on fermentation, but that under certain conditions the latter process may be checked by agitation.—A. K. M.

Hops. L. Briant and C. S. Meacham. J. Fed. Inst. of Brewing, 1896, 2, 408–440.

THE authors show that the resins in hops, after being stored in cylinders for three years, remain practically unchanged in spite of the objectionable odour which the hops develop, and that a low temperature preserves hops quite as effectually as storage in an atmosphere of carbon dioxide. The peculiar odour in stored hops is due to the alteration of the oils, which takes place either in the presence or absence of air, although the minimum effect was observed at low temperatures. In order to study the effect of such low temperatures upon the preservation of hops, portions of the same sample were introduced into stoppered bottles, and, judging from the results of the estimation of the resins, the

authors consider a temperature of 38°—40° F. to be the most favourable. Experiments are described showing that the preservative value of hops is due to the percentage of resins which they contain. Brewings were carried out with disoiled and ordinary hops, and the results obtained demonstrate that in disoiling hops the soft are partially converted into hard resins, that these undergo a further rapid deteriorative change, and that oil of hops does not possess preservative power.

The influence upon the value of hops, of climate, ripeness, soil, drying, and general manipulation are also dealt with.

—J. L. B.

Malt and Wort, Acidity of. H. Johnson. Bull. Assoc. Belge des Chimistes, 10, [4], 162—172.

THE author's experiments confirm Fernbach's observations (this Journal, 1896, 621), to the effect that organic acids may combine with neutral phosphates to form acid salts.

Referring to the acidity produced at certain temperatures in the brewing process, he finds that the percentage of acid in the wort increases with the temperature of the mash between 40° and 60° C., but is lessened if a higher temperature (70° C.) be maintained, the production of acidity in the wort ceasing at 65° C. The influence of added acid (acid wort or sour milk) and the effect of temperature on its action was also studied, with the result that at 40° C. the lactic ferments were found to exert an appreciable influence on the degree of acidity, but at 50° and 60° C. this action was no longer apparent.

In a final series of experiments the effects of alcohol and chloroform in retarding acidity formed the subject of investigation. From the results obtained it appears that only in the case of acidity due to added acid ferments can these two substances be said to exert such influence to any appreciable extent. From this circumstance it is considered that the acidity cannot be due to lactic acid, an opinion strengthened by the fact that 50° C. is the most favourable temperature for the development of the acidity observed, this temperature being an impossible one for the production of lactic acid. On account of the limits of temperature referred to it is evident that the action is not purely one of extraction, but rather chemical, and restricted to temperatures below 65° C. The conditions point to diastatic action, and, since starch products are out of the question, indicate acid bodies formed by the action of peptase on nitrogenous substances, *i.e.*, bodies similar in their characteristics to asparagin and aspartic acid. It is also considered probable that the increase in the acidity of the contents of the grain of barley during germination, may be due to the same action.

—C. S.

Wines, Preparation and Treatment of Fruit Wines.

J. Nessler. Zeits. für Spiritusind. 1896, 19, [37], 297.

IN fruit-musts the proportion of acid to sugar is generally excessive and the resulting wine will consequently be poor in alcohol, rich in acid, and therefore of inferior taste and stability. These defects may be overcome by the addition of sugar to the must, the amount required depending upon the acidity of the must and the character of the wine it is intended to produce. There may also be a deficiency of yeast food, resulting in a slow fermentation and difficult clarification, and these defects may be obviated by the addition of ammonium chloride to the must (20 grms. to the hectolitre). The fermentation should be carried out quickly and the yeast separated as soon as possible. Sometimes the number of yeast cells present on the fruit is very small, and in such cases it is advisable to add some pressed yeast. The temperature during fermentation is also of importance, and should be about 15°—19°. Acetic fermentation has, of course, to be very carefully guarded against. In order to ascertain if a wine will readily clarify, a portion is shaken to remove carbon dioxide, and allowed to stand in a bottle in which the rate of clarification can be observed. If it remain cloudy, clarification may be effected by means of fresh wine yeast or kaolin. Red wines require very careful treatment on account of the readiness with which the colouring matter becomes removed or destroyed. In the transport of wines, the temperature should not be allowed to fall below 4°, or the wine is apt to become cloudy,

and in the case of red wines the colour becomes paler or sometimes even brown. If wine becomes discoloured through contact with iron, clarification with wine yeast or with milk (one teaspoonfull to the bottle) is recommended.—A. K. M.

Wine, A Green-coloured Secondary ("Nachwein").

A. Borntraeger. Chem. Zeit. 1896, 20, 686—687.

THE green colour of a sample of wine submitted to the author is attributed to the action of ferric iron on anotannin (wine-tannin). The colour may be removed by the addition of gelatin, which throws down a dirty-green precipitate, the filtrate from which is faintly yellow in colour and contains about half as much iron as was originally present.

—A. K. M.

Alcohol, Denaturing. [French Legislation.] Rev. Chim. Ind. 1896, 7, 277—279.

JACQUEMIN has proposed to denature alcohol to be used for lighting purposes by the addition of "trihydrated ethyl hydrosulphide," obtained by distilling a mixture of solution of barium ethyl sulphate and barium sulphide; 5 grms. (costing 15 centimes) per hectolitre of alcohol of 90° is sufficient, the amount of sulphur thus introduced being negligible. Leroy has calculated that alcohol could not replace petroleum for heating purposes unless its price fell to 22 fr. 50, that of petroleum being 50 fr.

The following decisions in respect of denaturing alcohol have been made by a French committee. (1.) *Varnishes and colours for varnishes.*—Mix 15 litres of methylene with 100 litres (at 15°) of alcohol of 90° and upwards. (2.) *Lighting and manufacture of varnishes.*—Mix 15 per cent. of methylene and 4 per cent. at least of resin with alcohol of 90° or upwards. (3.) *Hat-making.*—Mix 15 per cent. of regulation wood spirit with the alcohol. (4.) *Insecticides.*—Mix 15 per cent. of methylene with the alcohol. (5.) *Ethers, simple or compound.*—The alcohol is mixed with 10 per cent. of its volume of the residue of ether already defined by the committee; the mixture must have the evil odour of the added matter, and must become opalescent when diluted with water; 10 or 20 per cent. of sulphuric acid, according to the application of the alcohol, is then added, following the prescription previously laid down.

The alcohol used for making ethyl bromide, iodide and chloride, alcoholic soda, aldehyde, chloral and collodion is to be mixed, under due supervision, with the reagents by which it is treated in the course of conversion into the product of the works.

(6.) *Dyes.*—Mix the alcohol with 14 per cent. of its volume of methylene. (7.) *Tannin and alkaloids.*—Add 15 per cent. by volume of methylene. (8.) *Mercuric fulminate.*—Mix the alcohol with 15 per cent. of its volume of regulation wood spirit, or add to the alcohol the residues of the previous batch of fulminate. (9.) *Lighting and heating.*—To 100 litres of alcohol (90°) add (a) 15 litres of methylene, (b) 0.5 litre of heavy benzine (b.p. 150°—200°), and (c) 1 gm. of malachite green. (10.) *Transparent soap.*—Add to the alcohol 15 per cent. of regulation wood spirit. (11.) *Chloroform.*—Dealt with in previous reports. (12.) *Pressure liquid.*—The alcohol is sufficiently denatured by the salt water with which it is diluted provided the alcoholic strength of the mixture does not exceed 10°. In the absence of these conditions 15 per cent. of methylene must be added.

In nearly all cases where denaturing with wood spirit or methylene is allowed it is provided that the mixture shall be made at the works and not removed outside.—A. G. B.

Tartaric Acid, the Manufacture of. V. Hölbling. Mitt. k.k. Tech. Gew. Museums in Wien. 1896, 6, 133.

See under VII., page 712.

Pentoses, Detection of; Improved Method of applying the Phloroglucinol Test. B. Tollens. Ber. 1896, 29, 1202.

See under XXIII., page 744.

Phosphoric Acid, Estimation of, in Medicinal Wines. F. Glaser and K. Mühle. Chem. Zeit. 1896, 20 [75], 723.

See under XXIII., page 746.

Alcohol, Production of, in Argentina. Oesterr. Handels Museum, Sept. 1896.

See under Trade Rep., page 752.

PATENTS.

Concentrating Liquids, Process and Apparatus for. L. M. H. R. Boudoin and P. E. L. Schribaux, Paris. Eng. Pat. 15,958, Aug. 24, 1895.

See under I., page 700.

Fermenting Vats or Vessels [Beer], An Improved Apparatus for Discharging Liquids from. X. Reischböck, Cüstrin, Germany. Eng. Pat. 20,933, Nov. 5, 1895.

THE apparatus consists of three parts:—A cylindrical tube which is inserted vertically in the bottom of the vessel; a cylindrical plug which fits into this tube and having the lower portion perforated, the perforations communicating with the interior of the plug, which is open below and closed above, and is capable of sliding in the casing tube; the third portion is a tap which screws on the lower end of the fixed tube and in doing so slides up inside this tube and presses the plug up so as to bring the perforations into communication with the contents of the vessel. Thus, when the tap is opened, the contents may be run off and are at the same time filtered by the perforated plug.

—A. L. S.

Beer and other Liquids containing Carbonic Acid, New or Improved Process and Apparatus for Increasing the Stability of. [Pasteurising.] H. Gronwald, Berlin, Germany. Eng. Pat. 9923, May 9, 1896.

THE apparatus consists of a boiler provided with a steam jacket, a filter, and receivers for the treated beer.

The apparatus is prepared for use by sterilising with steam, and then filling with sterile carbonic acid gas. The beer is then run into the boiler and heated to the required temperature, the gases which are given off being collected; the beer on being cooled re-absorbs these gases, is filtered, and collected in the receiving vessels.—A. L. S.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Chocolate, Estimation of Sugar in. Rocques. Ann. Chim. Anal. Appliq. 1896, 1, 288.

See under XXIII., page 747.

Cheese, Chemical Investigation of. A. Stutzer. Zeits. Anal. Chem. 1896, 35, [4 and 5], 493.

See under XXIII., page 746.

Milk, Congealing Point of. Bordas and Génin. Comptes rend. 1896, 123, 425.

See under XXIII., page 745.

PATENT.

Alimentary or Pharmaceutical Liquids or other Substances, Impts. in Concentrating, and in Apparatus therefor. [Evaporation in vacuo.] S. D. Rowland, London. Eng. Pat. 17,061, Sept. 12, 1895.

THIS specification describes a vacuum evaporating apparatus, in the working of which care is taken only to supply as much heat as is absorbed in evaporation, but not sufficient to raise the temperature above that of the air.—A. L. S.

(B.)—SANITATION; WATER PURIFICATION.

Carbonic Oxide in the Air, Detection and Estimation of. F. Clowes. Brit. Assoc., Chem. Sect., 1896.

See under XXIII., page 742.

PATENTS.

Filtration of Liquids, Impts. in. W. J. and C. J. Lomax, Bolton, Lancaster. Eng. Pat. 16,693, Sept. 6, 1895.

THE inventors describe an apparatus they call a "breathing" filter, in which the liquid during its passage is made to force air backwards and forwards through the filtering material. The filter bed is composed of layers of any suitable material, such as sand and polarite, and is preferably circular in form. The water or sewage to be filtered is admitted to a central tank, from which it is periodically flushed over the surface of the filter bed and percolates into a closed tank or chamber beneath. The displaced air from this tank is driven upwards through the filter bed, and when the tank is full enough it suddenly empties itself by siphon action, and in so doing aspirates fresh air through the filter bed in a reverse direction.—L. A.

Plates, Bricks, and Pipes for Filtering and like Purposes; Impts. in the Manufacture of Porous, Hard, and Acid-Resisting. W. Schuker, Isny, Württemberg, Germany. Eng. Pat. 18,573, Oct. 4, 1895.

See under IX., page 720.

Purification of Drinking Water [Liming, Subsequently Neutralising], Impts. in or relating to Processes and Apparatus for. H. J. N. Berge, Brussels. Eng. Pat. 19,360, Oct. 15, 1895.

IMPROVEMENTS in the method of purifying water by treatment with lime, followed by neutralisation of the excess of lime, are described. The water and the milk of lime are caused to flow in proportioned streams through a cone, whereby an intimate and very thorough mixture is claimed. If carbon dioxide be used for neutralisation, it is drawn into the water by causing the latter to flow through a kind of water-jet aspirator connected with the carbon dioxide producer. Instead of carbon dioxide, a solution of iron may be used for neutralisation.—L. A.

Purifying Water [Scrap Iron and Aëration], Impts. in Apparatus for. W. G. Waterman, London. From L. Alers-Hankey, New York, U.S.A. Eng. Pat. 15,611, July 14, 1896.

APPARATUS for purifying water by means of scrap iron is claimed; it has for its object efficient and economic means for aerating the water, for securing better contact of the iron with the water, and general simplification of such systems. The iron, in the form of borings or turnings, is contained in a series of boxes fixed round the periphery of a wheel or drum which slowly revolves in the water. Each box is perforated on one side only, and is fixed in such a position that the perforated side first meets the water when the wheel is rotating. The air imprisoned in the box is thus carried down to the bottom of the tank during the first half-revolution of the drum, but during the second half the perforated side of the box is turned up, causing the air to escape in bubbles and become replaced by water, which is emptied out again as the box passes over the top of the wheel. The friction, caused by the continual shifting of the iron in the boxes, keeps the metallic surfaces clean and thus in an active condition.—L. A.

Treatment of Sewage and other Liquids, Impts. in Apparatus for. E. W. Ives, Derby. Eng. Pat. 16,034, July 20, 1896.

IMPROVEMENTS are referred to in apparatus described in Eng. Pats. 13,411 of 1893 (this Journal, 1894, 832), 16,724 of 1894, 20,744 of 1894 (this Journal, 1895, 178), and 22,545 of 1895.

THE sewage flows first into a combined chemical chamber, detritus snuff, and storm overflow; thence into a circular screening chamber, where the suspended solids are broken up, and finally into the precipitation tank, constructed as described in the previous patents. If the effluent from this tank be not clear enough, the outlet valve is closed, causing the water to rise through a filter bed in the upper part of the tank. This filter bed is arranged round a

central short vertical cylinder, open top and bottom, and projecting above and below the filter bed. When the rising water reaches the lower edge of the cylinder, the air in the annular space between cylinder and tank walls, is trapped and forced upwards through the filter; and when the water-level is lowered again by opening the tank outlet valve, fresh air is admitted below the filter through the open cylinder.—L. A.

(C).—DISINFECTANTS.

Corrosive Sublimate Dust [Germicide]. Efficiency of.
P. Chavigny. Ann. Inst. Pasteur, 10, 351—357.

THE author made experiments to ascertain how the disinfecting power of the finely-powdered mercuric chloride compared with that of sublimate dissolved in common salt solution and in hydrochloric acid. The experiments showed that sprinkling with sublimate was not sufficient to destroy germs of micro-organisms, but only weakened their virulence. The protection which the sprinkling afforded against bacteria, was a limited one, and was done away with if the protecting antiseptic layer were removed and communication between the protoplasm and the surrounding medium restored.—A. S.

"Formalin" (Formaldehyde), Disinfecting Power of.
H. Strehl. Centr. Bl. f. Bakter. u. Parasitenk. 19, [1], 785—787.

THE author experimented with formalin vapour. He used, in one case, a trunk of $\frac{1}{2}$ cb. m. capacity, with a wooden grating placed 15—30 cm. above the bottom, on which grating were spread out layers of cloth. As objects of experiment, the spores of cattle distemper (anthrax) and staphylococci dried on silken threads were used; they were partly hung free in the chest in finely-netted, small wire baskets and partly wrapped in sterilised paper and put in the pockets of the dress-pieces used in the experiment. The formalin was sprayed into the trunk by means of a suitable apparatus; or filter paper saturated with formalin was placed under and between the layers of cloth; or the cloth impregnated with infected threads was wrapped up with cloth sprinkled with formalin. The cloth remained from 24 hours to 3 days in the trunk. It was found that 50 c.c. of pure formalin was not sufficient to destroy the bacteria in the closed trunk—a statement not in accord with the experiments of Lehmann, Stahl, Oelmichen, &c.

Experiments were also made on the sterilisation of smooth, rough, and velvet carpets, by means of formalin. Virulent broth cultures of staphylococci and anthrax bacillus were well rubbed into the sterilised pieces, and, after drying, they were hung free and sprayed with formalin solutions of different strengths until they were equally damp all over. After using a 5 per cent. formalin solution, the cultures of staphylococci still exhibited growth, a 10 per cent. solution sufficing to destroy all bacteria.

It appears therefore that formalin vapour is only in a small degree, capable of destroying bacterial life in dried

material; on the other hand, a direct contact of the formalin solution with the bacteria appears to be necessary, in order to cause satisfactory disinfectant effect.—A. S.

Formaldehyde as a Disinfectant. E. Schepilewsky. Centr. Bl. für Bakter. und Parasitenk. 19, [1], 794—796.

THE author experimented with a view of establishing (1) the influence of formaldehyde in solution and in the form of vapour on different kinds of vegetative bacteria (baceilli of cholera, typhus, staphylococci, pyog. aureus) and on the spores of cattle distemper (inflammation of the spleen), and the saprophytic bacteria occurring in sheep skins, which are capable of great resistance; (2) its influence in the form of vapour on the bacteria occurring in their natural conditions; (3) its influence on fabrics, furs, metals, and dyed stuffs; (4) the most advantageous method of using formaldehyde for disinfecting in the form of vapour.

The experiments were partly carried out in large glass bell-shaped vessels, and partly in a chamber of 1 cb. m. capacity. The action of the commercial formalin solution on the vegetative kinds of bacteria was scarcely stronger than that of carbolic acid in the same condition; the action was the same whether the bacteria were free or contained in albumin. On spores of cattle distemper, formalin acted more powerfully than carbolic acid, but the action of sublimate was 14 times stronger. On the other hand, the vapour of formaldehyde showed a greater disinfecting power than its solution, and the moist object was found to be made sterile more easily than the previously dried one. The spores of bacteria taken from a thick sheep skin, such as is met with in practice (covered with dirt and grease), were destroyed in the course of 4 hours by the formaldehyde vapour from 1 c.c. of formalin per litre.

The experiments in the chamber showed that the vegetative forms of bacteria, notwithstanding the closest wrapping up, were destroyed in 6—10 hours on evaporation of 0.5 c.c. of formalin per litre of chamber space. Cholera baceilli were thus destroyed in 6 hours, the spores of cattle distemper and the bacteria from sheep skin, those found between the lining and folds of a dress, were destroyed after 16 hours, when, for every litre, 1 c.c. of formalin was evaporated. The vapour of formalin did not at all damage leather, furs, and fabrics, did not attack metals, and did not alter the colour of dyed stuffs.

The author found that disinfecting at a higher temperature reduced the period of action and the quantity of disinfectant necessary. He doubts, however, whether the effective disinfection of a whole living room can be brought about by means of formaldehyde vapour.—A. S.

XIX.—PAPER, PASTEBOARD, Etc.

Paper, Testing of. W. Herzberg. Mitt. aus der Königl. tech. Versuchsanst. zu Berlin, 14, 1896, [2], 119—122.

THE testing of four samples of tissue copying paper gave the following results:—

Sample.	Mean Breaking Length.		Mean Stretching Power.	Composition of Fibre.	Mean Absorbing Power (Height).
No.					Mm.
1	Dry, 5,050 m.	Wet, 165 m.	Dry, 2.2 per cent.	Linen and cotton	12.5
2	Dry, 4,200 m.	Wet, 277 m.	Dry, 1.8 per cent.	Linen, cotton, wood and straw cellulose	12.5
3	Not tested	Not tested	Not tested	" " " "	9.5
4	"	"	"	" " " " " "	16.5

Of two other samples, one (No. 5) gave a good clean copy, while in the other (No. 6) the ink spread and the letters were with difficulty deciphered. In quality and quantity of the fibrous and mineral constituents, these two samples were practically the same. The absorbing capacity differed in the two samples, No. 5 having a mean absorbing height of 14 cm., and No. 6, 19.5 cm., but whether this accounted for the difference in the papers could not be ascertained.

Strength of Paper.—The strength of paper is generally greater lengthwise than crosswise, the proportion being from 60:100 to 75:100; the extensibility being the reverse, *viz.*, greater crosswise than lengthwise, the proportion varying considerably, sometimes from 100:100 to 297:100. With copying paper, the author found the extension is greater lengthwise than across, as shown by the following table of results:—

Sample.	Direction of Machine.		Crosswise to Machine.	
	Breaking Weight.	Extension.	Breaking Weight.	Extension.
No.	Kilos.	Per Cent.	Kilos.	Per Cent.
1	1.60	2.4	0.73	2.0
2	1.68	2.6	0.80	2.0
3	1.56	2.6	0.78	1.9
4	1.46	2.3	0.77	2.0
5	1.54	2.0	0.84	2.0
Average.....	1.58	2.4	0.78	2.0
Breaking length.....	6,750 m.		3,350 m.	

In a second series of tests the same observations were made, but in a less distinct manner. A normal water-marked writing paper (3 b) gave the following results:—

Sample.	Lengthwise.		Crosswise.	
	Breaking Weight.	Extension.	Breaking Weight.	Extension.
No.	Kilos.	Per Cent.	Kilos.	Per Cent.
1	6.67 kilos, and 1.6 per cent.		4.65 kilos, and 1.7 per cent.	
2	6.69 " 1.8 "		4.64 " 1.8 "	
3	6.74 " 1.7 "		4.62 " 1.4 "	
4	6.83 " 1.8 "		4.83 " 1.8 "	
5	7.22 " 1.8 "		4.19 " 1.6 "	
Average	6.82 kilos, and 1.7 per cent.		4.59 kilos, and 1.6 per cent.	
Breaking length.....	4,850 m.		3,300 m.	

—S. P. E.

Waste Sulphite Liquor. C. D. Ekman. Papier Zeit, 69, 1896, 2218—2219.

THE experiments of Ahrens as to the precipitation of the organic matter contained in the sulphite liquor, are valuable in showing that there are no prospects of success in this direction, and these experiments are fully in accord with those of the author.

One of the earliest to direct attention to the utilisation of waste sulphite liquor was Mitscherlich, who tried to use the liquor for the purpose of tanning hides, though without success—no doubt due to the absence of any tanning material in the liquor.

In Carl Hoffman's "Handbuch der Papier Fabrikation," there are mentioned certain patents obtained by Mitscherlich for using sulphite liquor for the preparation of paper size, but no practical results followed the use of this process.

A very interesting patent was taken out by Cross and Bevan in 1883, in which they proposed to manufacture both a sizing material and mordant, by adding glue or gelatin to sulphite liquor, and to dissolve the precipitate in sulphites or alkalis, by which means a sizing material, soluble in hot water, is obtained, which is precipitated by alum, sulphate of alumina, or an acid. It was called Gela-lignosine, and is identical with what Mitscherlich many years later called "*Gerb-leim*" (this Journal, 1883, 541). This Gela-lignosine has been now so far perfected in England that it may be used for the best class of white papers without affecting the colour more than the usual animal size does. Very satisfactory results have been obtained by its use, samples sized with it in the beaters showing an increase in strength in the weakest direction, of 50 per cent. over the same paper sized with rosin. It also gives the paper an excellent "surface," and writing may be erased and rewritten without the ink spreading. The only drawback to the manufacture of it on a large scale is the high cost. A recent process is the manufacture of "dextrine," which is a kind of dextrin, from the sulphite liquor, which process has been patented by the author. By this process the liquor is first evaporated to a very thick liquid, and then, by adding a suitable salt, the "dextrine" floats on the top as a paste. This "dextrine" is then dried, powdered, and packed in the usual manner. The "dextrine" is used in the textile manufacture, and it is said that cloth treated with it will not suffer from damp or mildew, as it does when the usual dextrin is used.

To get rid of the sulphite liquor some mills have tried to drain it into the earth, either by using wells or spreading it over a large area, but the results have been most unsatisfactory. After a time the decomposed or partly oxidised sulphite liquor, in the form of a dark, ill-smelling liquor, finds its way into the watercourses and wells in the neighbourhood, rendering the water unfit for use.

The quicker the sulphite liquor is got rid of the better, and it should be diluted as much as possible before being run into any river. In large rivers, where the percentage of sulphite liquor to water is very small, an oxidation is probably effected and ill-effects avoided.

The best means yet known, where a large river or the sea is not close at hand, is to evaporate the liquor, and condense the steam, so as to prevent pollution of the air.

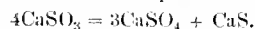
—S. P. E.

Sulphur, Separation of, during the Boiling of Wood with Bisulphite Liquor. A. Haupf. Wochenblatt. für Papierfabr. 1896, 1761—1763, and 1911—1916.

THE Papier Zeit, No. 16, 1896, contains an article signed H. D., and Dr. A. Frank (Papier Zeit, 1896, [19]) contributes some notes, upon the Salomon-Bruggler wood-pulp digester. The former writer says: "The finish of the boiling was ascertained by the smell and colour of the liquor." The liquors, containing only a small quantity of free acid, he also observed, were turbid, and after carefully bottling samples and allowing them to stand, a distinct deposit was formed. This sediment was washed and filtered, and upon examination was found to be free sulphur. The lower the percentage of SO₂ present, the greater was the amount of sulphur precipitated. "This separation of sulphur, it is stated, was only found in liquors from the Salomon-Bruggler digesters, and not in the cylindrical digesters of the Ritter-Kellner and other systems." The incrustation deposited in these digesters, according to H. D., contained CaOSO₃, CaSO₃, a trace of iron, organic matter, CaS, and free sulphur. In No. 19 of the Papier Zeit., Dr. Frank points out that the statements of H. D. are of value, both as regards the theory as well as the practice of boiling wood. It is evident that the separation of sulphur from sulphite liquors was a fact hitherto unknown to H. D. and Dr. Frank. The following analysis of the deposited crust from sulphite digesters is also given by Dr. Frank:—

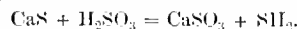
	Per Cent.
Calcium sulphite	62.23
Calcium sulphate	26.77
Water and organic matter	9.93

The presence of CaS in the incrustation may be explained as follows:—The first deposit upon the metal shell of the boiler and steam pipes will be calcium monosulphite, upon which new layers of the same salt will be deposited at each boiling. The first layer, being protected from the liquor by the subsequent layers, is liable to be overheated, which would cause it to be decomposed thus:—

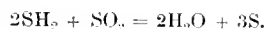


The temperature was 153° C. (5 atmospheres pressure).

The presence of free sulphur is probably due to the decomposition of the CaS by SO₂ with the liberation of SH₂, thus:—



This SH₂ meeting nascent SO₂ is decomposed, liberating sulphur, thus:—



Another reaction may also take place when SH₂ and SO₂ are brought in contact with each other, with the formation of pentathionic acid and free sulphur, thus:—



When pentathionic acid is heated, it also decomposes and forms free sulphur.

With reference to the presence of precipitated sulphur in liquors from over-boiled wood, the remarks of H. D. simply confirm numerous previous tests. In speaking of a boiling, the author (Papier Zeit, 1891, [18]) then said: "The liquor was dark brown, turbid, and without any smell of SO₂, but of a disagreeable sweetish odour. Ammonia gave no

precipitate, and it was easily seen that the wood was over-boiled." A reliable test of the amount of SO_2 in the liquor could not be made with iodine, as organic matter was present, although 0.0316 per cent. of SO_2 was found. The presence of organic matter ought to have been taken into consideration in the tests made by H. D., who only observed the separation of sulphur in cases where the SO_2 present was less than 0.12 per cent.

It is further stated in the article in *Papier Zeit.* of 1891: "After standing for a few hours, a whitish deposit is formed, which was at first thought to be calcium monosulphite or the sulphate. No sulphurous or sulphuric acid or lime could be detected, but it was found to be pure sulphur." (See Nos. 38 and 39, *Papier Zeit.* 1892.) In *Papier Zeit.* No. 92, the author (Harpf) divided the boilings into regular or perfect cookings, and irregular or imperfect cookings. The liquors from regular cookings are never cloudy, but perfectly clear and brown, and do not give a deposit of sulphur. This deposit, however, can be obtained by treating the liquor with hydrochloric acid and allowing it to stand for some time. A flask filled with ordinary liquor was acidified with hydrochloric acid and allowed to stand on the steam boiler, and after a few days a distinct deposit of sulphur was found.

The sulphur is found in one or more of the following conditions:—

(1.) A small portion as SO_2 in the calcium sulphate, in the liquor of good cookings.

(2.) A further portion as SO_2 , partly free and partly combined, but in a form that may be titrated with iodine solution.

(3.) Another part is contained as SO_2 in the liquor, but in a combined form, which can only be freed by treating with strong acid.

(4.) The last portion of the sulphur exists combined with foreign organic matter, and can only be liberated by heating with hydrochloric acid.

The simplest way of obtaining this precipitate is to add water, acidify with HCl , and heat for a considerable time at a moderate temperature. At first the liquor will turn dark, and then clear, and then, after some time, sulphur is deposited. The above refers to Mitscherlich liquor, which is more concentrated than the liquor of most other processes.

With irregular or over-cooked boilings the liquor changes its odour, which becomes sweetish and disagreeable, the solution passing from a clear yellow to a dark brown, with a precipitate of sulphur. By over-boiling, the organic lime salts decompose, liberating free sulphur, which finally settles.

The author has seen a liquor that deposited sulphur taken from a South Austrian mill worked by Kellner's system.

Some years ago he heated some wood under pressure in glass tubes with bisulphite of lime, and distinctly recollects that the wood was over-boiled through the temperature being too high, and the liquor deposited lime and became dark brown and cloudy. The change in the smell of the liquor and the deposition of sulphur are two signs of over-cooking, and if the boiling be continued the liquor becomes darker and darker, with a deposit of calcium monosulphite. This is easily noticeable in the Mitscherlich boiling, whereas with direct steam boiling it is not so easy to detect the deposition of calcium monosulphite.

At a Mitscherlich sulphite mill where an imperfect boiling had been produced, the author saw amongst the pulp large quantities of monosulphite of lime mixed with free sulphur, which is a certain proof that the process of boiling does not involve the oxidation of sulphurous acid, but is, as pointed out in 1891 by him, substantially a reduction process.—S. P. E.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Active Principles, Localisation of. Pharm. J. 1896, [1866], 177—178.

M. SACVAN gives the result of his observations on the distribution of a number of alkaloids and glucosides in the living plant.

Strychnine.—In *Strychnos nux vomica* and other species of the genus, strychnine occurs in the cortical parenchyma and liber of the root and stem, both in old and young plants; in the parenchyma of the leaves and liber of the veins; and in all the cells, both of the embryo and of the endosperm, in the ripe seed, always in their interior.

Brucine accompanies strychnine in all the organs where it occurs in the various species of *Strychnos*; it is also present in smaller quantities in the epiderm of the leaf and of the young stem.

Curarine is found in various species of *Strychnos*, in the interior of the cortical parenchymatous cells and in those of the liber, in the root and stem; also in the epiderm of the young stem and the cells of the parenchyma and liber of the root, stem, leaf-stalk, and leaf, and even in the pith of the stem.

Berberine occurs in *Berberis vulgaris*, in the interior of the cells of the cortical parenchyma, liber, cambium, and medullary rays, and in the interior and walls of the xylem vessels in the root, in the interior of the cells of the cortical parenchyma, liber, and cambium of the stem, and in all the cells of the embryo and endosperm.

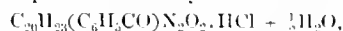
Tarine of the yew is found in the parenchymatous and pericyclic cells of the root, but not in the sieve tubes; in the same elements and also in the pith of the stem; in the epiderm and the pericyclic and liber cells of the leaf; and in all the cells of the embryo and endosperm of the seed.

Helleborine and **helleboreine** occur in the same organs, though not usually in the same cells of various species of *Helleborus*. *H. viridis* is the richest in helleborine; *H. niger* in helleboreine.

Daphnine occurs in special abundance in the fruit of *Daphne alpina* and *D. genkium*.—A. S.

Benzoylquinine. A. Wuosch. Nordisk. pharm. Tidsskrift, 1896, 3, 213.

BENZOYLQUININE rotates a beam of polarised light to the right to the same extent as quinine itself does to the left, but addition of hydrochloric acid decreases its optical activity. All its salts are acid, and in dilute aqueous solution they are fluorescent. Benzoylquinine forms normal salts with 2 mols. of a monovalent acid, and also basic compounds with half that amount. The latter are stable, crystalline, and not readily soluble in water; the normal salts are more difficult to prepare and more easily decomposed, even by water. The author has prepared the following compounds. Basic hydrochloride—



basic hydrobromide, basic salicylate, basic tartrate, containing 9 mols. of water, &c. The normal hydrochloride, $\text{C}_{20}\text{H}_{23}(\text{C}_6\text{H}_5\text{CO})\text{N}_2\text{O}_2 \cdot 2\text{HCl} + \text{C}_2\text{H}_5\text{OH}$, is obtained as a white powder by the action of hydrochloric acid gas on a solution of benzoylquinine in absolute ether. The base combines readily with alcoholic iodides—compounds with 1 and 2 mols. of methyl iodide having been produced, the former as white or yellow needles, and the latter as a red crystalline mass.—F. H. L.

Aconitum Septentrionale (Koele). *Pharmacological Researches on.* H. V. Rosendahl. J. Pharm. Chim. 1896, 4, 262.

The three following alkaloids have been obtained from the above species of *aconitum*:—

Lupaconitine, $\text{C}_{34}\text{H}_{48}\text{N}_2\text{O}_8$, well-formed voluminous hexagonal crystals, melting at 205°, with a bitter taste. The alkaloid and its salts are dextro-rotatory. It dissolves in 126 parts of alcohol, 330 of ether, 1,472 of water, and the solutions have a violet-red fluorescence. With sulphovanadic acid it gives at first a yellowish-red coloration, and with bromine, tribromolupaconitine. When heated with alkalis, two other alkaloids, of melting points 98° and 106° C., and an acid not containing nitrogen, are produced.

Septentrionaline, $\text{C}_{31}\text{H}_{48}\text{N}_2\text{O}_8$, is a white or yellowish powder with a bitter taste, melting at 128.9° C., and, together with its salts, is dextro-rotatory. It dissolves in 1.7 parts of alcohol, 2.1 of ether, and 58 of water; the solutions do not fluoresce. The solution of the alkaloid in freshly prepared furfural sulphuric acid, is cherry-red in

colour. This alkaloid also forms a tribromo derivative, and warmed with caustic soda gives alkaloids, melting at 88° and 105° C., and an acid identical with that obtained from lapaconitine.

Cynoctonine, $C_{36}H_{55}N_3O_{13}$, is an amorphous unstable greyish powder with a bitter taste, easily soluble in alcohol, dissolving in 1,373 parts of ether and 23 of water. These solutions do not fluoresce. It is dextro-rotatory, and melts at 137° C. Concentrated sulphuric acid colours it a deep brown; evaporated to dryness with fuming nitric acid, it leaves a residue which, with alcoholic potash, gives a blood-red coloration, changing at once to brownish-red. With bromine, tribromoecynoctonine is produced.—A. C. W.

Alkaloid from Kopsia Flavida. Separation and examination of the. W. P. H. v. d. Driessen. *Marceuw. Nederl. Tijdschr. Pharm.* 8, 199—204.

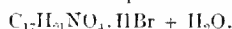
An alkaloid was first isolated from the *Kopsia Flavida*, belonging to the family of the *Apocynaceæ*, by Greshoff (Ber. d. botan. Gartens zu Buitenzorg, 1890, 60). The author obtained it from the bark of the plant by extracting with alcohol, taking up the residue of the alcoholic solution with dilute hydrochloric acid, and shaking the liquid, supersaturated with ammonia, with chloroform. To purify the crude product, he dissolved it in dilute hydrochloric acid, treated again with ammonia, shook up with chloroform, then in like manner with ether and with petroleum spirit. The alcoholic solution of the white residue, on spontaneous evaporation, left the alkaloid in the form of small prisms. The chloride, sulphate, and acetate also crystallise. With the alkaloid group reagent, a precipitate was formed. With Mayer's reagent, iodine dissolved in potassium iodide solution, the double iodide of potassium and bismuth, and with phosphomolybdic acid, about 1 part in 20,000 may be detected. Strong sulphuric acid is coloured yellow by it, with warming, violet; concentrated hydrochloric acid and potassium bichromate, after 5 minutes, purple-violet; cerium oxide and sulphuric acid, violet. Red fuming nitric acid evaporated to dryness on the water-bath with a trace of the alkaloid gives a green colour, changing to brownish-red with caustic soda; nitro-sulphuric acid produces a reddish-violet colour. With bromine water is formed in a weak acid solution, an addition product. The physiological action of the alkaloid is weak.—A. S.

Bebirine (or Bebeerine). M. Scholtz. Ber. 1896, 29, 2054.

This alkaloid, investigated by MacLagan in 1843, was obtained by him in an impure form from the bark of *Nectandra Rodiei*, a tree indigenous in British Guiana. The pure alkaloid may be obtained in the form of small colourless crystals by dissolving the amorphous variety in methyl alcohol. The crystals melt at 214° , dissolve with difficulty in methyl and ethyl alcohols, from which solvents the crystalline form again separates; they are readily soluble in acetone and chloroform, the amorphous form separating from these solutions. The crystalline hydrochloride melts at $259-260^{\circ}$, and is formed on evaporation of the hydrochloric acid solution of crystalline bebirine. Bebirine, $C_{18}H_{21}NO_3$, is optically active; $\alpha_{D}^{20} = -298$. On oxidation with potassium ferrieyanide, it yields the base $C_{15}H_{19}NO_4$.—A. C. W.

Scopolamine. E. Schmidt. Ber. 1896, 29, 2009.

O. Hesse has stated that commercial scopolamine hydrobromide is a mixture of the hydrobromide of hyoscyne, $C_{17}H_{23}NO_3$, and an isomeric base, atropine. This the author denies, the samples with low optical rotation are mixtures of scopolamine hydrobromide $C_{17}H_{21}NO_4 \cdot HBr + 3H_2O$ with a hydrobromide of inactive scopolamine—



The inactive alkaloid is obtained from the active by the action of alkalis, and the samples of normal rotation $\alpha_{D}^{20} = -25^{\circ} 43'$, are obtained by making the extract alkaline with sodium bicarbonate or ammonia, those of weak rotation $\alpha_{D}^{20} = -6^{\circ} 62'$, by the use of strong potash or soda. The salts of the active and inactive bases are identical in crystalline form and in their therapeutic effect.—A. C. W.

β -Asparagine, Formation of. A. Piutti. Ber. 1896, 29, 2069.

By the action of concentrated alcoholic ammonia on maleic anhydride at 105° — 110° there is produced a mixture of the two asparagines, identical with the natural product.

—A. C. W.

Stachydrine, Occurrence of, in the Leaves of Citrus Vulgaris. E. Jahns. Ber. 1896, 29, 2065.

By extracting the orange leaves with boiling water, precipitating with lead acetate, adding sulphuric acid, and throwing down the bases with potassium bismuth iodide, and treatment of the precipitate with silver or barium carbonate, a solution of a base was obtained which, after recrystallisation, possessed the formula $C_{12}H_{15}NO_2 + H_2O$, and was identical with stachydrine. This is a monobasic acid, and on evaporation with strong potash and heating until the potash melts, the mass evolves dimethylamine. Thus the formula $C_{11}H_{14} \cdot N(CH_3)_2(CO_2H)$ is indicated.—A. C. W.

Digitoxin. Kiliani. Archiv. der Pharmacie, 234, 181.

The author obtained, on a former occasion, by treating the alcoholic extract of digitalis leaves with ether, a crystalline glucoside, which presented the same characteristics as the digitoxin described by Schmiedeberg, and he provisionally called it β -digitoxin (Pharm. J. 55, 120). Further examination of digitoxin, prepared according to Schmiedeberg's method, has shown that it is a glucoside, and really the same substance as the author obtained in his experiments. By treating digitoxin with an alcoholic solution of hydrochloric acid, without heating above 25° C., it dissolves after four or six hours, and on adding some water, crystals of digitoxigenin are deposited. After leaving the mixture for several hours, and filtering, the filtrate is shaken with chloroform, which is separated and distilled, and the syrupy residue washed into a basin with proof spirit, and warmed to drive off chloroform, when more digitoxigenin will be deposited. The aqueous liquid separated from the chloroform is shaken with sufficient silver oxide to remove hydrochloric acid, filtered, and evaporated in a vacuum to syrupy consistence. After some time, crystalline crusts are formed, which are dried upon clay slabs, and when dissolved in the least possible quantity of methyl alcohol, form, on addition of ether, fine prismatic crystals of digitoxose, melting at 101° C. Taking the composition of digitoxose to be $C_{20}H_{32}O_{10}$, and that of digitoxigenin to be $C_{20}H_{30}O_8$, that of digitoxin would be $C_{20}H_{30}O_{10}$, which agrees with the analytical data obtained. The author considers that the substance described by Arnaud (this Journal, 1890, 323 and 324) as "digitaline crystallise," melting at 213° — 245° C., was probably digitoxin. It was found that the seeds of digitalis contained a comparatively large amount of digitogenin, but no digitoxin.—A. S.

New Toxic Glucoside. Plugge. Arch. de Pharmacodyn, 2, 537.

The bark of *Lumnisa amara*, a tree also known as *Rabulaisia philippinensis*, and growing in the island of Luzon, is used there by the *Negritos* as an arrow poison. Plugge finds that this bark contains a very toxic glucoside, acting on the heart like digitalin, 0.01 grm. of it killing a frog. The glucoside is soluble in water and alcohol, less in chloroform, and is difficult to extract by the latter solvent. The chloroformic solution can, however, be obtained colourless, and on evaporation in a desiccator, gives crystals which are deliquescent in the air.—A. S.

Coronilla and Coronillin. F. Schlagdenhauffen and E. Reeb. Zents. Oesterr. Apoth.—V. 34, 487—490.

The authors have examined the constituents of the coronillas, viz., the seeds of the *Coronilla scorpioides*. From the pulverised seeds, by means of petroleum ether, an orange-yellow fatty oil was obtained (4.3 per cent.), sp. gr. 0.912, which turns brown with sulphuric acid and violet on addition of ferric chloride. It contained cholesterin, some lecithin, and yielded, by saponification, arachidic, stearic, and palmitic acids.

Coronillin.—1 kilo. of the oil from the pulverised seeds was digested for six hours at 100° C., with six times its own volume of water, and the mass, after cooling, was mixed with its own volume of 95 per cent. alcohol. After standing for three days, the mixture was filtered and evaporated to one-sixth of its weight. After 24 hours, crystals having the formula $C_{17}H_{15}O_5$ separated out, which, on account of a cumarin-like odour which was apparent when they were heated, were called *pseudo cumarin*. The liquor filtered from the crystals was evaporated to a thick extract, which was dissolved in 95 per cent. alcohol (3 litres of alcohol to 50 grms. of extract), the solution filtered, the alcohol distilled off, and the residue dissolved in water and shaken up with ether. The ether extract was decomposed on the water-bath with sodium and magnesium sulphates, whereby a thick mass separated out, which was dissolved in alcohol. The filtered alcoholic solution was then decomposed with lead acetate, the filtrate freed from lead by H_2S , filtered, evaporated to dryness, dissolved again in water, filtered through unglazed porcelain, and again evaporated to dryness. The residue, washed with chloroform and ether and dissolved in very little alcohol, was finally mixed with ether, and the filtered yellowish solution evaporated. Coronillin was thus obtained as an amber-yellow powder. Formula $C_{17}H_{15}O_5$, soluble in water, alcohol, and acetone, with difficulty soluble in ether and chloroform. It is a glucoside, and splits up on dilution thus:—



Coronillin gives, with H_2SO_4 , $H_2SO_4 + Br$, $FeCl_3$ and KI , almost the same reactions as specimens of the commercial digitalin (yet not the blue reaction with Lafont's reagent) and is distinguished by a characteristic cherry-red to reddish-brown colour, which is formed on the addition of nitric acid and a trace of chlorine. In its physiological action, coronillin closely resembles digitalin (glucoside).—A. S.

Malarin [Acetophenone-phenetidine Citrate]. Pharm. Zeit. 41, 598.

This is the citrate of a condensation product of acetophenone *p*-phenetidine, is insoluble in cold water and has a slightly acid taste. The condensation product (acetophenone-phenetidine) is prepared by heating equivalent proportions of acetophenone and *p*-phenetidine, either alone or with addition of dehydrating agents. It crystallises in yellow needles, melting at 88° C., and is readily soluble in hot alcohol, ether, or glacial acetic acid.—A. S.

Amyloform. Claassen. Pharm. Zeit. 41, 615.

The author has obtained by the action of formic aldehyde upon starch, an inodorous white powder, insoluble in any menstruum, and having a very marked antiseptic character. Under the microscope it does not show any structure of starch. When applied to surgical dressings, they can be sterilised without fear of alteration, as amyloform when heated to 110° C. loses 2.87 per cent. of water without being decomposed. It is stated to be preferable to iodoform as a dressing for wounds.—A. S.

Essential Oils and Essences from Government Flower Farm, Dunolly, Victoria: Report on Preliminary Examination of. J. C. Muncey. Imp. Instit. Jour., Scient. and Tech. Research Dept., Aug. 1896, 302.

Oil of Anise.—This oil has a density of 0.914 at 15°, an optical rotation of + 16 in a 109-mm. tube, and does not solidify at 1° C., it is thus very different from the slightly levo-rotatory oils of anise fruit and star anise, which have a density of 0.980–0.990 and solidify at 14° C. The odour is more suggestive of fennel than anise, and so are the physical constants. It did not appear from a comparison with the liquid portion of anise oil that the difference was due to the solid parts being separated by the use of ice water in the condenser. No commercial value can be placed on the oil in the form in which it was examined.

Oil of Absinthe.—The sp. gr., 0.939, lies between that of the English and American oils; the optical rotation could not be discovered owing to the dark green colour of the oil,

but on fractionation it gave the following result as compared with a pure American oil:—

	Below 200° C.	200° —205° C.	205° —210° C.	Above 210° C.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dunolly	4	20	28	48
American	15	12	14	59

Oil of Boronia Polygalifolia.—This oil might be largely employed in perfumery. It is new to commerce, has a sweet smell resembling tarragon, with a slight after-smell of rue. A complete chemical examination is desirable. The specific gravity is 0.839 and the optical rotation + 10. On fractionation the following results were obtained:—

	Per Cent.
150°—170° C.	31
170°—180° C.	38
180°—190° C.	15
Above 190° C.	16

The ketone, boiling at 225°, characteristic of rue oil, does not therefore exist in any quantity in this oil; the highest fraction gave no crystalline compound with sodium bisulphite.

Oil of Eucalyptus citriodora has a powerful citronella odour, a specific gravity of 0.8809 and an optical rotation of -1. On fractionation it gave—

	Per Cent.
190°—200° C.	76
210°—219° C.	12
Residue	12

The aldehyde citronellon was present to the extent of 90 per cent., no eucalyptol was found by the phosphoric acid test. The oil has no medicinal value, and probably could not be produced to compete with citronella oil for perfumery purposes, the odour of the latter oil, however, is modified by the presence of a considerable percentage of geraniol.

Essences of Jonquille, Milkflowers, and Tuberoze.—These samples were useless for perfumery purposes, owing to insufficient concentration and the use of non-odorless spirit. No fat could be separated by freezing, hence they had probably not been prepared by the "enfleurage" process. Probably the essences would be valuable if carefully prepared by this process.

The aroma of the jonquille is good, and of the tuberoze fair; that of the milkflowers is spoiled by the presence of sage or absinthe.

Oil of Rose Geranium and African Geranium.—From the following figures it will be seen that these oils show no great deviation from the French and African geranium oils:

	Specific Gravity.	Optical Rotation.	Total Geraniol.
Dunolly rose geranium	0.906	- 11.25	51.8
" African geranium	0.902	- 7.5	62.4
French rose geranium	0.894	- 10.75	57.1
African geranium	0.898	- 7.5	69.6

Oil of Lavender.—The specific gravity was 0.916, the optical rotation + 11; these figures point to the possibility of the oil having been distilled from a mixture of *lavandula vera* with *lavandula spica* or other lavenders. The proportion of esters was 5.25 per cent.; most English samples show 7–10 per cent. The alcohol $C_{10}H_{18}O$ was present to the extent of 29.75 per cent.; the oil of *lavandula vera* usually contains about 45 per cent.

Oil of Lemon Thyme.—After removal of added alcohol (20 per cent.), the specific gravity was 0.898, and the rotation - 3. A fractionation gave this result—

	Per Cent.
210°—220° C.	28
220°—230° C.	54
Above 230° C.	18

The first fraction consisted almost entirely of citral; the second showed a large proportion of phenols, chiefly, if not entirely thymol.

Oil of Myrtle.—The specific gravity was 0.926, the optical rotation -4 ; after removal of 28 per cent. of a non-volatile residue, a mixture of a caoutchouc-like substance, with a wax of melting-point 45°C ., the purified oil gave the following results, which are compared with two French samples:—

Sample.	Specific Gravity.	Rotation.	Fractionation			
			Below 170°	170° — 185°	185° — 200°	Above 200°
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dunolly.....	0.916	-5	18	9	20	43
France I.	0.885	$+25$	78	16	1	2
France II.	0.893	$+24$	56	24	6	14

Oil of Rose.—The sample was free from alcohol, had a specific gravity of 0.8886, and only became slightly opaque at 5°C .; whilst Turkish otto of rose solidifies at 17° — 20° , and has a specific gravity of 0.865—0.870. Probably the stearoptene had been partially removed in the condensation of the oil. In odour the sample compared favourably with Turkish otto.

Oil of Peppermint.—The specimen was of a pale greenish-yellow colour; the numbers in the following table, obtained after removal of added alcohol, show that it compares fairly well with other samples:—

Sample.	Specific Gravity.	Rotation.	Menthyl as Esters.	Free Menthol.	Total Menthol.
			Per Cent.	Per Cent.	Per Cent.
English (black)	0.9072	-18.5	5.6	57.5	63.1
" (white)	0.9058	-33.0	13.6	51.9	65.5
Dunolly	0.912	-27.0	8.3	45.6	53.9
American	0.9215	-29.0	8.4	38.0	46.4
Saxon.....	0.9057	-26.25	6.1	55.3	61.4

Oil of Pennyroyal had a marked peppermint odour in addition to that of pennyroyal, the further examination showed the sample to be a mixture of the two oils. Its specific gravity was 0.918, and rotation $+7$; the English and American pennyroyal oils have a specific gravity of not below 0.930, and the rotation is between $+18$ and $+20$. The specific gravities of most peppermint oils do not exceed 0.915, and their rotation is -20 to -30 . The following are results of comparative fractionations:—

Sample.	Below 210°	210° — 220°	220° — 223°	Above 223°
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dunolly	43	34	13	10
American	4	79	12	5
English (old) ...	15	37	7	41

The percentage of alcohol (probably menthol) was, as ester 8.7, as free alcohol 27.5, calculated as menthol and menthylacetate. This is 10—15 per cent. more than is given by English and American oils.

Oil of Rosemary.—This oil is of exceptionally high borneol value, and compares with the finest English oil, as the following table shows:—

	Specific Gravity.	Rotation.	Fractionation.			
			Below 176°	176° — 200°	Above 200°	Borneol.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dunolly	0.906	$+0.25$	13	64	23	15.1
England (Lines)	0.9097	$+7.5$	14	73	13	13.26
France (Grasse)	0.9079	$+3.5$	22	59	19	11.07

Oil of Sage.—The oil so described had a strong thyme odour, quite different from the usual oil of sage from *salvia officinalis*; it contained 17 per cent. of phenols, with a boiling point of 232° — 233° (carvacrol), but was practically free from alcohols, whilst true oil of sage has 22—23 per cent. of alcohols, and only 2—3 per cent. of phenols. The sample has thus probably been distilled from *Satureja hortensis* (summer savory).

Oil of Tansy.—The specific gravity, 0.922, and rotation, $+37$, and the results of a fractionation (200° — 210°C ., 26 per cent.) show its identity with the American oil.

Oil of Thyme of the Alps.—The following comparison with samples of red and white oils shows the value of this oil and its freedom from oils of wild thyme and spike (*Larandula spica*):—

Distilled in	Specific Gravity.	Rotation.	Percentage of Phenols.	Remarks.
Dunolly	0.922	37	23	Pure.
France	0.901	15	11	Mixed with oil of Lavandula spica.
France	0.926	44	49.4	Pure.
Germany, white ..	0.925	38	34	Pure.

Oil of Vervain.—The sample had the characteristic odour of the verbenia or lemon-grass oil, though much more agreeable, it was probably, however, distilled from common vervain.

Lippia Citrodora.—The specific gravity was 0.891, the rotation -16 , fractionation under atmospheric pressure was unsatisfactory, because of considerable decomposition. The aldehydes (citral) amounted to 74 per cent. This oil would be of considerable value for soap and perfumery compounding, if it could compete in price with Ceylon lemon-grass oil.

The specific gravities mentioned in this paper were taken at 15°C ., and the optical rotations in a 100 mm. tube.

—A. C. W.

Bergamot Oil, Proof of the Purity of. A. Borntraeger. Zeits. anal. Chem. 1896, 35, 523.

In a former paper (this Journal, 1896, 223) the author adopted 38 per cent. of linallyacetate as the standard of purity of bergamot oil, whilst Schimmel and Co. had stated that the percentage varies between 34 and 43. In their April report, this firm states that of the last crop the oil of unripe and half ripe fruits contains 43—34 per cent., and of ripe fruits about 37 per cent. Only in the case of a few Parthian oils at the close of the season does the content rise to 40—44 per cent. Thus the saponification process must always be supplemented by determinations of density and optical rotation to detect a simultaneous adulteration with oil of turpentine and fats.—A. C. W.

Essential Oils. Dayk. J. Pharm. Chim. 1896, 4, 38 and 206.

Cinnamon Oils.—In Belgium the official oil is obtained from the bark of the Ceylon cinnamon; in other countries the oil of *cinnamomum cassia* is made use of. The principal constituent of both oils is cinnamic aldehyde. Ceylon cinnamon oil is a yellowish liquid of density 1.024, without action on polarised light (according to Umney it is slightly dextro-rotatory), and should not contain less than 60 per cent. of the aldehyde. A solution of a few drops in 10 c.c. of alcohol should give a pale green coloration with ferric chloride; deep blue or green indicates the presence of essential oils of the leaves or roots, which both contain a large percentage of eugenol; a brown coloration is produced by oil of cassia. The Ceylon oil contains 6—8 per cent. of eugenol, a terpene (probably phellandrene), small quantities of safrol, a stearoptene, &c. The oil of cinnamon leaves is characterised by the presence of much eugenol and little cinnamic aldehyde; the oil of the roots also contains much eugenol and a camphor, but only traces of aldehyde. Chinese cinnamon oil or oil of cassia contains

70--80 per cent. of aldehyde, also cinnamyl-acetate, eugenol, a terpene, and a camphor, which last is an aldehyde and is transformed by oxidising agents into β -methylcoumaric ether. It is a deep yellow liquid of density 1.055—1.065; the alcoholic solution gives a brown coloration with ferric chloride. Oil of cassia should give no precipitate on shaking with water, filtering and adding basic lead acetate. On distillation the residue should be syrupy, and not amount to more than from 8—10 per cent., and on adding to a solution of 1 c.c. of the oil in 3 c.c. of 70 per cent. alcohol a mixture of 2 c.c. of saturated lead acetate solution and 4 c.c. of 70 per cent. alcohol, no precipitate should be obtained. The best test of the purity of a cinnamon oil is an estimation of its aldehyde content. Schimmel's process for this is as follows:—10 c.c. of the oil are placed in a 100-c.c. flask with a long neck graduated in $\frac{1}{10}$ c.c.; the flask is then three-quarters filled with a 30 per cent. sodium bisulphite solution. After shaking and warming, more bisulphite solution is added, so that the bisulphite compound having dissolved, the oily layer enters the neck of the flask and its volume is then read off. Subtracting this from the 10 c.c. of oil used, the volume of aldehyde is obtained, and hence the percentage, the aldehyde and mixture of other constituents having approximately the same density. An oil containing less than 70 per cent. of aldehyde should be regarded with suspicion; oil marked Cheong-Loong and Yang-Loong have given the highest values.

Caraway Oil.—A good sample should have a density of at least 0.910 at 15° C., not more than 15 per cent. should distil over below 185°, and 55 per cent. should come over above 200° C. The rotatory power varies from 79° to 80°. On keeping, a phenol is formed; to this is due the blue coloration given by ferric chloride.

Anise Oil.—The density is between 0.980 and 0.990 at 15°, and the rotation is about + 4.5° in a 200 mm. tube. At 9° it almost entirely solidifies to a crystalline mass of anethol. The proportion of this constituent is determined by strongly cooling and pressing the crystalline mass between absorbent paper: a good sample should not contain less than 85 per cent. of anethol. On keeping it becomes acid through oxidation. The properties of this oil are very similar to those of star-anise, from which it is distinguished by giving an intense blue coloration on addition of a solution of hydrochloric acid gas in absolute alcohol, oil of star-anise producing a brownish colour.

Fennel Oil solidifies at 5°—10° C., its density should not be less than 0.950. Adulteration with turpentine may be detected by examination of the lowest boiling fraction and by determination of the optical rotation; this is + 6.75 for the pure oil, the adulterated product being levo-rotatory. To estimate the substances for which this oil is valuable, the liquid estragol must be converted into the isomeric anethol by boiling with alcoholic potash, after which the anethol may be determined as above.—A. C. W.

Aconitine, A Test for. J. Pharm. China. 1896, 4, 266.

See under XXIII., page 745.

Alkaloid Solutions, Use of Iodine Solutions for the Titration of. C. Kippenberger. Zeits. anal. Chem. 1896, 35, [4 and 5], 422.

See under XXIII., page 747.

Vicin; A Glucoside. H. Ritthausen. Ber. 1896, 29, 2108.

See under XXIV., page 749.

Allorantin from Convicin, obtained from Broad Beans and Vetches, Reactions of. H. Ritthausen. Ber. 1896, 29, 2106.

See under XXIII., page 745.

Theobromine, Determination of, in Cocoa. Ewinget. Forschungsber. 1896, 275.

See under XXIII., page 748.

PATENTS.

Alimentary or Pharmaceutical Liquids or other Substances, and in Apparatus therefor; Impts. in Concentrating. S. D. Rowland, London. Eng. Pat. 17,061, Sept. 12, 1895.

See under XVIII. A., page 733.

Pharmaceutical Substances, The Manufacture of. [Active Substance of Thyroid Glands.] Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 20,827, Nov. 4, 1895.

Processes are claimed for isolating and preparing the active principle of thyroid glands. The thyroid glands of sheep (or other animal) are heated, either with (a) 3 per cent. sodium hydrate solution, or (b) With water only, under pressure at 180° C. The solution after filtration (a) is acidified, when the thyroidea is precipitated; (b) Deposits the active constituent in flocks on cooling. In either case traces of thyroidea still remaining in solution may be separated by addition of salt. The impure product is dissolved in hot alcohol, the solution filtered and allowed to cool, when fatty acids, if present, will crystallise out, and may be filtered off. Finally, the solution is evaporated to dryness in order to obtain the thyroidea, or, if a very pure product be required, precipitation with ether may be resorted to.—H. T. P.

Vanillin, Impts. in the Manufacture or Preparation of. C. F. Boehringer and Soehne, Waldhof, Germany. Eng. Pat. 22,351, Nov. 22, 1895.

The production of vanillin from its ethers (benzyl-vanillin, &c.), by hydrolysis of the latter with halogen acids, as claimed in Eng. Pat. 361, 1892 (this Journal, 1893, 61), is improved upon by effecting the operation in presence of an alcohol. By this means the proportion of acid required for hydrolysis may be much reduced, on account of the fact that the halogen alkyl ordinarily formed in the course of the reaction is at once decomposed by the added alcohol, free acid being regenerated. For example, starting with benzyl-vanillin, ethyl alcohol (and HCl), the end-products are vanillio, benzyl-ethyl ether (and HCl). In practice the proportion of acid may be reduced to one-fifth of that demanded by theory (alcohol being absent).—H. T. P.

Sugar, Ferric Oxide, and Chloride of Sodium [Medicinal Preparation]; Impts. in or relating to the Manufacture of a New Product from. C. Stahlschmidt, Bartscheid, Germany. Eng. Pat. 7793, April 13, 1896.

A MEDICINAL preparation. 600 grms. of sugar are dissolved in 1 litre of ferric chloride solution (sp. gr. 1.049), and diluted with 0.5 litre of water. The solution is then heated to from 80°—100° C., and 640 c.c. of caustic soda solution (sp. gr. 1.0985) added, and the whole evaporated to dryness on a water-bath. A black, shining, amorphous mass is thus obtained. The preparation is soluble in three times its weight of water. The solution is not precipitated either by the common mineral and organic acids, or by salts (alum, sodium sulphate).—H. T. P.

Ozone, Impts. in Apparatus for the Production of. [Hollow Electrodes.] E. Andreoli, London. Eng. Pat. 10,372, May 14, 1896.

See under XI. A., page 726.

Ortho-Sulphamine Benzoic Acid ["Saccharine"], Preparation of. G. Cerekel, Paris, France. Eng. Pat. 15,493, July 13, 1896.

AN intimate mixture of ortho-cresol and ammonium bisulphite in equivalent proportions is heated for about 12 hours, preferably in a closed vessel, to a temperature not exceeding 150° C. The mass is then dissolved in hot water, and the unaltered cresol removed by steam distillation. The toluene sulphamine remaining in the solution is purified by crystallisation from water, and finally oxidised by potassium permanganate in the usual way.—H. T. P.

Albumin-Tannin Compound [Astringent], *Impts. in the Manufacture or Production of an.* W. L. Wise, London. From Knoll and Co., Ludwigshafen, Germany. Eng. Pat. 13,281, June 16, 1896.

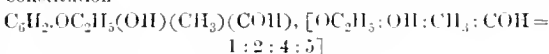
THIS improvement on the patentee's previous specification (this Journal, 1896, 470) consists in substituting for the heating of the washed precipitate, the treatment of it with alcohol, or an acid, or formic aldehyde, any one of which will render the albumin-tannin compound with difficulty digestible in the gastric juices of the stomach.—A. G. B.

Pyrocatechin, Impts. in Mono-Alkyl Ethers of, and in the Production of such Ethers [Antiseptic and Odorant]. Chemische Fabrik von Heyden, Radebeul, Germany. Eng. Pat. 16,047, July 20, 1896.

THIS invention has reference to pyrocatechol-ethyl ether, which is described as a hitherto unknown substance. It is prepared by heating under pressure a solution containing pyrocatechol, sodium hydrate, and sodium ethyl sulphate (or ethyl chloride, &c.) in equivalent proportions. The pyrocatechol mono- and diethyl ethers thus formed are removed by steam distillation, and finally separated by treatment with caustic soda solution, in which only the monoethyl ether is soluble. Pyrocatechol-ethyl ether ($C_6H_4 \cdot OC_2H_5(OH)$) crystallises in large, well-developed, clear, colourless prisms. It fuses readily, and solidifies at 26° – 27° C. It boils at 215° C., and is soluble in alcohol and ether, with difficulty soluble in water. Its odour resembles that of thymol. Heinisch (Monatshefte für Chem. 15, 152) has described a substance which he supposed to be pyrocatechol monoethyl ether. This supposition is stated to be erroneous.—H. T. P.

New Perfume [Ethyl Homovanillin], and *Process for the Manufacture of the same.* Chemische Fabrik von Heyden, Radebeul, Germany. Eng. Pat. 16,162, July 21, 1896.

THE new perfume—ethylhomovanillin—is obtained by the action of chloroform on an alkaline solution of homopyrocatechol-ethyl ether. It crystallises from alcohol in colourless needles, melting at 91° C., and possesses an extremely persistent odour, resembling, but distinguishable from, that of vanillin. Ethylhomovanillin probably has the following constitution—



(see this Journal, 1896, 614).—H. T. P.

XXI.—PHOTOGRAPHY.

PATENT.

Photographs in Relief in Gold, Silver, and other Materials; Improved Means of Obtaining. A. Hill and A. A. Barratt, Surrey. Eng. Pat. 15,935, Aug. 24, 1895.

THIS is a process for making use of the relief existing on a bichromated gelatin film for the production of a plaster matrix, whence a metallic cast may be obtained by electrolysis or otherwise. The special aim of the present specification is to increase the ordinary low relief of the gelatin print; this being effected by cementing the exposed film to a plate of glass by means of isinglass dissolved in weak acetic acid containing also a little celluloid in amyl acetate, and developing first with water, and afterwards with 1 part of citric acid in 6 of water.

In the case of portraits with a light background, &c., false modelling is likely to occur, as the original negative indicates differences of colour as well as of form. To obviate this, either a silver print is prepared, the necessary corrections made with the brush, and a fresh negative taken from it; or the first negative may be kept very thin, intensified with uranium, and "reduced" where necessary with strong ammonia.—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

PATENT.

Lucifer Matches [Coating with Inflammable Waterproof Mixture], *Impts. in.* P. Fowler and A. W. F. Bower, London. Eng. Pat. 15,574, Aug. 19, 1895.

THE heads and part of the stems of matches prepared in the usual manner, are soaked in a waterproofing mixture such as beeswax and rosin, or paraffin-wax, or a solution of india-rubber, gutta-percha, or shellac, "which, whilst absolutely preventing them from being injuriously affected by wet or damp, does not interfere with their ready and effective ignition when required." In some cases the waterproofing material may be incorporated with the composition of which the heads are made; and it is also suggested that the tips should be dipped in a "liquid or solid lubricant, such as oil or grease," to reduce the liability of adhesion or abrasion.—F. H. L.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Pyrometers and their Errors. Wiborgh. Oesterr. Zeits. Berg-u. Hüttenw. 44, 1895, 495.

PYROMETERS depending upon the unequal expansion of two metals (e.g., spirals of silver and platinum) can only be used up to 300° – 400° C., on account of changes in the texture of the metals. Mercury thermometers containing nitrogen can only be used up to 450° – 500° . Air thermometers can be used up to $1,300^\circ$ – $1,400^\circ$, but are more adapted for laboratory than for workshop use. Calorimetric methods, in which a body of known mass and specific heat is allowed to drop into water, are liable to errors. Substances which melt at known temperatures can be used for pyrometric determinations; for high temperatures, only silver, gold, and platinum should be employed, as the other metals (and alloys still more) do not fuse at constant temperatures. A mixture can be made of quartz, felspar, kaolin, and marble in definite proportions, having melting points between $1,000^\circ$ and $1,800^\circ$; this can only be used for furnaces which are slowly heated up to a definite temperature. The author does not consider that the pyrometers of Siemens (depending on the change of resistance of a platinum wire) and Le Chatelier (consisting of a thermo-couple of platinum and platinum-rhodium) have proved satisfactory as practical instruments. Optical pyrometers, which measure the intensity of the light emitted by the glowing body, can be used for the highest temperatures. The best pyrometer is that of Mesuré-Nonel, which contains two Nicol prisms and a quartz plate. The composition of the light given out by a glowing body varies with the temperature; and for a given temperature the analyser must be rotated through a given angle to obtain the same transition tint. Finally, the author suggests the use of an apparatus which he calls a "thermophone." This contains an explosive mixture in a fire-resisting case; the time which elapses before the explosion occurs is used as a measure of the temperature.—D. E. J.

Thermophone, The: A New Pyrometer. Wiborgh. Berg-u. Hüttenw. Zeit. 55, 257–259.

THE apparatus consists of a fire-resisting cylinder (clay, graphite, &c.) in which is placed a closed metal capsule containing a small quantity of an explosive, which detonates at a constant temperature. This is placed in the space, the temperature of which is to be determined, and the temperature calculated (by reference to empirical formulæ or previously drawn curves) from the time which elapses before explosion takes place. Temperatures between 300° and $2,000^\circ$ can be estimated to within $\pm 20^\circ$.—J. T. D.

Auto-Pneumatic Stirrer. H. Brearley. Chem. News, 1896, 74, 63.

IN the estimation of the total carbon in iron, the metal is decomposed by copper ammonium chloride solution, and the deposited copper dissolved in the excess of the solution.

Hitherto, either a glass rod or a mechanical stirrer has been used for bringing fresh portions of the solution into contact with the metal, but both of these are open to objection. The author recommends agitation by a current of air, washed with lead acetate solution to free it from sulphuretted hydrogen and particles of dust, &c. The air is drawn through the system of bottles or flasks by means of a Bunsen water filter-pump. The iron borings and acidified copper solution (Langley, Chem. News, 69, 4) are placed in the flasks. When the pump is started, there is a continual passage of air through the series, which keeps the solution in constant motion. With this apparatus, there is no grinding of the carbonaceous residue, which largely retains the shape of the borings, and thus can be easily washed from the flask, and has no tendency to run through the filter, as would be the case with mechanical stirring with hard substances.—A. S.

INORGANIC CHEMISTRY.—QUALITATIVE.

Iodine, Detection of Traces of, in Presence of Bromine and Chlorine, by means of Ozonised Aldehydes. E. Ludwig. Ber. 1896, 29, 1451—1456.

The author finds that all the known aldehydes possess (like turpentine, for example) the power of absorbing and retaining oxygen in an active or ozonised condition, in which state they are able to liberate iodine, even from very dilute solutions of potassium iodide (1:600,000), and constitute a delicate test for that halogen. The solution (aqueous) to be examined, should be neutral, free from reducing bodies and salts of mercury, and should not be too highly charged with salts of the heavy metals; and only 2—5 drops of aldehyde should be added in order to avoid reabsorption of the liberated iodine. The latter may be rendered visible by addition of starch-paste, or preferably by extraction with carbon bisulphide. The presence of 1/50,000th of potassium iodide in a saturated solution of potassium bromide, is clearly indicated by the above means, although its presence is not revealed by the usual nitrous acid test. The preparation of ozonised aldehydes is a simple matter. In the case of acetaldehyde, a few cubic centimetres may be exposed to the air in a large flask for an hour. Paraldehyde, propionic aldehyde, methyl-propionic aldehyde, and phenyl-formaldehyde should be distilled (in small quantities) in a current of air; or, with the two last named, it suffices to boil a small quantity in a test-tube. Ozonised aldehydes retain their activity for a considerable time (except methyl-propionic aldehyde), but gradually become inert in presence of water. For quantitative purposes, paraldehyde would appear to be useful. A solution of potassium iodide (2 grms.) in water (100 c.c.), when distilled with paraldehyde (6 grms.), a current of air being drawn through the apparatus towards the end, was found to be quite free from iodine. The residue in the retort consisted of potassium acetate.—H. T. P.

INORGANIC CHEMISTRY.— QUANTITATIVE.

Carbonic Oxide in the Air, The Detection and Estimation of. F. Clowes. British Assoc., Chem. Sect., 1896.

CARBONIC oxide gas, when mingled with air in suitable proportion and fired, produces explosion. But a far greater danger arises from its poisonous nature when breathed. As small a proportion as 0.2 per cent. in air produces poisonous symptoms in man. This gas is introduced into the air by leakage of unburnt water-gas and other gaseous fuels, amongst which ordinary coal-gas must be included. It is produced in the coal-mine by the firing of certain explosives, such as blasting powder and the nitro-cottons; also during an explosion of fire-damp, and by burning of coal or gob-fire. Hence carbonic oxide may be frequently encountered in air, and since it cannot be smelt or detected by any ordinary tests, it is important to make known recently devised methods for detecting and estimating the gas.

Dr. Haldane has brought forward a method which depends upon the change in colour produced in diluted blood when it is shaken up with the gas. This is probably

the most delicate and accurate method known. But it requires some time for its performance, and good daylight is an absolute necessity.

Other methods are well known to the chemist which are not sufficiently delicate, and require to be carried out in a chemical laboratory.

The author recommends the flame-cap test as being at once quick of execution, sufficiently delicate, and also wide in its range of indications. The standard hydrogen flame, 0.4 in. in height, gives a cap 0.5 in. in height in air containing 0.25 per cent. of carbonic oxide, and the height of the cap increases as the percentage of carbonic oxide in the air becomes larger. The only drawback of the method consists in the fact that all combustible gases give flame-caps, and these are indistinguishable from that furnished by carbonic oxide. Hence the flame-cap test is only suitable when other combustible gases are known to be absent.

The test may be made by introducing into the air to be examined a hydrogen safety-lamp, such as has been now adopted in delicate tests for fire-damp and coal-gas. Since, however, there might be serious risk involved in entering and breathing the atmosphere, it is preferable to collect a sample of the air and pass it over the flame, as is done by Mr. Redwood in testing for petroleum vapour. A still more simple plan will often consist in pumping the air to be tested over the standard hydrogen flame in a suitable apparatus, such as was exhibited by the writer. It consists of a small metal cylinder with glass front, within which the hydrogen flame burns, being fed from a pocket cylinder of the compressed gas. The cylinder containing the flame is mounted on a folding portable camera tripod. The air to be tested is drawn through a long rubber tube, by working a valved rubber ball by the hand, and is made to pass over the hydrogen flame. A black cloth is thrown over the observer's head and the flame-cylinder, so as to enable the flame-cap to be accurately observed in darkness, and the height of the cap is registered by shifting a bent wire, moving stiffly in a stuffing box, until it just touches the tip of the cap. On removing the black cloth, the percentage of carbonic oxide is then at once read off upon a scale on the cylinder, the number standing opposite to the top of the movable wire.

The flame-cap test applied in this way presents the advantage of being rapid and delicate, and may be applied without any risk to the operator.

Oxygen by Absorption, The Accurate Determination of, with Alkaline Pyrogallol Solution. F. Clowes. Brit. Assoc., Chem. Sect., 1896.

It was found repeatedly in the author's laboratory that during the absorption of oxygen from the Brin gas, a considerable volume of carbon monoxide was evolved, although this did not occur in absorbing oxygen from the air. If the evolution of the gas was known to take place, and the carbon monoxide was subsequently absorbed by cuprous chloride solution before reading off the residual nitrogen, the estimation of the volume of oxygen was correct; if this precaution was not taken, the estimation was open to serious error. Repeated trials with varying proportions of pyrogallol and potassium hydrate showed that the evolution of carbon monoxide might be entirely prevented by using a sufficiently large excess of potassium hydrate. With the following proportions no fear of this source of error need be felt, even when pure oxygen is being absorbed:—160 grms. of potassium hydrate and 10 grms. of pyrogallol in 200 c.c. of solution. This solution is prepared by dissolving 160 grms. of potassium hydrate in 130 c.c. of water and then dissolving the 10 grms. of pyrogallol in the alkaline solution.

Boric Acid, Volumetric Determination of. M. Honig and G. Spitz. Zeits. für ang. Chem. 1896, 549—552.

Two methods are described:—

1. (a.) *Boric Acid (and Total Alkali) in Alkaline Borates.*—About 30 grms. of the sample are dissolved in water up to 1,000 c.c., and 50 c.c. of the solution exactly neutralised with $\frac{1}{2}$ N HCl, and methyl orange as indicator. The total alkali is thus found. To the solution, which now contains the boric acid in the free state, a few drops of phenolphthalein and 50 c.c. of glycerin are added, and

titration continued with $\frac{1}{2}N$ NaHO (perfectly free from CO_2) until the colour changes. If now a further quantity of glycerin be added, the solution will, as a rule, again become colourless; and it is necessary to continue adding alkali and glycerin (10 c.c. at a time) alternately until the red tint is no longer discharged. Under these conditions, the end-reaction is quite sharp, and the volume of alkali consumed, accords with the equation $B_2O_3 = 2NaHO$, i.e., 1 c.c. of $\frac{1}{2}N$ alkali = 0.0175 grm. B_2O_3 .

If the sample contain carbonates, the solution, after neutralisation with HCl, and prior to titration of the B_2O_3 , must be boiled under an inverted condenser to expel CO_2 . The latter, if desired, may be collected and determined by any suitable method.

(b.) *Boric Acid in Borates insoluble in Water (Boracite, &c.).*—2 grms. of the sample are boiled with a measured excess of $\frac{1}{2}N$ HCl (50 c.c.) under an inverted condenser until solution is effected and CO_2 expelled. The solution is allowed to cool, neutralised with $\frac{1}{2}N$ NaHO and methyl orange, and the boric acid finally titrated as under I. (a).

(c.) *Boric Acid in Mineral Silicates, Glass, &c.*—The finely-powdered substance is fused with sodium and potassium carbonates, the mass dissolved in water, boiled with a slight excess of ammonium chloride, and finally treated with ammoniacal zinc hydrate solution to get rid of the remaining traces of silica. The filtrate from the latter is concentrated to a small bulk, boiled with a slight excess of HCl to eliminate CO_2 , finally exactly neutralised (methyl orange), and treated as described under I. (a).

II. This method depends on the fact that the borax present in a solution may be measured by the quantity of ammonia evolved on distillation with ammonium chloride ($Na_2B_4O_7 = 2H_2O_3 = 2NH_3$). Alkaline carbonates, if present, must be destroyed, which may be effected by precipitation with silver nitrate in presence of ammonium nitrate. In the case of insoluble borates the finely-powdered substance (15 grms.), is boiled for 1 hour with a solution of sodium bicarbonate (10 grms.), a stream of CO_2 being passed through the liquid during the operation. By this means the boric acid is extracted, and passes into solution as borax. The liquid is then diluted to 500 c.c. and filtered. To 100 c.c. of the filtrate are added 4–5 grms. of ammonium nitrate, and then 10 per cent. solution of silver nitrate so long as a precipitate forms (about 60 c.c.). The whole is then diluted to 300 c.c., mixed, immediately filtered, and 200 c.c. of the filtrate distilled with about 2 grms. of ammonium chloride, the ammonia set free being received in standard acid in the usual way. 1 c.c. of N acid = 0.070 grm. B_2O_3 . Test analyses, by both methods, yielded highly satisfactory results.—H. T. P.

Alkali and Vitriol Works, Analytical Methods for. P. Dobriner and W. Schranz. Zeits. f. ang. Chem. 1896, 453–456.

I. *Estimation of Free Sulphuric Anhydride in Fuming Vitriol.*—The authors propose a modification of the existing process with a view to eliminate the ordinary sources of error due to the use of too little substance, errors in reading the burette, and alterations in the standard solutions due to changes in temperature.

The open end of a test tube is drawn out to a fine point and the tube is then weighed. From 6 to 8 grms. of the vitriol are filled into this by placing its pointed end in the acid and warming the wider portion, and, after sealing off the tip and drying the outside, the tube is again weighed. It is broken in 150 c.c. of water contained in a strong stoppered bottle and so much pure sodium carbonate added that after boiling to remove the carbonic acid, from 3 to 4 c.c. of normal acid are required to render the solution neutral. The indicator used is phenolphthalein. If A per cent. represents the total acidity, calculated as SO_3 , the percentage of free anhydride, in the absence of sulphurous acid, is obtained by using the formula—

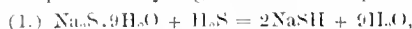
$$\frac{49}{9} A - 444.44.$$

II. *Estimation of Caustic Soda.*—The two methods in use (a) Determination of alkalinity before and after precipitation of the carbonic acid by barium chloride, and (b)

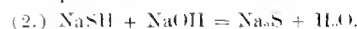
Estimation of the alkalinity and carbonic acid as such, are found to give identical results if a quantitative filter paper be used to filter off the barium carbonate. If hardened plaited filters are used, the results may come out 1 to 2 per cent. too low by method (a), owing to the absorption of alkali by the paper.

Sufficiently accurate results are obtained by using phenolphthalein as indicator and titrating with normal acid until the colour vanishes, then adding a slight excess of acid and, after boiling, titrating back with normal alkali.

III.—*Estimation of Sodium Sulphide and Sodium Sulphydrate.*—Sodium sulphydrate is obtained by the action of sulphuretted hydrogen on sodium sulphide.



and, on the other hand, sodium sulphydrate is reconverted into sodium sulphide under the influence of caustic soda.



For this reason sodium sulphide, sulphydrate, and caustic soda cannot exist in the same solution, and the analysis resolves itself into (a) the estimation of sodium sulphide in presence of sulphydrate, or (b) the estimation of sodium sulphide in presence of caustic soda.

(a.) 12 grms. of the substance are dissolved and made up to 1 litre with water. 25 c.c. of this solution are run from a burette into about 15 c.c. (or less if the yellow colour does not vanish), $\frac{1}{20}$ normal iodine solution, rendered acid with 10 c.c. of normal sulphuric acid and diluted to about 150 c.c. with water, and, after addition of starch solution, the excess of free hydrogen sulphide is titrated back with iodine. The c.c. of iodine used $\times 2$ give the percentage of $Na_2S + 9H_2O = A$ per cent.; this is equivalent to $\frac{34}{210} A$ per cent. of total SH_2 in the substance.

The alkali is obtained by dissolving 6 grms. of the product in water, boiling with excess of normal sulphuric acid, and titrating back this excess with normal alkali. The sodium sulphide (= B per cent.) is got by multiplying the acid actually used by 2; the sulphuretted hydrogen bound to sodium is therefore $\frac{34}{210} B$.

From these values we obtain in the substance B per cent. sodium sulphide and $\frac{34}{210} (A - B)$ per cent. free hydrogen sulphide. This mixture, according to equation (1), corresponds to $(2B - A)$ per cent. of $Na_2S.9H_2O$ and $\frac{7}{15} (A - B)$ per cent. of NaSH.

(b.) The titrations for sulphuretted hydrogen and caustic soda are made as above, giving respectively, when calculated to sodium sulphide, U per cent. $Na_2S.9H_2O$, and V per cent. $Na_2S.9H_2O$. From equation (2) it is seen that the mixture consists of U per cent. $Na_2S.9H_2O$, and $\frac{1}{2} (V - U)$ per cent. of NaOH.

In this process the presence of polysulphides and sulphites is not taken into account.—J. T. C.

Nitrites, A New Reagent for the Detection and Estimation of. M. C. Schuyten. Chem. Zeit. 1896, 20, [75], 722–723.

One part of antipyrine is dissolved in 10 parts of 10 per cent. acetic acid, and 5 c.c. of the solution mixed with an equal volume of the liquid to be tested. If nitrites are present, a permanent green colour appears within a minute and is distinctly perceptible for 1 part of nitrite in 20,000 of water. Alkalis, chlorides, organic bodies such as sugar, alcohol, and phenol, are, if not too concentrated, without appreciable influence. Oxidising substances destroy the colour, hydrochloric and sulphuric acids change it into a yellow. For quantitative purposes colorimetric standard solutions are prepared, in which the amount of nitrite varies from 1 part in 1,000–20,000 parts of water respectively.—J. L. B.

Insoluble Phosphorus in Iron Ores. C. T. Mixer. Eng. and Mining J., July 4, 1896.

The present method of estimating the insoluble phosphorus in iron ores is very objectionable owing to the time and patience required in the fusion of the siliceous residue with

carbonate of soda. The author discovered by experiment, that the phosphorus is rendered soluble by simply calcining the siliceous residue. The following method is given:—The ore is dissolved in the usual manner in hydrochloric acid, filtered into the precipitation flasks, and the paper and residue put into a platinum crucible for ignition. When the paper is burned off, the residue is broken up with a platinum rod is calcined at a red heat a couple of minutes longer, when it is removed and placed in a beaker. A little water is added and 5 or 6 drops of hydrochloric or nitric acid and the solution is gently boiled for 3–5 minutes, after which it is filtered and is then ready for precipitation with ammonium molybdate. The method is said to give practically the same results as the one now in use.—A. S.

Thomas Slag, Citrate Solubility of. H. Dabbers. *Zeits. f. aug. Chem.* 1896, 468–473.

From his investigations the author comes to the conclusion that concordant results can only be obtained by long continued shaking of the sample with an excess of acid ammonium citrate solution. This treatment is especially necessary with strongly basic slags, if the analytical differences are not to exceed the limit of 0.75 per cent. of P_2O_5 .—J. T. C.

Palladium: Its Separation from Platinum. Cohn and Fleissner. *Monatsh. f. Chem.* 17, 361–364.

THE determination of palladium by precipitation with mercuric cyanide cannot be carried out in presence of copper, whilst its determination (and in small quantities even its detection) as iodide is vitiated by the solubility of the iodide in excess of potassium iodide solution.

The method proposed depends on the different solubilities of ammonium platinchloride, palladiochloride, and palladiochloride, and is carried out as follows: The aqua regia solution of the two metals is freed from nitric acid by repeated evaporation, 10 cc. of a 10 per cent. solution of ammonium chloride added, and the whole taken nearly to dryness on the water-bath. To the residue a few drops of water are added and then excess of 30 per cent. ammonium chloride solution. After standing awhile, the precipitate of $(NH_4)_2PtCl_6$ is filtered off, washed first with ammonium chloride solution, and afterwards with alcohol (the first washings being added to the filtrate), placed with the filter, while still damp, in a porcelain crucible, and incinerated. The filtrate, containing the palladium as $(NH_4)_2PtCl_6$, is slowly evaporated down with sufficient nitric acid; after some time, the bright red crystalline precipitate of $(NH_4)_2PtCl_6$ is filtered off, washed with strong ammonium chloride containing a little nitric acid, and incinerated like the platinum salt. If the resulting palladium is bluish through imperfect reduction, a few moments' heating while coal-gas is directed into the crucible, will complete the reduction.

A series of experiments with known mixtures of the two metals showed the method to be accurate, whatever the relative proportions of the two. The method, too, is clearly unaffected by the presence of other metals, such as iron or copper.—J. T. D.

Quantitative Analysis by Electrolysis. M. Heidenreich. *Ber.* 1896, 29, 1585–1590.

THE author investigates, as to their trustworthiness, some of the published methods for the electrolytic determination of metals (see also this Journal, 1896, 378). In his experiments, roughened (sand-blasted) platinum capsules, and circular, flat anodes—as recommended by Classen—were used. In all cases the volume of the electrolyte was 120 c.c. The currents are expressed in amperes per 100 sq. cm. (ND_{100}).

Iron (*Zeits. Analyt. Chem.* 28, 342).—From a solution containing sodium citrate and free citric acid, iron is deposited, partly metallic, partly dull in appearance, and contains occluded carbon. The results obtained are, on this account, somewhat high. The same difficulty occurs when ferric oxalate is electrolysed.

Copper (*Amer. Chem. J.* 12, 213).—A spongy deposit, unfit for weighing, is obtained from a solution containing sodium phosphate and phosphoric acid.

Cadmium (*Ber.* 11, 2048).—Unsatisfactory results were obtained from solutions containing—(1.) Normal acetate; (2.) The same plus acetic acid; (3.) Sodium phosphate and phosphoric acid.

Silver (*Amer. Chem. J.* 12, Smith).—The deposit is spongy from an ammoniacal sodium phosphate solution.

Molybdenum (*Ber.* 11, 2048).—From a solution of ammonium molybdate, the separation of molybdenum (as sesquihydrate) is not complete, even after 2–4 days; moreover, during ignition of the sesquihydrate—prior to weighing—a little is apt to volatilise.

Uranium (*Amer. Chem. J.* 1, 329).—Electrolysis of the acetate yielded unsatisfactory results.

Separations.—Lead from Mercury (*Zeits. anorg. Chem.* 4, 267).—Fair results are obtained if the solution contain free nitric acid, 20–30 c.c. of HNO_3 (sp. gr. 1.3–1.4); current strength, $ND_{100} = 0.2–0.5$ ampere.

Silver from Lead (*ibid.*, 268).—In presence of free nitric acid, a spongy deposit of silver is obtained.

Copper from Zinc (*ibid.*, 269).—In an acid solution (1 c.c. of HNO_3 , sp. gr. 1.4) very good results are obtained, providing the E.M.F. be not allowed to exceed 1.4 volts. The bulk of the copper is rapidly deposited (current = 0.2 ampere); but the separation requires for its completion 18–20 hours.

Copper from Cadmium (*ibid.*, 268).—A nitric acid solution proved unsatisfactory. Better results were obtained in presence of free sulphuric acid (15 c.c. of H_2SO_4 , sp. gr. 1.09). The E.M.F. must not exceed 1.85 volts. Time required, 24 hours; current, 0.03–0.07 ampere.

Silver from Copper (*Zeits. f. Elektrochem.* 2, 312).—The solution employed contained KCN, 2 grms.; $AgNO_3$, 0.25 grm.; $CuSO_4 \cdot 5H_2O$, 0.75 grm.; current strength, 0.03–0.10 ampere; E.M.F., 1–1.4 volts; time required, 6–8 hours. The results are very good. By warming the solution to 65–70° C. during electrolysis, the time of deposition may be, however, materially shortened.

Silver from Zinc.—A double cyanide solution (KCN, 2.5 grms.; $AgNO_3$, 0.3–0.4 grm.; $ZnSO_4 \cdot 7H_2O$, 1.0 grm.) yielded good results. E.M.F., 2 volts; current, 0.05 ampere; time required, 15–22 hours, or 6 hours when working at 60°–70° C.

Mercury from Zinc.—Good results are obtained from a cyanide bath (KCN, 2–3 grms.; $HgCl_2$, 0.25 grm.; $ZnSO_4 \cdot 7H_2O$, 1 grm.), but the platinum vessels are strongly attacked. E.M.F., 1.6–1.7 volts; current, 0.03–0.08 ampere; time, 14 hours.

Mercury from Nickel.—The solution as in previous separation, but containing nickel ammonium sulphate instead of zinc sulphate. E.M.F., 1.2–1.6 volts; current, 0.05–0.09 ampere; time, 5–12 hours; results, good.

—H. T. P.

ORGANIC CHEMISTRY.—QUALITATIVE.

Pentoses, Detection of, Improved Method of Applying the Phloroglucinol Test. B. Tollens. *Ber.* 1896, 29, 1202–1209.

AS is well-known, solutions of pentoses, when heated with hydrochloric acid and phloroglucinol, develop a cherry-red coloration and exhibit a characteristic absorption spectrum. In presence of impurities (sugars, &c.), however, also yielding coloured decomposition products, the pentose reaction may be partially or completely obscured. In such cases the author finds it practicable to purify the red colouring matter (which separates out on cooling) by washing, and subsequently to examine its alcoholic solution, when, in presence of pentoses, the characteristic absorption spectrum becomes clearly visible. (A dark band extending from D to E, and a fainter band in the violet, the intermediate blue-green region being comparatively bright.) The details are as follows:—5 c.c. of the liquid under examination, contained in a test-tube, are treated with 5 c.c. of HCl (sp. gr. 1.19) and 20–30 mgrms. of phloroglucinol. The mixture is gently heated, and immediately viewed by the spectroscope. If no indication be obtained, the solution is heated nearly to boiling, and after 2–3 minutes, cooled, filtered through a wet paper, and the precipitate washed 2–3 times with water. The residue (violet-coloured in

presence of pentose, galactose, &c.) is then dissolved in 93 per cent. alcohol, and the solution examined. The principal sugars yield, with phloroglucinol, brownish or yellowish solutions, and, in some cases, a violet precipitate; but in no case does the alcoholic solution exhibit any trace of absorption bands. Solutions of xylose or arabinose (1:500) in urine, which gave no direct indications, still afforded a distinct absorption spectrum when examined as above, the limit of sensitiveness being attained at a dilution of 1:1000 to 2000. In presence of dextrose, &c., however, the reaction is somewhat less delicate. The author shows that the common wines (clarks and Rhine wines) frequently contain pentoses, to the presence of which, rather than to traces of unfermented levulose, the "residual" reducing power of wine must, perhaps, be ascribed.—H. T. P.

Milk, Estimation of the Freezing Point of, as a Means of Detecting and Quantitatively Estimating Dilution with Water. H. J. Hamburger. *Nederl. Tijdschr. Pharm.* 8, 209—215.

The freezing point of pure cow's milk apparently fluctuates within very small limits, namely, according to the author's experience, between 0.556° and 0.575° below 0° C., the average being 0.561°.

By a determination of the freezing point, an addition of water may be detected and quantitatively estimated with great accuracy, as is shown by the following table:—

	Observed lowering of the Freezing Point.	Added Quantity of Water, calculated from the lowering of the Freezing Point in comparison with that of whole Milk.	Added Quantity of Water, calculated on the average lowering of the Freezing Point of whole Milk = - 0.561° C.	
				Per Cent.
Whole milk.....	-0.558			Per Cent.
" + 5% H ₂ O	-0.532	4.7	5.0	
" + 10 "	-0.506	10.5	10.9	
" + 15 "	-0.476	14.7	15.1	
" + 20 "	-0.445	20.5	20.7	
" + 25 "	-0.413	25.9	26.4	

—A. S.

Milk, Congealing Point of. Borda and Génin. *Comptes rend.* 1896, 123, 125—127.

The authors have determined the congealing point of 50 samples of cows' milk, and they find that the temperature is by no means constant, but varies between - 0.44° and - 0.56° with different samples. In the case of why the differences are greater still. These results lead to the conclusion that the determination of the congealing point does not constitute a satisfactory method for detecting the watering of milk. It gives, in their opinion, no more information than the density, whilst the latter is more readily determined.—A. K. M.

Aconitine, A Test for. *J. Pharm. Chim.* 1896, 4, 266.

On adding to a solution of aconitine a slight excess of potassium permanganate a violet, crystalline precipitate is produced. The presence of 0.000025 grm. may be detected by this reaction. Cocaine, hydrastinine, and papaverine also give precipitates with the same reagent, but they are distinguished by their colour from that produced by aconitine.—A. C. W.

Eucaine Hydrochloride, To distinguish; from Cocaine. *Bull. Gén. de Thérap. Sec. Pharm.* 1, 499.

35 c.c. of a solution of eucaine hydrochloride, gives, with three drops of 5 per cent. chromic acid solution, an immediate citron-yellow, distinctly crystalline precipitate. Hydrochloride of cocaine under similar conditions gives no precipitate. The addition of 3 c.c. of 10 per cent. potassium iodide solution to 5 c.c. of 1 per cent. solution of eucaine hydrochloride causes a milky appearance, and if left for a

time the whole solution becomes converted into a crystalline paste, due to the formation of colourless scales of eucaine hydriodide. Solutions of cocaine hydrochloride are not affected under the same conditions. The solubility of cocaine and eucaine hydrochlorides are widely different. Of the former, 1 part dissolves in 0.75 parts of water at 15° C., whilst 1 part of the latter requires about 10 parts of water. (See this Journal, 1896, 679.)—A. S.

Alloxantin from Convicin obtained from Broad Beans and Felches, reactions of. H. Ritthausen. *Ber.* 1896, 29, 2106.

FURTHER reactions proving the identity of alloxantin prepared from convicin and that obtained from uric acid (see this Journal, 1896, 169) are: (1.) The formation of murexide on evaporating its ammoniacal solution. (2.) The formation of uramil by boiling it with ammonium chloride. (3.) The formation of iso-uric acid by heating it with cyanamide. This is of some interest as proving the occurrence of derivatives of uric acid in the seeds of plants.

—T. E.

Bergamot Oil, Proof of the Purity of. A. Borntraeger. *Zeits. Anal. Chem.* 1896, 35, 523.

See under XX., page 739.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Ethylene, Estimation of, in Gaseous Mixtures. P. Fritzsche. *Zeits. f. ang. Chem.* 1896, 456—459.

The earlier methods of estimating ethylene when admixed with other gases are neither simple nor satisfactory; a combustion requires too much time, whilst absorption with fuming sulphuric acid or bromine gives respectively the total heavy hydrocarbons or the unsaturated compounds which are present and not the ethylene alone.

The author bases his method upon the absorption of ethylene by means of sulphuric acid, and the subsequent splitting up of the ethylsulphuric acid thus formed into sulphuric acid and alcohol, the amount of which latter compound can be estimated.

The reaction is quantitative and for gases rich in ethylene no difficulties are to be feared. The following mode of procedure is recommended.

The gas, freed from tar, ammonia, and sulphuretted hydrogen, is made to fill a glass cylinder fitted at both ends with glass taps and of from 200—300 c.c. capacity. Sufficient concentrated sulphuric acid for easy agitation is now admitted into the tube and shaking continued until, on carefully opening one of the taps, no more air enters the apparatus. The acid is now drained out and the apparatus washed with a small quantity of water (not more than twice the weight of sulphuric acid used) and the acid and washings distilled. To this distillate a small quantity of soda is added and it is then re-distilled till two-thirds of its bulk have passed over. The absolute weight and specific gravity of this second distillate are determined and the quantity of alcohol calculated from Mendeleeff's figures. The best results are obtained when the alcoholic content lies between 1 and 2 per cent.

For coal-gas, &c. the method is not so simple owing to the small quantity of ethylene present. To avoid the necessity of using large volumes of sulphuric acid for absorption the author carries out the experiment at 100° C., at which temperature combination occurs more rapidly, and only employs sufficient acid to moisten the walls of the slowly rotating gas vessel. At 100° C. the time required for complete absorption is about four hours, whilst, working at ordinary temperature, the reaction is not finished after 20 hours. The ethyl sulphuric acid obtained, is diluted and distilled as before, and the successive distillates redistilled four or five times, until a final solution is obtained sufficiently rich in alcohol for a correct specific gravity determination. For coal-gas, the absorption vessel should be 500 mm. long and 110 to 120 mm. in diameter; the concentrated acid used should be about 20 c.c., and the wash-water about 40 c.c.

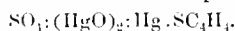
The butylene may be removed from the gas before filling the tube by passing the gas through a wash-bottle

moistened with 70 per cent. H_2SO_4 —any propylene present is estimated as ethylene.

Trials of a volumetric method dependent on the splitting up of barium ethyl sulphate in concentrated solution into alcohol, barium sulphate, and free sulphuric acid did not lead to satisfactory results. The reason of this, according to the author, is that the ethylene absorbed, exists partially as ethyl sulphuric acid, and also partially as alcohol, in the sulphuric acid solution.—J. T. C.

Thiophene in Benzol, Rapid Volumetric Estimation of.
G. Denigès, Bull. Soc. Chim. 15, 1896, 1064—1065.

This is a development of the method already given (Bull. Soc. Chim. 13, 1895, 537; this Journal, 1895, 893, and Bull. Soc. Chim. 15, 1896, 862) and is carried out as follows:—Mix in a 60–90-c.c. flask, 2 c.c. of the benzol under examination with 30 c.c. of acetone-free methyl alcohol, and add quickly 10 c.c. of a solution of mercuric sulphate prepared by dissolving 50 grms. of red oxide of mercury in 200 c.c. of pure sulphuric acid and 1 litre of distilled water. Close the flask, shake and allow to stand for 20 minutes, and filter from the compound—



Of the filtrate carefully preserved from evaporation, 21 c.c., corresponding to 1 c.c. of benzol, are put into a litre flask together with 350 c.c. of water, 15 c.c. of ammonia, 10 c.c. of potassium cyanide solution (equivalent to $\frac{1}{10}$ N silver nitrate), and 5 or 6 drops of a 20 per cent. potassium iodide solution. The turbidity due to the separation of the benzol disappears on shaking or on slightly warming the solution, and decinormal silver nitrate is added to the clear liquid until a permanent opalescence is produced. If n be the number of c.c. of silver nitrate required, then the amount of thiophene x contained in a litre of the given benzol is $x = 2.8 (n - 0.3)$. If the benzol contain more than 25 grms. of thiophene per litre, only 1 c.c. should be taken for the test.—T. A. L.

Sugar, Estimation of, in the Beetroot. H. Pellet.

Rev. de Chim. Indust. 1896, 7, 233—237.

THE aqueous method of extraction is only adapted for material resulting from conical rasps. The normal or double the normal weight of pulp is placed in a suitable extractor, provided with a tap, and hot or cold water allowed to percolate slowly through the mass. The extract is received in a 200-c.c. flask, a few c.c. of basic lead acetate are added, and the whole made up to volume at the ordinary temperature. It is generally advisable to extract a second time.

The method of hot aqueous digestion is suited for the examination of fresh diffusion cosettes and of finely divided beetroot pulp. The normal or double the normal weight of pulp is introduced into a 200-c.c. flask of particular shape. 5 to 15 c.c. of basic lead acetate, and 180–190 c.c. of water are added, and the contents of the flask heated in a water bath from 80°–85° C. for 1 to 1½ hours, according to the quantity of pulp. The mixture is then cooled, made up to 200 c.c., filtered, and polarised.

In the rapid cold aqueous extraction, the normal weight is placed with water in a 200-c.c. flask. 5 to 8 c.c. of basic lead acetate are added, the contents made up to volume, then filtered and polarised in a 400-mm. tube.

Wojcieki's process consists in weighing out 26.048 grms. of fine pulp, and placing this amount in an ungraduated vessel of 150 c.c. capacity, provided with a tightly-fitting cover. 77 c.c. of water containing from 5 to 7 c.c. of basic lead acetate are added, then shaken, filtered, and polarised, after addition of one or two drops of acetic acid. Ledoete has modified and accelerated this method by using metal capsules provided with covers, into which the pulp is directly weighed. 177 c.c. of water containing basic lead acetate are delivered from a pipette; the mixture is well shaken, filtered, and polarised. In adding 77 or 177 c.c. of water, allowance is made for the average quantity of juice contained in beetroot pulp, and the volume is thereby at once adjusted to 100 or 200 c.c.—J. L. B.

Phosphoric Acid, Estimation of, in Medicinal Wines.

F. Glaser and K. Mühle. Chem. Zeit. 1896, 20, 723.

100 c.c. of the wine are placed in a 250-c.c. flask, and evaporated over wire gauze to a syrupy consistency. It is allowed to cool, 25 c.c. of strong nitric acid added, and heated with a small flame until the reaction sets in, which then continues without further warming. When the evolution of gas has ceased, 75 c.c. of strong nitric acid are added, and the mixture is heated as before; the evaporation proceeds rapidly nearly to dryness without explosive violence or spitting. 10 c.c. of concentrated sulphuric acid and a small quantity of mercury are added to the cooled liquid in the flask; on warming, the clear liquid is darkened by the carbonisation of incompletely decomposed organic matter, and, if necessary, the oxidation may be hastened by heating with a fuller flame. After a few minutes, the decomposition of the organic matter is completed—a stage indicated by the clear colour of the liquid; it is cooled, the flask filled up to volume, filtered, and 100 c.c. of the filtrate (= 40 c.c. of wine) neutralised with ammonia before determining the phosphoric acid by the molybdenum or citrate method.

The decomposition can also be effected by concentrated sulphuric acid and mercury, or sulphate of copper; the method is, however, slower, as the sulphuric acid occasions a puffing-up of the charred sugar.—J. L. B.

Cheese, Chemical Investigation of, Composition of.

A. Stutzer. Zeits. anal. Chem. 1896, 35, 493.

1. *The Total Nitrogen* was determined by Kjeldahl's method in 10 grms. of a mixture of 100 grms. of cheese and 400 grms. of washed, ignited, and sieved sand.

2. *Nitrogen as Ammonium Salts* was determined by distilling a quantity of the sand mixture, containing 5 grms. of cheese, with 200 c.c. of water and barium carbonate. If magnesia or magnesium carbonate (which usually contains some oxide) be used in this process too high results are obtained, because of the partial decomposition of amides.

3. *The Nitrogen in the Form of Amides* is obtained by shaking the same amount of the sand mixture with 150 c.c. of water for 15 minutes, allowing to stand 15 hours, adding 100 c.c. dilute sulphuric acid, and then phosphotungstic acid so long as a precipitate appears. The precipitate is washed with dilute sulphuric acid until the filtrate amounts to 500 c.c., in 200 c.c. of which the nitrogen is determined, by subtracting from this the nitrogen found as ammonium salts, that present as amides is obtained. Copper hydroxide is not adapted to the separation of albumins when pancreaspeptone (the peptone of Kühn) is present, since this is only partially thrown down. Phosphotungstic acid serves to separate casein, albumin, albumoses, and pancreaspeptone from the worthless tyrosin, leucin, and other amides, and from the ammonium salts.

4. *Indigestible Nitrogenous Substances.*—The mucous membrane of several fresh pigs' stomachs was cut into small pieces, placed in a flask, and for every stomach 5 litres of water, 100 c.c. of a hydrochloric acid containing 10 grms. of acid, and 2.5 grms. of thymol dissolved in alcohol were added. After standing 24 hours, with occasional shaking, the mixture was filtered in turn through flannel, coarse, and fine filter paper. If necessary, after titration, so much hydrochloric acid was added that the liquid contained exactly 0.2 per cent. Gastric juice thus prepared keeps for months unaltered.

A quantity of the sand mixture containing 5 grms. of cheese was extracted with ether, then 500 c.c. of gastric juice added, and the mixture warmed 48 hours in a thermostat at 37°–40° C. At intervals of about 2 hours, 5 c.c. of a 10 per cent. hydrochloric acid solution were added until the acid amounted to 1 per cent. After filtering, the nitrogen was determined in the washed residue. According to Kühn, treatment with pancreatic extract can be avoided by digestion for at least 48 hours.

5. *Nitrogen as Albumoses and Peptones.*—The same amount of the sand mixture was heated to boiling with 100 c.c. of water, and the liquid poured off into a 500-c.c. flask. The extraction was repeated until the flask was nearly full, then, after cooling, making up to the mark and filtering, 200 c.c. of the filtrate were precipitated with

the solution, made neutral or feebly alkaline (under these conditions proteins remain in solution), is precipitated with an iodine solution saturated with potassium iodide, after standing, the liquid is filtered through an asbestos filter, the precipitate washed with cold water and dissolved in pure acetone. The dark brown solution is made alkaline, and then acid, and mixed with water; it then contains the alkaloid as acid salt. The acetone is driven off by a gentle heat on the water-bath, the liquid decolorised by a few drops of thiosulphate, and after addition of sodium carbonate in excess, the alkaloid is extracted by shaking with chloroform. In the case of morphine and narcotine the extraction is different (amyl alcohol or chloroform from an ammoniacal liquid or chloroform containing alcohol from a sodium carbonate solution). (Glicosides do not give a reaction with solution of iodine in potassium iodide. The method for obtaining alkaloids from plant extracts is quite similar, except that after acidifying the acetone solution of the periodide and adding water, it is immediately shaken with petroleum ether of boiling point 30° — 50° C.; this extracts most of the acetone and also impurities possibly present; this extraction is repeated, and the ether washed with a little acidified water. The alkaloid solution is then warmed on the water-bath, thiosulphate added, after cooling, and the extraction with chloroform takes place as before.

Generally, in heating to drive off the solvent before weighing, the alkaloid becomes brown; this is avoided in the presence of alkalis. The use of ammonia to precipitate the base is not advisable, for, though soluble in ether, it is volatile. The author adds ether which has been shaken with aqueous sodium carbonate (very slightly soluble in ether) to the solvent used; thus the browning is prevented, the error introduced is negligible in view of the varying amounts of water of crystallisation contained in the alkaloids.

The method of isolating pure alkaloids by addition of acid to their ethereal solutions is objectionable, generally because this will also precipitate salts of amide bases, and particularly objectionable when ammonia has been used to separate the free alkaloid.

A Morphine Reaction.—On addition of potassium iodide solution of iodine to an alkaline hydroxide morphine solution, there is obtained at first a yellow coloration, which, by a very gradual addition of iodine, turns to a grass green, the same coloration is given by bromine, but not chlorine. Apomorphine does not give this reaction, nor do codeine and other alkaloids; it is possibly due to an oxidising action of iodine.—A. C. W.

Theobromine, Determination of, in Cacao. Eminger.
Forschungsberichte, 1896, 275.

The author first extracts vegetable fat by digesting 10 grms. of the finely-powdered material with 150 parts of petroleum spirit; the residue is then dried, and a weighed portion boiled for about half an hour, or until the formation of cacao-red is completed, with 100 c.c. of dilute sulphuric acid (3—4 per cent.) in a flask fitted with a reflux condenser. The contents of the flask are then turned into a beaker, and, whilst hot, exactly neutralised with the calculated quantity of baryta; the whole is evaporated to dryness with some sand, and the residue extracted in a Soxhlet apparatus, with 150 parts of chloroform, for five hours; the chloroform is then distilled off, and the residue dried at 100° C. This residue is then washed with not more than 100 c.c. of carbon tetrachloride, which dissolves the fat and caffeine; the theobromine, being quite insoluble in carbon tetrachloride at 18° C., is collected on a filter, dissolved in boiling water, the solution filtered and evaporated, and the residue weighed. By this method the theobromine in different kinds of cacao was found to vary from 1.05 to 2.34 per cent., and the caffeine from 0.05 to 0.36 per cent. Theobromine is soluble in 736.5 parts of water at 18° C., in 135 parts at 100° C.; in 818 parts of boiling absolute alcohol; in 21,000 parts of ether at 17° C.; in 2,710 parts of boiling chloroform, and in 5,808 parts at 18° C. "Theobromine begins to sublime at 220° C. without melting, whilst caffeine sublimes at 180° C., and begins to melt at 220° C." Theobromine is more or less decomposed

if warmed for any length of time with alkalis, earthy oxides, or hydrated lead oxide.—A. S.

Chloroform, Analysis of. Gay. J. Pharm. Chim. 1896, 4, 259.

1. A piece of filter paper saturated with the chloroform should dry completely, and the odour remain pleasant to the end. The contrary indicates the presence of amyl alcohol.

2. Shake 6 c.c. with 3 c.c. of water and test with litmus paper; this should not be reddened.

3. Shake with an equal volume of 10 per cent. silver nitrate; a white precipitate on standing indicates the presence of hydrochloric acid, and a black precipitate on boiling, that of aldehyde or acetone.

4. To 5 c.c. add 2 c.c. of a solution of 1 part of potassium bichromate in 100 of parts strong sulphuric acid, and warm gently; if alcohol be present a green coloration appears. A quantitative test for alcohol is necessary, since 0.5 per cent. may be added to preserve the chloroform. To 5 c.c. add 1 c.c. of Mohr's solution (1 part of potassium permanganate and 10 parts of alcoholic potash dissolved in 25 parts of water) in such a manner that the liquids do not mix; then shake whilst slowly turning the tube, and observe the time between the mixture and appearance of a green colour.

Time: 5 minutes	Very pure chloroform.
" 2.5 "	0.01 per cent. alcohol.
" 35 seconds	0.1 " "
" 5 "	0.5 " "
" Less than 5 seconds ..	more than 0.5 " "
One agitation	1.0 " "

5. Shake violently 10 c.c. with an equal volume of strong sulphuric acid and let stand. The mixture remains colourless, even for an hour, if the product is pure, but if it becomes brown, the presence of chloro-derivatives of ethyl alcohol or of the higher homologues is indicated.—A. C. W.

Invert Sugar. J. Heron. J. Fed. Inst. of Brewing, 1896, 2, 440.

See under XVII., page 731.

Acetylene, Limiting the Explosive Proportions of, and Detecting and Measuring the Gas in Air. F. Clowes. Brit. Assoc., Chem. Sect., 1896.

See under II., page 701.

Gluc-making Industry in Germany. R. Kissling. Chem. Zeit. 1896, 20, 697.

See under XIV., page 729.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Phenols which are Insoluble in Water, Action of the Oxidising Ferment of Mushrooms on. E. Bourquelot. Comptes rend. 1896, 123, 423—425.

SEE also this Journal, 1895, 683. In continuation of his experiments on the oxidising action of the ferment of mushrooms, the author now describes experiments with ortho-, meta-, and paraxylenol, with thymol, carvacrol, and α - and β -naphthol. He employs dilute alcohol as the solvent, and he shows that this substance neither interferes with the oxidising action of the ferment, nor becomes oxidised itself. In all cases the phenols underwent oxidation. In the case of α -naphthol, the solution became first violet, then blue, and finally deposited a dirty blue precipitate. The solution of β -naphthol, on the other hand, gave a white precipitate, which gradually became yellow; and this difference may be used to distinguish the two isomers.—A. K. M.

Acetylene: Is it an Electrolyte? G. Bredig and A. Usoff. Zeits. f. Elektrochemie, 1896, 3, 116—117.

H. C. Jones and C. R. Allen have published measurements of the molecular conductivity of aqueous solutions of acetylene, according to which its conductivity is about as great as that of an equivalent quantity of acetic acid. This

would indicate that in solution, acetylene suffers considerable electrolytic dissociation. As the acid character of acetylene rendered it likely that the carbon-anion C_2^- = (the existence of which has not yet been demonstrated) might make its appearance in fused or dissolved acetylene salts (carbides), the authors have studied the behaviour of acetylene and its salts (Ag_2C_2 , CuC_2 , &c.). They find that the determinations made by Jones and Allen are incorrect. The molecular conductivity of acetylene is exceedingly small; it is an exceptionally feeble electrolyte, and is therefore one of the weakest acids. Thus the salts of acetylene must be almost completely hydrolysed in aqueous solution, as, indeed, is shown by the action of water upon calcium carbide.

Ethylene oxide, like acetylene, occupies a position between electrolytes and non-electrolytes; its molecular conductivity is vanishingly small, and hence it must be regarded as a very weak base.—D. E. J.

Vicin, a Glucoside. H. Ritthausen. Ber. 1896, 29, 2108.

"VICIN," a substance prepared from broad beans and vetches by the author 20 years ago, was classified by Boilestein as an alkaloid. It appears, however, to be a glucoside, since by boiling it with dilute sulphuric acid a sugar is formed. After standing for several years, this crystallised, but could not be obtained sufficiently pure to be identified. Its reactions make it probable, however, that it is a mixture of glucose and galactose.—T. E.

New Books.

ROSCOE-SCHORLEMMER'S LEHRBUCH DER ANORGANISCHEN CHEMIE. VON SIR HENRY E. ROSCOE, LL.D., F.R.S., UND ALEXANDER CLASSEN, Ph.D. 2ter Band. 3te Gänzlich umgearbeitete und vermehrte Auflage. Erste Abtheilung. Friedr. Vieweg und Sohn, Braunschweig. 1896. Price 12s.

THIS is Part I. of the Second Volume of the third edition of the Roscoe-Schorlemmer Treatise on Inorganic Chemistry. This third edition is issued by Sir Henry Roscoe in conjunction with Professor A. Classen, of Aachen. It contains 432 pages of subject-matter, and, incomplete in itself, runs on to page 433, which will follow in the Second Part. The table of contents is given at the end of the uncompleted volume. The pages of Part I. are illustrated with 135 wood engravings, in most cases representing plant and apparatus employed in leading technical processes. The subjects treated of are chiefly the following:—Metals: Alkali Metals, Ammonium Compounds, Metals of the Alkaline Earths, and Magnesium. Metals of the Copper Group: Copper, Silver, Gold, and Aluminium. Alums: Phosphate and Silicate of Aluminium. Ultramarine, Glass, Porcelain, and Earthenware.

DETECTION AND ESTIMATION OF INFLAMMABLE GAS AND VAPOUR IN THE AIR. By FRANK CLOWES, D.Sc., and BOVERTON REDWOOD, F.R.S.E. Crosby, Lockwood, and Son, 7, Stationers' Hall Court, Ludgate Hill. 1896. Price 5s.

8vo volume, with frontispiece representing the "Methane and Petroleum Vapour Flame-Cups over the Standard Hydrogen Flame," adapted by permission from Redwood's work on Petroleum and its Products. The work begins with a preface by Professor Clowes, then follow 197 pages of subject-matter, illustrated with 48 wood engravings, a bibliographical list of works of reference, the subjects arranged alphabetically, and the alphabetical index. The subject-matter of the volume is arranged in eight chapters, with an appendix to each. These chapters treat of the following matters:—I. Conditions of Explosion of Inflammable Gases when they are mixed with Air. II. Historical Summary of Methods of Gas Testing used in the Coal Mine. III. Examination of the Accuracy and Delicacy of different Flame-Tests. IV. The Hydrogen Flame-Test for Gas. V. The Test-Chamber: A Simple Apparatus for producing and measuring Flame-Caps. VI. Detection and

Measurement of Carbonic Oxide in the Air. VII. Atmospheres which extinguish Flame and which are irrespirable. VIII. Detection and Measurement of Petroleum Vapour in the Air.

WOOL DYEING. By WALTER M. GARDNER, Head Master of the Chemistry and Dyeing Department of the Bradford Technical College. Part I. John Heywood, Deansgate and Ridgefield, Manchester; 29 and 30, Shoe Lane, London, E.C.; 22, Paradise Street, Liverpool; 33, Bridge Street, Bristol; and 15, Briggate, Leeds. 1896. Price 2s.

8vo volume, with preface, stating that the entire work will be issued in parts, of which the present forms Part I. It contains subject-matter filling 100 pages, and illustrated with 14 woodcuts. An alphabetical index concludes the work, which is subdivided into four parts or chapters, treating of the following subjects:—I. Wool Fibre. II. Wool Scouring. III. Wool Bleaching. IV. Water.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

IMPORT DUTIES ON SOAP IN SOUTH AMERICAN COUNTRIES.

The following statement, showing the rates of import duty levied in South American countries upon soap, has been recently prepared by the Board of Trade:—

Countries.	Import Duties.
ARGENTINE REPUBLIC.	
Soap	Pays 25 per cent. <i>ad val.</i> under heading of "all goods not specially enumerated."
PARAGUAY.	
Soap	25 per cent. calculated on the value stipulated in the valuation tariff.
<i>Note.</i> —The following additional duties are leviable:—5 per cent. in gold, destined for the conversion of paper money; 4 per cent. in paper money, destined to the "Consejo S. de Educacion"; 3 per cent. in paper money, destined to the "Consejo Secundario y Superior."	
URUGUAY.	
Soap, common, of all kinds	Pesos, cts. Kilo. gross 0 68
<i>Note.</i> —Peso = 100 centesimos = 1s. (about); kilogramme = 2·2 lb.	

Countries.	Import Duties.		
	Duty.	<i>Ad Valorem</i> Rate on which Duty is based.	Tare Allowance.
BRAZIL.			
Soap, not perfumed:—	Reis.	Per Cent.	Cases, 8 per cent. Tin, gross.
Black or dark.....	Kilo. 200	48	
Yellow	" 400	48	
White	" 700	48	
" <i>Saponeas</i> ," " <i>sapolins</i> ," and similar articles.	" 1,200	48	
<i>Note.</i> —1,000 reis=1 milreis =2s. 3 <i>d.</i> (nominal value); kilogramme = 2·2 lb.			

IMPORT DUTIES ON SOAP IN SOUTH AMERICAN COUNTRIES—*cont.*

Countries.	Import Duties.
VENEZUELA.	
	Bolivars etc.
Soap, white, marbled, called Castille, Marseilles, &c.	Kilo. 1 25
Do., common	" 1 25
<i>Note.</i> —The bolivar = 9 <i>ds.</i> , and is divided into 100 centimes; kilogramme = 2·2 lb.	
COLOMBIA.	
	Pesos etc.
Common oil soap	Kilo. 0 20
Common resin and tallow soap	" 0 25
Surtax:—25 per cent.	
Reductions: 10 per cent. in the Custom-houses of Arica and Meta; 30 per cent. in the Custom-house of Tumaco; 20 per cent. in the Custom-house of Buenaventura.	
Soaps not specially mentioned	" 1 20*
<i>Note.</i> —Pesos = 100 centavos = 4s. (nominal value), actual value about 3s. 4d.; kilogramme = 2·2 lb.	
ECUADOR.	
	Sueros etc.
Soap, common	Kilo. 0 65†
<i>Note.</i> —The monetary unit employed in Ecuador is the <i>suero</i> = 100 centavos = (about) 1s.; kilogramme = 2·2 lb.	

Countries.	Value on which Duty is levied.	Rate of Import Duty.
BOLIVIA.		
	Bolivianos etc.	
Soap, common, washing, gross weight.	Kilo. 0 12	30% <i>ad val.</i>
Do., for cleaning articles of metal.	" 0 30	30% <i>ad val.</i>
Do., powdered, for washing.	" 0 35	30% <i>ad val.</i>
<i>Notes.</i> —In Bolivia the <i>ad valorem</i> duties are calculated on the official values stated above.		
The monetary unit of Bolivia is the Boliviano = 100 centavos = 4s. (nominal value), actual value 2s. 4d. (about); kilogramme = 2·2 lb.		
PERU.		
	Soles etc.	Soles etc.
Soap, common, of all kinds, and of whatever origin.	Kilo. 0 15	40% <i>ad val.</i>
Do., and soap in cakes, perfumed, common and disinfecting soaps, such as tar, carbolic, phenic, and pitch, gross weight.	" 0 40	40% <i>ad val.</i>
Do., fine (as perfumery), gross weight.	" 0 80	40% <i>ad val.</i>
<i>Notes.</i> —The <i>ad valorem</i> duties are calculated on the official values stated above.		
Sol = 101 centavos = 4s. (nominal value), real value about 2s.; kilogramme = 2·2 lb.		
CHILE.		
	Pesos, etc.	
Soap, common, for washing, Castille, Marseilles, and green soap.	Kilo, gross 0 15	25% <i>ad val.</i>
Do., for cleaning metal objects, including wrappings.	Kilo. 0 35	25% <i>ad val.</i>
Do., powdered, called "Ivory," or others similar, for washing, including wrappings.	" 0 40	25% <i>ad val.</i>
<i>Notes.</i> —The <i>ad valorem</i> duties are calculated on the official values stated above.		
Peso = 3s. 9d. (about); kilogramme = 2·2 lb.		

* According to Decree No. 453 of 1893, this duty is increased by 5 centavos, but the increased duty is not subject to the rebates in the Custom houses of Buenaventura and Tumaco, nor to the surtax of 25 per cent.

† With an addition of 30 per cent. of the duty as surtax.

‡ Including interior receptacles or packages.

RUSSIA.

Classification of Sheep-dipping Powder.

Pound = 36 lb. Avoirdupois. Gold Rouble = 3s. 2d.

Under an order of August 31, 1896, Sub. No. 17,805, Little's patent powder dip for the treatment of sheep, which consists of powdered sulphur with an admixture of arsenic, is to pay duty under point 2 of section 91 of the Customs tariff, duty 5 copecks, gold, per pound, and Little's non-poisonous fluid sheep dip under section 112, duty 1 rouble 50 copecks, gold, per pound, gross, but on condition that the delivery out of Customs-houses and the sale of the above preparations shall be effected on the general basis established for poisonous substances and against prescriptions signed by veterinary surgeons.

UNITED STATES.

Tariff Decisions.

So-called "dead," "tar," or "creosote" oil is dutiable at 25 per cent. *ad valorem* under the provision in paragraph 60, Act of August 28, 1894, for "distilled oil," and not as carbolic acid.

Quanthic ether, otherwise known as pelargonate of ethyl or pelargonic ether, is assessed for duty under paragraph 17, Act of August 28, 1894, as fruit ether, at 2 dols. per pound.

OFFICIAL REPORTS.

MINERAL STATISTICS OF THE UNITED KINGDOM FOR 1895.

Ironmonger, October 17th, 1902.

The following is the official general summary of the mineral produce of the United Kingdom and of the Isle of Man for 1895, as compared with 1894:—

Description of Mineral.	1894.		1895.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum clay (Bauxite) .	7,900	5,618	10,408	2,506
Alum shale .	3,972	496	2,063	258
Arsenic .	4,801	48,614	4,798	52,198
Arsenical pyrites .	3,288	3,823	2,951	2,785
Barytes .	20,656	21,119	21,170	23,059
Bog ore .	7,803	1,051	5,952	1,413
Chalk .	..	..	2,921,235	153,864
Chert and flint .	..	..	94,787	16,961
Clays .	3,263,768	823,701	9,796,086	1,830,607
Coal .	188,277,525	62,730,179	189,661,362	57,231,213
Copper ore .	5,752†	13,909	7,531	21,912
Copper precipitate .	241‡	2,313	260	2,855
Fluor spar .	126	69	36	54
Gold ore .	6,603	13,573	13,296	16,584
Granite .	..	..	1,667,766	547,999
Gravel and sand .	..	..	1,014,477	81,107
Gypsum .	153,450	66,355	177,892	71,835
Iron ore .	12,367,308	3,190,647	12,615,414	2,865,700
Iron pyrites .	15,523	8,042	9,048	4,114
Jet .	* 179	* 48	* 168	* 16
Lead ore .	10,760†	206,905	38,412	273,392
Lignite .	334	83	Nil	..
Limestone (other than chalk) .	..	..	9,525,639	1,205,261
Manganese ore .	1,809	740	1,273	681
Ochre,umber, &c. .	8,516	14,040	7,625	16,989
Oil shale .	1,866,896	496,896	2,246,885	561,716
Petroleum .	49	92	15	28
Phosphate of lime .	700	1,277	500	875
Plumbago .	..	..	49	160
Quartz .	..	..	724	559
Salt .	2,235,912	763,629	2,173,253	709,751
Sandstone .	..	..	1,230,526	1,366,596
Slag .	..	..	134,882	5,888
Slate and slabs .	461,673	1,171,366	581,760	1,274,145
Soapstone .	10	45	Nil	..
Stone, &c. (estimated value) .	..	7,695,716	..	..
Strontium sulphate .	6,823	12,62	12,273	3,529
Tin ore .	12,910	487,523	10,612	370,530
Uranium ore .	19	815	40	2,071
Whitstone, basalt, &c. .	..	..	1,728,350	352,382
Zinc ore .	21,821	67,311	17,478	49,430
Total values ...	..	77,898,998	..	69,129,661

* Lb.

SUMMARY OF THE METALS OBTAINABLE BY SMELTING FROM THE ORES IN THE ABOVE TABLE.

Description of Metal.		1894.		1895.	
		Quantity.	Value at the Average Market Price.	Quantity.	Value at the Average Market Price.
Copper.....	Tons	144½	£ 19,482	579½	£ 27,263
Gold.....	Oz.	1,235	14,811	6,990	18,520
Iron.....	Tons	1,317,472	9,999,186	4,324,387	10,531,325
Lead.....	"	21,687	284,824	29,000½	398,734
Silver.....	Oz.	275,096	53,313	280,434½	34,908
Tin.....	Tons	8,327½	604,500	6,618½	445,780
Zinc.....	"	8,130	131,929	6,654	101,095
Total values ...	..	..	11,986,945	..	11,472,225

WHITE LEAD TRADE AND THE MERCHANDISE MARKS ACT.

Board of Trade Journal, October 1896, 388.

The Board of Trade have received from the London Chamber of Commerce copies of circulars which have been addressed by the Chamber at the instance of the leading white lead corrodors of the United Kingdom to all the buyers and users of white lead in the country.

The circular, dated the 27th August last, states that the leading white lead corrodors have resolved to support the action taken by the Chamber in this matter as far as lies in their power, and to induce their friends to adapt the same course.

With this view, they have decided—

1. To discontinue the use of the term "best" as a trade description for admixtures of white lead, believing it to be a false and misleading description within the meaning of the Merchandise Marks Acts, 1887 and 1891;
2. To brand or stencil all packages, wooden or iron, containing white lead admixtures with the word "Reduced"; and
3. To invoice all white lead admixtures as "Reduced white lead."

The responsibility for the illegal and dishonest practice of selling reduced white lead as "Genuine" (which might be unjustly fastened upon the manufacturer in the event of his having supplied reduced white lead without brand or mark, and the packages being subsequently branded or marked by a second party "Genuine") will, it is hoped, by the means proposed be brought home to any who are guilty of the dishonest practice.

These regulations were to come into force on the 1st October last.

THE NEW RUBBER INDUSTRY IN LAGOS.

(From the "Kew Bulletin," No. 111.)

The rubber industry of Lagos (this Journal, 1896, 124) affords one of the most remarkable instances of the rapid development of an industry that has taken place in recent years in any British colony. It owes its existence to a wild plant which was only discovered in Lagos within the last two or three years. It was found to be new as a source of rubber, although there is now reason to believe it had yielded some of that formerly exported from the Gold Coast. At the present time *Kickia* rubber from Lagos has established itself as a commercial article in great demand. The exports in January 1895 were 21,131 lb., of the value of 1,214*l.* This was practically the beginning of the industry. In December 1895 the exports had increased to 948,000 lb., of the value of 51,488*l.* From a recent return communicated to Kew by the Government of Lagos, the total exports during the year 1895 amounted to 5,069,504 lb. (2,263 tons), of the value of 269,892*l.* This considerable industry has therefore been called into existence within 12 months. The rubber is

purely a forest product, and the collection and preparation of it have been effected by means of native labour. The success of the industry is another indication of the undeveloped resources of our West African colonies. It is only a few years ago that a somewhat similar, though more gradually developed, rubber industry was called into existence at the Gold Coast. The origin of this is given in the following extract from a Colonial Office Report on the Economic Agriculture of the Gold Coast in 1889:—"Although the youngest of our industries, the preparation of india-rubber is now only second in importance to that of palm oil. Attention was first drawn to this valuable product by Sir Alfred Moloney (now Governor of Lagos), when administering the Government of the Gold Coast Colony in 1882, by letters to the local press. The first practical experiments were made by Mr. F. C. Grant, of Cape Coast, whose example was quickly followed by others, and the undertaking proving remunerative, the collection of rubber began in every part of the colony. The quantity now produced annually ranges from 30,000*l.* to 40,000*l.* in value."

During the year 1893 the Gold Coast exported rubber to the extent of 3,395,990 lb., and of the value of 218,162*l.*

The following table shows the export of rubber from Lagos during 1895:—

Export of Rubber from the Colony of Lagos from 1st January to 31st December 1895.

Month.	Weight in Lb.	Value.
January.....	21,131	£ 1,214
February.....	15,888	777
March.....	26,316	1,119
April.....	39,763	2,079
May.....	216,916	11,700
June.....	268,619	12,577
July.....	461,765	22,541
August.....	351,990	19,952
September.....	673,163	36,173
October.....	1,059,158	57,117
November.....	983,394	52,803
December.....	948,491	51,488
Total.....	5,069,504	269,892

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

THE ANGLO-SICILIAN SULPHUR TRUST.

U.S. Consular Reports, September 1896, 227.

The American Vice-Consul writes from Catania, August 1, 1896:—

The Anglo-Sicilian Sulphur Company, Limited, has been established in London. The capital of the company is 1,000,000*l.*, whereof 700,000*l.* are to be paid in at once. Having fulfilled all the requirements of Italian law, the company entered into operation to-day.

The completion of the trust was very uncertain until a few days ago, because the Italian Parliament refused to grant to the new company exemption from the heavy register and income taxes, which would have amounted to over 100,000*l.* Finally, however, an agreement was made by which the Anglo-Sicilian Company has to pay 1 lira per ton on all sulphur exported from Sicily.

The immediate consequence has been another sharp advance of prices—say 8 to 10 per cent.—during the last three days, and the tendency is for a further rise, especially for delivery after the 1st of October next, from which date the Italian export duty of 11 lire per ton of 1,000 kilos. has been abolished by a recent law.

The United States consume about one-third of the Sicilian production of sulphur, say 100,000 to 110,000 tons per year, and the higher prices for the crude brimstone will therefore cause great injury to the acid makers and the other manufacturers in the United States.

CHEMICAL MANURES IN BRAZIL.

Chamber of Commerce Journal, September 1896, 167.

The Belgian Consul at St. Paul reports that different manures imported from abroad have been now started with in the cultivation of coffee, and those who have used them have only had congratulations for themselves on their initiative. To come into general use their cost must be brought within the reach of the generality of planters, which has not thus far been the case. Brazilian taxes—indirect—have interfered, while most of the planters, knowing little of scientific agricultural matters, are completely ignorant of the nature and quantity of manure to use, as well as of the manner of utilising it and the period at which it is proper to spread it. This explains why they hesitate to avail themselves of it, whilst it is notorious that the soil of many plantations is already exhausted and requires artificial fertilisation. Phosphate of lime is the manure most used, and Lupton, rue S. Bento; Upton, rue Florencio de Abreu; Lion and Co.; and Camille Levy, are houses quoted by the Consul as engaged in the sale of phosphates. To manufacturers desirous of sending phosphates, the Consul thinks it useful to make the following recommendations:—(1.) State the price per 1,000 kilos., the phosphate being packed in full sacks weighing 100 kilos, each. (2.) Send with each consignment a rigorous qualitative and quantitative analysis of the substance. (3.) As far as possible give indications of the quantity it is necessary to apply to each coffee plant.

GENERAL TRADE NOTES.

THE PRODUCTION OF ALCOHOL IN ARGENTINA.

According to the Austrian *Handels Museum* for September 17, no industry has of late years made so great a progress in Argentina as that of the manufacture of alcohol. While in the year 1886 492,912 litres of alcohol were imported, the import of this article fell in 1887 to 140,135 litres, in the year 1888 to 21,038 litres, and in 1892 amounted only to 11 litres. During the last three years no alcohol whatever has been imported, as the native production is not merely sufficient for the local consumption, but supplies also more than is needed by means of the various manufacturing in which alcohol is produced, such as maize distilleries and cane-sugar factories. The existing maize distilleries are now in a position to put out about 40 million litres of alcohol, and the cane-sugar factories from 10 to 20 million litres.

It has been shown by a recent German consular report that this alcohol is employed in the manufacture of liqueurs, in the raising of the alcoholic strength of the natural wines of San Juan and Mendoza, which it had hitherto been impossible to lay down, and in the preparation of large quantities of expensive wine. In the year 1895 the consumption of wine in Argentina amounted to some 24 million litres, of which scarcely 6 millions remained in their natural condition.

In order to deal with the serious over-production and the consequent reduction in value of alcohol, the owners of almost all the maize distilleries formed a syndicate in the year 1894, and pledged themselves to limit the production of alcohol and to accommodate themselves to the condition of the market. But, in spite of this, during the second half of that year the prices of alcohol continued to go down, as the cane-sugar factories in Tucuman flooded the market with huge quantities of alcohol prepared from cane-sugar and from molasses to such an extent that when the article came on the market it often did not fetch the bare cost of original production. This over-stocking of the market with Tucuman alcohol takes place with regularity after the close of the sugar manufacturing in the months from July to January, as the working up of the waste molasses cannot be undertaken until the price of alcohol becomes higher, and the smallest sugar factories have enough capital in hand to lay in alcohol for a considerable time.

With regard to the fact that the sugar factories buy no raw material for the production of alcohol, but make it themselves out of the material they possess, the only possible chance of a diminution of the product of alcohol is a

lessening of the expense of extracting sugar. The syndicate mentioned above already in the year 1895 monopolised the entire alcohol business of the country by buying up the total amount of alcohol manufactured in the sugar factories at a relatively low price. By doing this, the syndicate prevented the tender during the months just mentioned from being excessive, and continued, by means of their own restricted production, to obtain fair prices.

PRODUCTION OF QUICKSILVER IN CALIFORNIA.

The *Engineering and Mining Journal* (New York) states that quicksilver production in California has shown this year a considerable increase, the total receipts at San Francisco for the six months ending with June having been 18,439 flasks, a gain of 4,743 flasks, or 34·6 per cent., over the first half of 1895, and of 6,033 flasks, or 18·7 per cent., over 1894. While these receipts gauge the rate of production very fairly, they do not give the whole amount, as the reports do not include the quicksilver sold directly from the mines, nor that shipped from them to the East by rail, which does not come to San Francisco at all.

The larger output seems to have been absorbed without difficulty. In addition to the greater demand from the California mines, there has been a growth in exports very nearly corresponding to that in the production. The trade with China, which had been suspended for several years, has been renewed, and has aided materially in disposing of the increased production.

TIN PLATES IN THE UNITED STATES.

Engineering and Mining Journal, Sept. 26th, 1896, 289.

The growth of the tin-plate industry in the United States is illustrated by the fact that the imports of tin from the Straits direct for the seven months ending with July this year reached a total of 9,048 long tons, or more than twice the quantity noted for the corresponding period last year. This year the United States took 29·7 per cent. of the total shipments from the Straits, against 15·1 per cent. last year. This statement includes only the direct shipments, and makes no mention of the metal which goes by way of England and Holland.

While the total tin imports into the United States for the earlier months of this year showed a gain, the business depression affected them later in the year, and the total for the seven months elapsed has been 10,586 long tons, against 14,416 tons last year. Nearly all this decrease was in the months of June and July. The imports of tin plates decreased from 294,848,812 lb. in the seven months of 1895, to 179,386,938 lb. this year, showing a decrease of 39·2 per cent.

QUARTZ SLATE.

Engineering and Mining Journal, Sept. 19th, 1896, 274.

Quartz slate, a highly refractory natural stone, is quarried at Crummendorf, near Strehlen, Silesia. It is, according to a recent German report, a cheap substitute for the best fire-brick. Quartz slate is a mineral of grayish-white colour, and is of rare occurrence, the Crummendorf quarry being the only one in Germany. Examined by means of a microscope, it shows a fine texture of sharp quartz molecules, which can only have by the pressure of an enormously high water column been brought into connection. The slate is found in layers from 2 in. to 10 in. in thickness. Its high contents of silica (91·4 per cent.) make it extraordinarily fireproof, and it can be worked easily on account of its softness. Quartz slate will, it is stated, last three times as long as the best fire-brick, even if subjected to the highest temperatures. Since 1854 it has been extensively used in Eastern Germany, especially in the manufacturing district of Upper Silesia, in Austria-Hungary, and in Russia, and has recently been used in the Rhine province and Westphalia for cupola, welding, and puddling furnaces, Bessemer converters, &c.

PETROLEUM IN CANADA.

Ironmonger, October 3rd, 1896, 3.

The United States predominate so greatly in the American production of petroleum that the Canadian output of that

oil is rather apt to be overlooked. Statistics show, however, that a very considerable quantity of petroleum is raised in British North America, chiefly in the province of Ontario, with the town of Petrolia as the centre of the oil-producing district. In the year 1886 the total quantity of petroleum raised in Canada was 486,441 barrels (of 35 Imperial galls. each, equal to the American barrel of 42 Winchester galls.), of which the value was 437,797 dols. In 1887 the production was 763,933 barrels, or nearly double the quantity of the previous year, but since then the output has not been greatly augmented, and has been fairly steady year by year. In 1895 it was 802,574 barrels (or about 27,000 barrels less than in 1894), the value being 1,201,186 dols., which was the highest total recorded for any one year in the history of the industry. The lowest average price was 78 cents in 1887, and the highest 1 dol. 49³ cents in 1895. The following table gives in comparative form and in detail the Canadian production in 1894 and 1895:—

Product.		1894.	
		Quantity.	Value.
			Dols.
Illuminating oils	Imp. Galls.	11,289,741	1,003,973
Benzine and naphtha	" "	645,031	51,515
Paraffin oils	" "	1,282,749	118,053
Gas and fuel oils	" "	7,323,374	197,193
Lubricating oils and tar	" "	1,801,174	74,309
Paraffin wax	Lb.	1,350,172	119,091
Total			1,567,134

Product.		1895.	
		Quantity.	Value.
			Dols.
Illuminating oils	Imp. Galls.	10,921,826	1,237,328
Benzine and naphtha	" "	7,081,717	285,308
Paraffin oils	" "	1,364,228	86,608
Gas and fuel oils	" "	2,213,639	79,589
Lubricating oils and tar	" "	2,400,404	205,591
Paraffin wax	Lb.	1,261,228	85,608
Total			1,981,632

There is an oil exchange at Petrolia, but its operations are decreasing yearly, owing to the oil being sold direct to the refiners by the producers.

ACETYLENE FOR LIGHTING.

Chemist and Druggist, October 17th, 1896, 580.

A committee, consisting of MM. Troost and Schutzenberger, of the Academy of Sciences, Professors Moissan and Riche, of the Paris School of Pharmacy, MM. Michel Lévy, Bunel, and Vieille, with seven assistant commissioners appointed by the Hygienic Council of the Seine Department to study the preparation of acetylene for lighting purposes, have lately published the report. It appears, with a postscript, in the form of a series of regulations issued by the Prefect of Police, to whom notice must be given by anyone desiring to employ the new gas on his premises. It must not be used in cellars or close courts, the apparatus must be in a light, airy place, and the reserve stock kept out of the sun. The liquids and refuse are to be diluted with water (1 to 10) before being emptied into drains. Receivers of less than 10 kilos. pressure to be tested by proprietor, and fitted with manometer; those with pressure above 15 kilos. to be tested by a Government engineer (School of Mines). Wrought-iron receivers to be used, and tested every three years by the above-named official, who will stamp them with certain details as a proof of examination.

PRODUCTION OF CHLORATE OF POTASH AT NIAGARA FALLS.

Mr. O. E. Dunlap describes, in a recent issue of the *Electrician*, the works of the Chemical Construction Company at Niagara Falls, which are now, he states, in operation.

The company have leased 8 acres of land, which includes permission to use 4,000 h.p. of electricity; but at present they have built but three workshops on a small portion of the land, and are using 500 h.p. They are making chlorates by the Blumberg process, and propose to make chloroform and iodoform later on.

In making chlorate of potash the process is started by dissolving the chloride in five tanks of 3,000 galls. capacity. From these tanks the solution is pumped by steam to the upper floor of the main building, where it passes through filters, and then into a storage tank of 4,000 galls. capacity. From this tank the solution is tapped off for use in the pot-room on the same floor. The main switchboard controlling the flow of the electric current is on the east side of the building and above the transformer room. In addition to this main switch, each pot has a switch by which it can be thrown in or out of circuit. There are 60 pots, 8 ft. long and 4 ft. or 5 ft. wide, made of iron and lined with porcelain. The pots are all insulated one from the other, and also from the floor. In these pots the chloride solution is decomposed, forming the chlorate, which is allowed to run down to the first floor into porcelain-lined crystallising tanks or pans, then into lead-lined pans, and finally into wooden pans, shown in the above illustration, after which it is shovelled up and thrown into a centrifugal dryer. It is next placed in the dry room, where the remaining moisture is removed, after which it goes into the packing room, where it is put up in 100-lb. kegs and sealed for shipment. From the time the chloride solution enters the pot-room to the time the chlorate is ready for shipment about 24 hours elapse. The present capacity of the plant is about 1 ton of chlorate of potash per day.

Mr. Dunlap describes the electrical equipment, and adds that chlorate of potash is now made by three electrical processes—namely, those employed by Gall and Monthauer, of France; by Franehot and Gibbs, of Buckingham (Canada); and Blumberg's process employed by the Chemical Construction Company.

CALIFORNIAN OLIVE OIL.

Chemist and Druggist, October 17th, 1896, 580.

Californian olives will bring the State 2,000,000 dols. this year, or eight times as much as last year's crops. Part of the olives only is used for making oil, and at present it is wholly consumed locally. The largest olive mill in the country is in Pomona, says Mr. E. J. Eastman in the *Pharmaceutical Era*. The power is a six horse-power engine. The grinders consist of two great rollers of 900 lb. each, revolving in a hollow pan-like iron receptacle 6 ft. in diameter and 1 ft. deep. The olives are run into this receptacle to the depth of several inches. The rollers are started, and the olives are ground into a pomace, like Hamburg steak. The pomace is then packed in "bruseoles," and placed in a 100-ton hydraulic press. The pressure, which must be gradual and slow, is put on, and then stopped till the oil has been allowed to drip out; then a little more pressure is used, and this is repeated until the oil has been pressed out. As it comes from the press it looks like black oil, or crude petroleum, but soon separates, with the oil on top. It is then put into large tanks, and allowed to stand for several weeks, to clarify. Then it is filtered through sand and charecoal, and lastly through white filter paper.

DENATURING OF ALCOHOL IN FRANCE IN 1885—1894.

Zeits. für Spiritusind. 1896, 19, 289.

The following figures represent the quantities of alcohol which were denatured in France in the years 1885 to 1894:—

	Hectol.		Hectol.
1885	49,285	1890	109,842
1886	59,196	1891	105,742
1887	85,400	1892	104,347
1888	107,063	1893	106,939
1889	108,210	1894	120,798

The quantities of denatured spirit used for various purposes during 1890—1894 are given as follows:—

	1890.	1891.	1892.	1893.	1894.
	Hl.	Hl.	Hl.	Hl.	Hl.
For heating purposes ..	37,316	45,705	52,500	53,702	65,826
For lighting purposes ..	4,111	6,068	1,513	4,990	1,398
For manufacture of varnish.	12,450	11,781	10,876	11,740	11,295
For manufacture of hats and in dyeing.	392	210	377	617	2,219
For manufacture of ether.	30,901	27,926	25,554	22,178	31,877
For manufacture of aldehyde.	3	9	18	45	..
For manufacture of fulminates, alkaloids, &c.	3,350	2,547	1,816	2,557	2,654
For destruction of insects.	9	2	8	5	18
For other purposes.....	15,187	11,534	9,296	11,105	2,601

—A. K. M.

MANUFACTURE OF STARCH AND STARCH PRODUCTS IN FRANCE.

D. Saure. Zeits. für Spiritusind. 1896, **19**, 295—296.

There are about 550—600 works in France in which starch and starch products are manufactured. Of these, 450—500 are potato-starch works, in the largest of which, in Châlons-sur-Saône, 200,000 kilos. of potatoes can be treated in a day. There are also about seven works in which maize starch and four or five in which wheat starch is manufactured. In addition to these there are 19 glucose, 20 caramel, and four dextrin works.

The amount of starch manufactured is difficult to estimate, but is probably about 1,500,000 to 2,000,000 cwt. The production and export of glucose, compared with that of Germany, is as follows:—

	Production in	
	France.	Germany.
	Cwt.	Cwt.
1893-94	332,000	380,000
1894-95	531,000	350,000

	Export from	
	France.	Germany.
	Cwt.	Cwt.
1893-94	12,000	57,700
1894-95	22,700	15,000

The import duty in France on 100 kilos. of the different products is as follows:—

	Francs.
Grain starch (amidon)	15
Potato starch (féoule)	12
Glucose	70
Maize	3

—A. K. M.

MINERAL OIL AND PARAFFIN INDUSTRIES.

Krey. Chem. Rev. Fett u. Harz Ind. **3**, 174, 186, 198.

In considering the possibility of a petroleum monopoly by the Russian and American producers, the author points out that the development of the Galician oil-fields and the low price of gas are factors militating against the success of such a scheme.

Turning to the proposed differential tariff on crude oil to favour the establishment of an oil-refining industry in Germany, he refers to the practice, latterly developed in Austria, of defrauding the revenue by declaring as crude oil refined oil mixed with 10 per cent. of heavy oil, whereby it acquires the appearance of the unrefined article; and expresses the opinion that whilst the proposed change

would benefit German industries but little, it would practically kill the brown coal-tar oil and paraffin industry in Saxony and Thuringia, since the centres of this industry are not favourably situated for the reception of imported oil, being remote from the great waterways; neither is the plant adapted for the refining of petroleum. These circumstances, coupled with the insecurity attaching to an industry wholly depending on foreign countries for its raw material, render the projected change undesirable from an economic point of view.—C. S.

THE RUSSIAN DRUG TRADE.

Chemist and Druggist, October 24th, 1909.

In view of the possible abolition of, or considerable reduction in, Customs duties on drugs and chemicals imported into Russia, the following table, taken from the official Russian Customs statistics, will be of interest as showing the imports of the principal drugs and chemicals into that country during 1894 and 1895:—

	Quantities in Thousands of Pounds.		Value in Thousands of Roubles.	
	Pound = 36 lb. Av.		Gold R. = 3s. 2d.	
	1894.	1895.	1894.	1895.
Benzoic acid and camphor.	44	38	422	308
Gums and gum-resins, unenumerated.	351	341	7,739	7,770
Chemicals and druggists' goods.	5,740.3	5,433.3	13,042	12,450
Including sulphur ..	1,313	1,192	960	582
" borax	54	66	70	47
" sal ammoniac and ammonia.	63	94	226	282
Chlorides of magnesium and sodium, and Epsom salts.	204	236	186	195
Bleaching powder	444	399	908	794
Caustic soda and potash	436	394	1,051	980
Bicarbonate of soda and potash.	81	80	230	227
Other salts of soda and potash.	305	333	457	512
Sulphuric acid	39	18	67	28
Nitric and hydrochloric acids.	197	83	459	354
Stassfurt salts	317	273	141	165
Nitrate of soda	860	752	894	624
Glauber salts	223	196	248	200
Fatty vegetable oils	751	722	5,773	5,648
Cocoa and palm oils	200	192	942	802
Essential oils	4.1	4.0	454	459
Cosmetics	11.3	13.2	792	831
Dyes and colours	4,087.8	3,907.1	14,788	16,133
Vegetable pigments	2,777	2,551	2,697	2,545
Colouring earths	349	374	534	537

OUTPUT OF CHEMICALS IN GERMANY.

Chemist and Druggist, October 24th, 1909.

According to official statistics, the following quantities of minerals and metals were produced in Germany last year:—Bismuth, 1,000 kilos., value 7,000 m.; cadmium, 7,047 kilos., value 39,238 m.; antimony, 924 tons, value 29,4612 m.; arsenic and arsenical compounds, 1,788 tons, value 393,451 m.; sulphur, 1,819 tons, value 136,340 m.; sulphuric acid, 416,239 tons, value 11,579,483 m.; hydrochloric acid, 8,627 tons, value 120,741 m.; nitric acid, 1,922 tons, value 555,619 m.; muriatic acid, 2,641 tons, value 157,062 m.; colouring earths, 2,059 tons, value 155,451 m.

IODINE MANUFACTURE IN JAPAN.

Chemist and Druggist, October 24th, 1909.

It is well known that enormous quantities of seaweed containing iodine are gathered along the coasts of Japan, and were it not for the fact that the manufacture of iodine from kelp is scarcely profitable in view of the competition of the Chilean product, Japan would no doubt be one of the principal iodine-producing countries. In fact, even under

the present circumstances, Japanese iodine and iodides find a market locally, and have even been seen in Europe in commercial quantities. A proposal has now been made to the Japanese Government by certain native chemists that the Customs duty on iodine and iodides in Japan should be increased to such an extent as to enable the Japanese industry to be self-supporting.

A FATAL ACETYLENE EXPLOSION.

Chemical Trade Journal, October 24th, 1896, 256.

A terrible explosion occurred on October 17th, at the works of M. Raoul Pietet, 136, Rue Championnet, Montmartre, Paris, through the explosion of a vessel containing acetylene gas. The accident took place in the gasometer room, which is a special building over 30 feet high, situated at the back of the main portion of the factory, and separated from it by a small courtyard. Only two men were in the room at the time, and they were both killed on the spot. They were engaged in checking a number of recently returned cylinders of liquefied acetylene gas. It is uncertain how the explosion occurred, but at present it is attributed to a leakage igniting at the open flame of a lamp. The walls of the building were blown down, and the neighbouring buildings were damaged. Near the gasometer room there is a small boiler-house, and the stoker engaged there was slightly wounded by splinters of glass. In all the other buildings of the factory, the engine-house, and the storehouses not a pane of glass was left unbroken. The courtyards of the adjoining premises are also all strewn with broken glass and with pieces of masonry belonging to the wrecked gasometer-house. It is astonishing that the gasometer itself, which is quite close, did not also blow up. Had it done so the explosion would have devastated the whole quarter.

DOMESTIC GAS FROM BY-PRODUCT OVENS.

Engineering and Mining Journal, October 17th, 361.

The first of the series of by-product coke-oven plants which it is proposed to build on the seaboard will shortly be in operation at Halifax, Nova Scotia. The ovens are of the Otto-Hoffmann type, and the company has arranged to furnish both fuel and illuminating gas to the city of Halifax, in addition to manufacturing coke and saving the ammonia sulphate and other by-products. At this plant of course, Cape Breton coal will be used. It is announced also that plans are being prepared for the larger plant which the same parties, under the organisation of the Massachusetts Pipe Line Company, purpose building near Boston; but work will not be begun until some experience is had at Halifax. At Boston it is the intention to use also Cape Breton coal, from the Dominion Coal Company's mines.

The people who are managing this enterprise are also interested in the United Coke and Gas Company, which is building a large plant of Otto-Hoffmann coke ovens near Pittsburg. The projectors are confident that they will be able, in the Eastern plants, to find a good market for their coke, and to reduce largely the cost of supplying gas; especially fuel gas, which they expect to furnish on a large scale to the cities.

BY-PRODUCTS IN COKE MANUFACTURE.

Engineering and Mining Journal, October 17th, 1896, 369.

A calculation was recently made by Herr E. Hagenstock, of Dahlhausen, which should be of interest to coke-makers. He told the members of a German technical society that in the Rhenish-Westphalian district alone about 6,000,000 tons of coke are now produced and consumed, for which 8,000,000 tons of coking-coal are required. If only 1 per cent. of ammonia sulphate be regarded as recoverable on an average, it will be seen that a quantity of 80,000 tons of this substance can thus be recovered yearly; and, at the low price of 1 mark per kilo. of nitrogen, amounting, with a 20 per cent. nitrogen content in the ammonia sulphate, to 200 marks per ton of this salt, the total saving would be 16,000,000 marks.

SAUERBECK'S TABLES.

Textile Recorder, October 15th, 1896.

(See this Journal, 1894, to face 762; 1895, 609.)

Mr. Sauerbeck's index numbers for August and September show a considerable rise in the prices of commodities since the end of July, when the lowest level ever recorded was reached. The recovery during the two months was from 59.2 to 61.3, the rise being 2.1, or at the rate of 3.54 per cent. The index number still stands, however, below that of the whole of 1895, which was itself under the figure for any previous year. In the following table the average numbers for each twelvemonth since 1890, as well as the course of the decline this year to July and the subsequent upward movement, are indicated:—

Index Numbers of Commodities.

Year 1891	72	December, 1895	61.2
Year 1892	68	March, 1896	60.7
Year 1893	68	April, 1896	60.3
Year 1894	63	May, 1896	60.1
Year 1895	62	June, 1896	59.3
		July, 1896	59.2
		August, 1896	59.7
		September, 1896	61.3

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 30th September.	
	1895.	1896.
	£	£
Metals	1,444,864	1,614,578
Chemicals and dyestuffs	119,963	450,451
Oils	596,581	676,216
Raw materials for non-textile industries	1,319,668	4,541,461
Total value of all imports	30,618,554	33,111,156

SUMMARY OF EXPORTS.

Articles.	Month ending 30th September.	
	1895.	1896.
	£	£
Metals (other than machinery)	2,480,097	2,780,378
Chemicals and medicines	649,704	639,278
Miscellaneous articles	2,696,148	2,679,516
Total value of all exports	19,461,940	19,797,980

IMPORTS OF METALS FOR MONTH ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore	8,958	10,704	57,099	44,422
Regulus	6,192	5,685	120,508	154,242
Unwrought	2,806	5,246	126,869	255,684
Iron:—				
Ore	441,292	419,855	288,836	296,206
Bolt, bar, &c.	7,105	7,307	58,545	59,582
Steel, unwrought ..	707	1,446	5,882	17,731
Lead, pig and sheet ..	8,792	12,073	92,720	136,090
Pyrites	34,694	56,504	63,866	103,453
Quicksilver	71,640	64,200	6,920	5,680
Silver ore	Value £	..	119,980	97,162
Tin	73,495	67,317	237,903	202,932
Zinc	5,383	5,227	85,078	87,830
Other articles	Value £	..	173,718	152,964
Total value of metals ..	..	..	1,444,864	1,614,578

IMPORTS OF CHEMICALS AND DYE-STUFFS FOR MONTH
ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	11,616	10,238	£ 8,664	£ 7,949
Bark (tanners', &c.) ..	37,216	25,572	12,759	8,149
Brimstone.....	21,761	42,804	5,693	11,068
Chemicals..... Value £	..	..	101,588	127,162
Cochineal..... Cwt.	306	686	1,967	4,641
Cutch and gambier Tons	1,732	1,894	38,828	32,960
Dyes:—				
Alizarin..... Value £	..	..	20,081	19,393
Anilin and other ..	..	..	27,604	40,046
Indigo..... Cwt.	1,451	830	15,611	11,049
Nitrate of potash ..	17,136	24,671	15,790	20,047
Valonia..... Tons	1,780	2,805	20,918	33,013
Other articles... Value £	..	..	150,550	135,013
Total value of chemicals	..	..	£19,963	450,451

IMPORTS OF OILS FOR MONTH ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa-nut..... Cwt.	25,056	14,398	£ 27,671	£ 15,694
Olive..... Tuns	733	961	27,497	31,190
Palm..... Cwt.	90,495	89,644	95,023	91,814
Petroleum..... Gall.	14,664,690	15,393,970	273,821	276,296
Seed..... Tons	1,919	2,655	38,396	55,433
Train, &c..... Tuns	2,268	2,370	35,739	38,431
Turpentine..... Cwt.	27,894	72,187	28,284	68,269
Other articles... Value £	..	..	70,240	99,080
Total value of oils...	..	..	506,581	676,216

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian .. Cwt.	1,263	2,724	£ 2,128	£ 3,800
Bristles..... Lb.	462,595	437,628	60,190	62,097
Caoutchouc..... Cwt.	24,757	32,559	219,201	403,169
Gum:—				
Arabic.....	4,060	2,379	9,581	4,574
Lac, &c.....	4,425	3,176	24,896	15,531
Gutta-percha.....	3,999	3,204	26,930	32,030
Hides, raw:—				
Dry.....	20,152	23,006	70,212	38,539
Wet.....	51,611	53,046	125,043	119,775
Ivory.....	619	1,039	27,156	42,071
Manure:—				
Guano..... Tons	7,160	4,393	53,484	12,450
Bones.....	4,289	2,331	18,131	6,068
Nitrate of soda....	6,357	1,093	51,305	8,475
Phosphate of lime ..	17,854	25,081	28,680	36,030
Paraffin..... Cwt.	54,181	78,400	58,395	73,401
Linen rags..... Tons	2,129	1,092	17,206	12,352
Esparto.....	22,742	12,120	59,883	50,239
Pulp of wood.....	29,000	28,912	159,102	145,296
Rosin..... Cwt.	106,763	108,512	27,996	27,046
Tallow and stearin ..	104,560	97,281	123,670	94,790
Tar..... Barrels	36,159	29,548	29,074	17,428
Wood:—				
Hewn..... Loads	275,862	258,891	535,984	518,117
Sawn.....	743,567	822,220	1,539,537	1,896,946
Staves.....	21,503	14,050	67,274	56,005
Mahogany..... Tons	3,054	7,324	23,353	62,982
Other articles..... Value £	..	..	931,302	830,379
Total value .....	..	..	4,319,968	4,541,461

Besides the above, drugs to the value of 79,413*l.* were imported, as against 192,719*l.* in September 1895.

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	8,548	3,280	£ 34,402	£ 40,992
Copper:—				
Unwrought....	60,106	33,619	144,761	81,919
Wrought.....	25,196	18,978	70,103	58,612
Mixed metal....	24,371	16,209	52,325	39,780
Hardware..... Value £	..	..	164,690	175,771
Implement.....	..	..	101,462	118,192
Iron and steel... Tons	269,346	314,736	1,709,377	1,978,784
Lead.....	2,739	3,730	33,152	45,851
Plated wares... Value £	..	..	32,420	39,055
Telegraph wires ..	..	..	45,268	76,273
Tin..... Cwt.	7,833	12,048	26,799	38,296
Zinc.....	12,204	15,574	8,450	11,925
Other articles... Value £	..	..	53,918	74,921
Total value .....	..	..	2,480,097	2,780,378

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	519,068	381,326	£ 126,360	£ 100,554
Bleaching materials ..	104,723	90,042	39,161	29,992
Chemical manures.....	30,694	39,556	156,125	159,804
Medicines..... Value £	..	..	88,827	95,338
Other articles.....	..	..	238,693	253,590
Total value .....	..	..	649,706	639,278

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 30TH SEPTEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gimpowder..... Lb.	662,700	551,800	£ 13,704	£ 9,823
Military stores... Value £	..	..	190,106	71,240
Candles..... Lb.	1,657,200	1,746,000	27,756	26,067
Caoutchouc..... Value £	..	..	97,519	99,569
Cement..... Tons	37,027	34,898	61,060	55,376
Products of coal Value £	..	..	104,126	118,971
Earthenware ...	..	..	146,901	137,646
Stoneware.....	..	..	13,076	17,238
Glass:—				
Plate..... Sq. Ft.	129,273	109,823	7,986	7,148
Flint..... Cwt.	7,832	9,421	17,945	19,400
Bottles.....	63,381	69,246	30,656	33,971
Other kinds....	19,372	20,351	13,977	15,515
Leather:—				
Unwrought	13,213	12,304	127,155	109,709
Wrought..... Value £	..	..	38,131	44,751
Seed oil..... Tons	3,267	5,186	67,813	93,399
Floorecloth..... Sq. Yds.	1,645,500	1,745,700	6,673	74,508
Painters' materials Val. £	..	..	123,066	130,924
Paper..... Cwt.	73,771	87,779	119,728	137,227
Rags..... Tons	3,871	4,683	21,729	27,063
Soap..... Cwt.	60,160	46,976	62,667	52,362
Total value .....	..	..	2,696,148	2,670,516

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 20,431. L. F. Haubtman. Improvements in apparatus for clarifying saccharine solutions. Sept. 15.
 20,716. A. Müller, jun. An improved drying kiln with sinking shelves. Complete Specification. Sept. 18.
 20,982. J. Van Ruymbeke and W. F. Jobbins. Improvements in distilling apparatus. Complete Specification. Sept. 22.
 21,203. J. H. W. Ortmann and C. W. C. Herbst. New or improved apparatus for pasteurising liquids. Complete Specification. Sept. 24.
 21,579. G. A. Oncken. Improvements in injectors suitable for use with liquid fuel. Sept. 29.
 21,597. J. H. R. Dinsmore. Improvements in and connected with thermometers. Sept. 30.
 21,696. J. H. Dunn and J. A. S. Colquhoun. Improved means for drying or superheating steam. Sept. 30.
 22,060. W. F. E. Casse. Improvements in apparatus for heating, pasteurising, and cooling liquids. Complete Specification. Oct. 5.
 22,109. W. B. Strype and J. A. Mason. Improvements in metal hampers or baskets for earboys. Oct. 6.
 22,385. F. A. Roche. An improvement in the construction of filter presses. Oct. 9.
 22,675. J. B. Fenby. Improvements in manufacturing porous carbon blocks for use in filters. Oct. 13.
 22,777. T. Levoz. Improvements in converters. Oct. 14.
 22,811. F. N. Cookson and J. Stewart. Improved means for providing for the collection and removal of saline and other deposits from steam boilers, evaporators, and the like. Oct. 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

- 19,356. E. Thomas. Continuous kilns.
 19,623. A. Thomson. Apparatus for evaporating and condensing. Sept. 30.
 19,754. H. W. Godfrey. Masticators or mixers suitable for the preparation of linoleum and other plastic materials. Oct. 21.
 20,998. W. H. Stead. Apparatus for forming into cakes pulverulent, granular, or pasty coherent material, such, for instance, as oil-seed meal. Oct. 7.
 21,468. W. Calver. Apparatus for the manufacture of gases. Oct. 7.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 20,258. O. Hehner and R. M. Prideaux. Improvements in incandescent mantles. Sept. 14.
 20,294. E. Le Riche. Improvements in incandescent gas lamps or burners, and in the mode of constructing the same. Sept. 14.
 20,406. R. Trost. Improvements in acetylene gas lamps. Sept. 15.
 20,490. A. Barham. An improvement or improvements in or connected with candles. Sept. 16.
 20,501. H. Hill. Improvements in the manufacture of thread foundations or caps for incandescent mantles. Sept. 16.

20,529. G. S. T. Gastine. Improvements in and in apparatus for the production of acetylene. Complete Specification. Sept. 16.

20,599. J. A. Denthier. Improvements in and relating to method of and apparatus for producing acetylene gas. Complete Specification. Sept. 17.

20,602. W. B. Rickman.—From J. Pintsh. Apparatus for the production of acetylene gas. Complete Specification. Sept. 17.

20,608. R. Türr. Improvements in lamps for generating and burning acetylene gas. Sept. 17.

20,694. W. P. Thompson.—From V. I. Comucci. Improvements in apparatus for generating and storing acetylene gas. Sept. 18.

20,713. J. L. Waldapfel. Improvements in or relating to burning liquid hydrocarbons in conjunction with an incandescent hood or mantle to produce an incandescent oil burner. Complete Specification. Sept. 18.

20,895. D. D. Esson. An improved combustible compound or fuel. Sept. 21.

20,903. V. Sardi. Improvements in apparatus for the manufacture of acetylene gas. Complete Specification. Sept. 21.

21,098. S. Katz. Improvements in the manufacture of charcoal fuel blocks. Complete Specification. Sept. 23.

21,267. G. Löwenberg. Composition to be used in the manufacture of glow bodies for incandescent lamps. Complete Specification. Sept. 25.

21,351. A. Kay. Improvements in and relating to apparatus for the generation and storage of acetylene gas. Sept. 26.

21,374. J. D. Palmer, H. Palmer, and H. E. Trestrail. Improvements in night lights. Sept. 26.

21,468. S. Kon. Improvements in generators for acetylene gas. Complete Specification. Sept. 28.

21,667. A. Köhler. Improvements in apparatus and materials for carburetting air. Complete Specification. Sept. 30.

21,682. H. Palmer. Improvements in the treatment of paraffin scale or paraffin. Sept. 30.

21,695. J. B. Fournier. Improvements in apparatus for containing and supplying liquefied gas for lighting and other purposes. Sept. 30.

21,698. A. H. Barker. Improvements in and relating to generators for acetylene gas. Sept. 30.

21,758. E. C. L. Pillion and C. Bertolus. Improvements in apparatus for generating and storing acetylene gas. Oct. 1. Date applied for April 1, 1896, being date of application in France.

21,769. H. Maximi. Improvements in and relating to the manufacture of incandescence bodies for illuminating purposes. Oct. 1.

21,947. H. L. A. Luchaire. Improvements in apparatus for the manufacture of acetylene gas. Filed Oct. 3. Date applied for March 3, 1896, being date of application in France.

22,068. H. L. A. Luchaire. Improvements in apparatus for the manufacture of acetylene gas. Filed Oct. 5. Date applied for April 30, 1896, being date of application in France.

22,185. C. Morris. Improvements in or connected with burners for incandescent gas lighting. Oct. 6.

22,194. P. Jebsen. A process for carbonisation of peat by electric heating. Complete Specification. Filed Oct. 6. Date applied for March 13, 1896, being date of application in Norway.

22,347. H. Winkler. Improvements in incandescent gas light are lamps. Oct. 8.

22,359. E. H. Maddock and W. Jones. Improvements in acetylene gas generators and gasometers. Oct. 8.

22,457. H. D. Fitzpatrick.—From The Actien Gesellschaft für Fabrikation von Broncewaaren und Zinkguss vormals J. C. Spinn und Sohn. Improvements in the burners of incandescent gas lights. Oct. 10.

22,480. R. J. Uppihart and G. Kros. Improvements in and connected with the production of illuminating and heating gas. Oct. 10.

22,526. L. T. FitzGibbon. Improvements in and connected with the production of acetylene gas. Oct. 10.

22,549. J. H. Darby. Improvements in the manufacture of gas with recovery of by-products. Oct. 10.

22,570. H. Akeroyd. A new and improved mantle or veil for incandescent gas lights. Oct. 12.

22,628. E. A. Morton-Brown and F. Maundrell. Improved apparatus for the production and storage of acetylene gas. Oct. 12.

22,646. A. G. Smith. Improved acetylene gas generator, purifier, and holder. Oct. 13.

22,647. A. J. Smith and A. G. Smith. A method of adapting acetylene gas for use on cycles, carriages, or other vehicles. Oct. 13.

22,741. A. J. Boulton.—From G. Zambaldi. Improvements in or relating to the production and treatment of acetylene gas, and in apparatus connected therewith. Oct. 13.

22,782. P. Sylva. An apparatus for producing acetylene. Oct. 14.

22,787. A. Schemidt and O. Kaufman. Improvements in the production of acetylene gas and in apparatus therefor. Oct. 14.

22,812. E. Martin and A. Tournier. An improved burner for incandescent gas light. Oct. 14.

22,828. C. W. S. Crawley, A. Soames, and C. V. Drysdale. A method of obtaining a continuous supply of gas or vapour under pressure. Oct. 14.

22,887. G. E. Stevenson. Certain improvements in the construction of gas-retort settings and regenerator furnaces for the same. Oct. 15.

22,956. J. B. Heal and S. H. Heal. Improvements in system connected with the installation of acetylene gas and fittings. Oct. 16.

23,006. A. Quentin. Improvements in and relating to incandescent bodies for heating purposes. Oct. 16.

23,080. B. H. Thwaite. Improved methods of utilising fuel for evaporating brine, aqueous and other solutions. Oct. 17.

23,079. O. Streiber and F. Kiefer. Improvements in factory fuel. Complete Specification. Oct. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

13,510. J. Green. An improved method or process for use in obtaining hydrogen gas from water, and means for obtaining, by the aid of such method or process, carburetted hydrogen and other combinations of hydrogen, and apparatus for use in such method or process. Sept. 23.

16,431. J. Chagot. Apparatus for compressing coal-dust and the like mixture into fuel cakes. Oct. 14.

18,156. G. Haycraft. Manufacture of fuel. Sept. 30.

18,263. W. H. Wheatley.—From C. Schmid. Manufacture of incandescence bodies for illuminating purposes. Sept. 30.

18,395. J. T. Thomas and A. V. Hunt. Manufacture of coal-gas. Sept. 30.

19,243. C. Weygang. Manufacture of artificial fuel. Oct. 14.

19,830. A. Davis. Apparatus for the production or generation of gas for artificial lighting and motive-power purposes. Oct. 21.

21,545. G. C. Fowler and M. B. Fowler. Improvements in night lights, and in cases and holders for the same, and an apparatus employed in the manufacture of the said night lights. Oct. 7.

23,521. G. Trouvé. Apparatus for producing, storing, and utilising acetylene gas. Oct. 14.

1896.

1129. F. Knoefl. Method of producing light. Oct. 21.

5905. G. Webb and J. W. Kelly. Automatic gas generator. Sept. 23.

6919. J. E. Dowson. Apparatus for making combustible gas. Oct. 21.

8161. W. Tyree. Combustion of fuel. Sept. 23.

13,618. J. Musso. Portable and hygienic incandescent lighting wherein the evaporation of hydrocarbons is produced under pressure. Oct. 14.

14,278. F. P. J. Ackemaon. Apparatus for producing acetylene gas. Sept. 23.

15,500. R. J. Eiffe.—From F. Meyer and Co. Preparation of incandescence bodies. Sept. 30.

16,345. R. Haddad.—From A. Boter. Apparatus for production of acetylene gas. Sept. 23.

16,728. A. J. Boulton.—From F. Alexandre. Production of acetylene gas, and means or apparatus employed therein. Sept. 23.

17,450. W. C. Clarke. Apparatus for generating acetylene gas. Sept. 23.

17,729. I. N. Knapp. Treatment of illuminating gas. Oct. 7.

18,924. A. Spranger. Production or manufacture of ozone solutions. Oct. 7.

19,288. A. J. Boulton.—From H. E. Fuller. Construction of apparatus for generating gas by the chemical action of a liquid upon a solid material. Oct. 14.

20,599. J. A. Deuther. Improvements in and relating to method of and apparatus for producing acetylene gas. Oct. 21.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

20,676. O. N. Witt. Manufacture of derivatives of para-amido-alpha-naphthol and of colouring matters therefrom. Sept. 18.

21,196. G. B. Ellis.—From La Société Chimique des Usines du Rhone anciennement G. P. Monnet et Cartier. Improvements in and relating to the production of colouring matters. Sept. 24.

21,197. G. B. Ellis.—From La Société Chimique des Usines du Rhone anciennement G. P. Monnet et Cartier. Improvements in and relating to the production of colouring matters. Sept. 24.

21,198. G. B. Ellis.—From La Société Chimique des Usines du Rhone anciennement G. P. Monnet et Cartier. Improvements in and relating to the manufacture of colouring matters. Sept. 24.

21,211. W. Clark.—From C. H. Boehringer and Sohn. Process of preparing solutions of artificial and natural colouring matters for dyeing and printing purposes. Sept. 24.

21,431. R. Wilkinson and F. Wilkinson. A new or improved dye. Sept. 28.

21,437. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of a new black mordant-dyeing colouring matter. Sept. 28.

21,493. I. Levinstein and Levinstein, Lim. Production of new direct colouring matters. Sept. 29.

21,498. L. P. Marchlewski, E. S. Wilson, and E. Stewart. Improvements in the production of dyes. Sept. 29.

22,041. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of ortho- and para-nitrobenzyl-aniline and its homologues. Oct. 5.

22,420. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture of chemical compounds and of dyestuffs derived therefrom. Oct. 9.

22,943. H. H. Lake.—From Farbwerk Muhlheim. Improvements in the manufacture of azo colouring matters. Oct. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,481. O. Imray. — From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of a compound of salicylic acid and hexamethylenetetramine. Oct. 7.

23,054. C. D. Abel. — From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of derivatives of the triphenylmethane series. Oct. 7.

23,312. J. Imray. — From La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis. Manufacture of sulphuretted colouring matters dyeing non-mordanted fibres. Oct. 7.

23,853. O. Imray. — From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of basic blue dyestuffs. Oct. 21.

1896.

1331. H. H. Lake. — From K. Ochler. Manufacture of colouring matters. Oct. 21.

V.—TEXTILES, COTTON, WOOL, SILK, ETC.

APPLICATIONS.

20,714. R. Thomas and E. Prevost. Improvements in or relating to mercerising vegetable fibrous substances. Complete Specification. Sept. 18.

20,736. C. O'Brien and J. Shearer. Method for improving the colour of raw jute fibre. Sept. 19.

20,737. C. O'Brien and J. Shearer. Method for improving the colour of raw jute fibre. Sept. 19.

20,360. C. Junge. — From S. B. Allison. Improvements in machines for separating and cleaning the fibres of plants of every description. Sept. 22.

21,370. A. Wyser. An improved process and apparatus for treating cotton yarns for the purpose of obtaining a glossy appearance of the yarn. Sept. 26.

21,557. R. B. Hardman. Improvements in apparatus for clearing fibres from grease and impurities. Sept. 29.

22,197. W. C. Kipling. Improvements in and relating to waterproofing silk, wool, or other fabrics. Oct. 6.

22,605. S. Whittaker. Improvements in or connected with machinery for preparing or spinning cotton or other fibrous materials. Oct. 12.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

20,846. B. Lec. Improvements in and connected with vessels for dyeing purposes. Sept. 21.

21,244. F. V. Williams. An improved process for the fixation of soluble colouring matters or mordants or pigments or powders upon woven fabrics. Sept. 25.

21,245. J. Arrowsmith and G. A. Kennedy. — From W. Coventry. Improvements in or applicable to apparatus for dyeing or bleaching yarn in cop or other compact form. Sept. 25.

21,286. J. O. O'Brien. — From G. Schneider. Improvements in or connected with the scouring or dyeing of wool and other fibres and textile fabrics. Sept. 25.

21,492. F. Davies and A. Liebmann. A new or improved machine for dyeing, finishing, sizing, washing, or similarly treating yarn. Sept. 29.

22,218. T. Ingham. Improved apparatus for dyeing mixed fabrics. Oct. 7.

22,522. A. M. Clark. — From C. H. Boehringer and Sohn. An improved mordanting agent and process for vegetable fibres. Oct. 10.

22,823. J. Kent. An improved method or process of bleaching cotton and other vegetable textile materials. Oct. 14.

22,931. W. Shedlock. Improvements relating to the bleaching, dyeing, and washing of textile materials and to apparatus therefor. Oct. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,040. R. Thomas and E. Prevost. Improvements in or relating to Mercer's system of treating vegetable fibres or fabrics for dyeing purposes. Sept. 30.

21,355. L. C. G. Sharp. Production of coloured border effects on fast black dyed grounds upon ordinary grey cotton cloths, especially suitable for umbrella cloths, selvedges, and the like. Oct. 14.

21,393. M. Walton. Bleaching kiers. Sept. 23.

1896.

372. A. M. Clark. — From C. H. Boehringer. Process of mordanting vegetable textile materials for dyeing. Sept. 23.

4890. A. Ashworth. Fixing metallic mordants on fibres and fabrics. Oct. 14.

14,252. A. Eudler. Process for bleaching cotton and cotton goods. Oct. 14.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

20,290. J. Walter and C. Lehmann. Nitric acid regenerator. Complete Specification. Sept. 14.

20,423. P. Jensen. — From H. Cappelen and D. Cappelen. Improvements in pumping apparatus for chlorine gas and the like. Complete Specification. Sept. 15.

20,598. J. A. Deuther. Improvements in and relating to calcium carbide and the treatment of the same to form a uniform composition. Complete Specification. Sept. 17.

20,794. B. Kosmann. Method of manufacturing thorium hydrate. Sept. 19.

20,818. M. N. d'Andria. Improvements in and connected with the manufacture of magnesia and of calcium carbonate. Sept. 21.

20,822. M. N. d'Andria. Improvements in and connected with the utilisation of calcium chloride solutions, the recovery of hydrochloric acid, and the manufacture of magnesium sulphate or magnesia and chlorine. Sept. 21.

20,883. G. P. Lewis and R. A. Cripps. Improved means for manufacturing and recovering cyanides, and apparatus therefor. Sept. 21.

21,178. A. Schmitz and E. C. W. Toenges. Process for obtaining tartaric acid and tartrates. Sept. 24.

21,205. Brante, Etienne, and Co. Improved apparatus for the manufacture of sulphuric acid. Sept. 24.

21,443. G. Webb, jun., and J. W. Kelly. Improved apparatus for the production of carbide of calcium. Sept. 28.

21,572. M. P. E. Letang. An improved process for the treatment of carbide of calcium. Complete Specification. Sept. 29.

21,764. C. C. Moore. Improvements in the treatment of crude borates and in obtaining boric acid. Oct. 1.

21,892. J. J. Holleyhead. Improved apparatus for the manufacture of salt. Oct. 2.

21,953. T. Savage. Improvements in the production of or copper sulphate. Oct. 3.

22,512. M. Schwab. Improved method of and apparatus for concentrating sulphuric acid. Oct. 10.

22,717. G. Kynoch and Co., Lim., and A. T. Cocking. An improved method and apparatus for mixing and conveying acids for use in nitro-glycerine and other manufactures. Oct. 13.

22,718. G. Kynoch and Co., Lim., and A. T. Cocking. An improved process for denitrating acid which has been used in the nitro-glycerine manufacture. Oct. 13.

22,792. J. W. Chenhall. Improvements in the manufacture of bleaching compounds. Oct. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,785. H. Hibbert and A. Frank. Production of phosphors, its acids and salts, from mineral phosphates, bones, and other materials containing phosphoric acid. Oct. 14.

19,201. G. C. Downing.—From J. R. Moise. Manufacture of alkaline cyanides, ferrocyanides, and their derivatives, and apparatus therefor. Oct. 14.

20,377. W. Mills. Manufacturing metallic fluorides. Sept. 9.

21,380. C. F. Claus. Roasting sulphide ores. Sept. 23.

21,678. J. Raschen and J. Brock. Manufacture of cyanides and ferrocyanides from sulphocyanides and the recovery of by-products. Sept. 23.

21,997. T. L. Willson. Production of metallic cyanides and other nitrogen compounds. Oct. 7.

22,037. D. A. Peniakoff. Manufacture or production of alkaline silicates or silicates of the alkaline earths, and of chlorine or hydrochloric acid. Oct. 23.

22,038. D. A. Peniakoff. Manufacture or production of alkaline aluminates of the alkaline earths, and of sulphurous acid. Sept. 23.

22,039. D. A. Peniakoff. Manufacture or production of aluminates and of sulphurous acid, and of chlorine or hydrochloric acid as by-products. Sept. 23.

23,572. W. P. Thompson.—From The Chemische-Werke vormals H. and E. Albert. Manufacture of alkaline phosphates and caustic alkali. Oct. 21.

1896.

720. B. Willecox.—From The Chemische Fabrik Griesheim. A process for obtaining hydrosulphide of sodium or sulphate of sodium and sulphuretted hydrogen and sulphate of calcium from sulphide of calcium or soda residues and mono- or bi-sodium sulphate. Oct. 14.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

20,439. J. T. Newell. Improved method of preparing granulated glass for tiles, facing bricks, walls, panels, and the like. Sept. 15.

20,975. C. Mountford. Improvements in the decoration of pottery, porcelain, earthenware, glass, and the like. Sept. 22.

21,194. A. Simmons and G. M. Fricake. Improvements in ornamenting or decorating glass, earthenware, metal, and other plates and sheets, and other surfaces. Sept. 24.

21,762. D. Laffan, G. Moore, and T. J. Glynn. Improvements in or relating to apparatus for blowing or forming bottles and other glassware. Complete Specification. Oct. 1.

22,486. W. F. Mason. Improvements in kilns for bricks, pottery, and the like. Oct. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

24,858. J. Maddock. A kiln hood for placing pottery-ware during fire. Sept. 30.

1896.

17,390. P. T. Sievert. Process and apparatus for the manufacture of glass sheets, glass tubes, and cylinders for the production of glass sheets and other articles. Sept. 30.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

20,432. J. Grunhut. Improvements in the manufacture of artificial stone. Complete Specification. Sept. 15.

20,603. G. G. M. Hardingham.—From F. D. Cumber. Improved means applicable for use in drying cement, slurry, liquid clay, and other substances in like condition. Sept. 17.

20,612. P. Kleber. A new or improved manufacture of artificial stone. Complete Specification. Sept. 17.

20,693. C. O. Trechmann. Improvements in the manufacture of cements, whitening, and the like, and in apparatus adapted for use in connection therewith. Sept. 18.

21,313. G. C. Levey and C. L. O'Brien. Improvements in the manufacture of artificial stone. Sept. 25.

21,781. A. C. Ponton. Improvements in the manufacture of fire-bricks and fireproof mortar. Oct. 2.

23,105. J. A. Just. Improvements in the manufacture of compositions for paving and like purposes. Complete Specification. Oct. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,331. E. Robbins. An improved cement and means and method for producing the same, and architectural and other works thereof. Oct. 7.

18,410. H. Hellewell. Preparation or manufacture of asphalt or cement for laying pavements, floors, or the like. Sept. 30.

19,101. A. Gosling. Artificial stone. Oct. 7.

21,735. A. B. Grieg. Construction of paving blocks for roads, footpaths, and other ways. Oct. 21.

21,870. F. Hinton and J. Day. Fireproof floors. Oct. 21.

1896.

8311. L. Preussner. Production of artificial stone. Oct. 21.

11,738. H. H. Lake.—From M. Friedheim. Plastic substances for building and decorative purposes. Oct. 21.

15,520. K. Hergenbalm. Process for the preparation of masonry (in marble, granite, syenite, sandstone, and the like) for pillars, pedestals, door and window cases, monuments, and the like, or other objects. Oct. 14.

16,258. A. Gibbs and Eastwood and Co. Burning bricks and other material, and apparatus therefor. Oct. 7.

17,799. E. T. Dumble. See Class XIII.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

14,330A. A. G. Brown. Improvements in the manufacture of rods and tubes mainly from aluminium and aluminium alloys. Complete Specification. Filed Oct. 17, date claimed June 29, 1896.

20,504. A. J. Boulton.—From H. L. Salman. Improvements in or relating to the recovery of precious metals from their solutions. Sept. 16.

20,510. J. Kidd. Improvements in connection with blast furnaces and the like. Sept. 16.

20,615. A. J. Boulton.—From Kochler and Co. Improvements in or relating to the obtainment of metals or metallic compounds from ore residues or other bodies containing them. Sept. 17.

20,679. H. Facer. Improvements in soldering aluminium. Sept. 18.

20,838. W. Noad and R. J. Lightfoot. Improved method for the extraction of and recovery of metallic copper. Sept. 21.

20,866. B. K. Jamison. Improvements in the treatment of crude or low-grade steel. Sept. 21.

21,012. A. J. C. Nettel. A new or improved process for the extraction of silver from refractory sulphide ores and apparatus connected therewith. Sept. 22.

21,038. W. Douglas. Improvements in the recovery of gold and silver and other metals from cyanide solution. Sept. 23.

21,394. J. W. Chenhall. Improvements in the treatment of arsenical and iron sulphide ores containing gold. Sept. 28.

21,428. J. Pullman. Improvements in the treatment of sulphide ores. Sept. 28.

21,827. S. Curteis. Improvements in the extraction of gold from ores or other substances containing same. Oct. 2.

21,976. A. L. Le Redotte. Improvements in processes for the manufacture of certain metals and alloys, especially for the manufacture of magnesium and its alloys. Oct. 3.

22,355. W. P. Thompson.—From A. Sinding-Larsen. Improved process for extracting metals. Complete Specification. Oct. 8.

22,361. J. Armstrong. Improvements in the extraction of lead, zinc, gold, silver, and other metals from sulphides, refractory or other ores or mattes. Oct. 9.

22,715. J. W. Clarke. Improvements in and connected with amalgamating apparatus for extracting gold and silver from their ores. Complete Specification. Oct. 13.

22,721. T. Storer. Improvements in the treatment of nickel ores for extraction of the nickel and the production of iron oxide pigment. Oct. 13.

22,791. T. Teague. Bar tin or metal casting machine. Oct. 14.

22,923. W. Beardmore and H. V. Holden. Improvements in casting armour plates, and moulds therefor. Oct. 15.

22,976. D. C. Dalzell and A. Fairley. Improvements relating to the annealing of steel or iron. Oct. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

15,356. J. W. Butler. Apparatus for extracting gold by means of mercury. Sept. 23.

16,303. J. Cobeldiek. Treatment of slimes or tailings for the extraction of gold or silver therefrom by means of solvents, and apparatus therefor. Oct. 7.

17,250. R. I. Roman. Aluminium compounds, and means for producing same. Sept. 23.

18,116. F. C. May. Process for the extraction of gold and silver from their ores. Sept. 30.

22,041. F. A. Ellis. Soldering or brazing metals, particularly applicable to aluminium alloys. Sept. 23.

22,732. C. A. Burghardt and G. Rigg. Process and apparatus for the electrolytic production of metallic zinc from ores of zinc, and metallic zinc and metallic copper from zinc ores containing copper, and the production of oxygen gas in the cases specified. Oct. 14.

22,812. H. S. Maxim. Extracting gold from refractory auriferous ores. Oct. 21.

1896.

9388. C. A. Burghardt and G. Rigg. Obtaining copper from copper ores. Oct. 21.

13,163. C. C. Schirm and A. Silbermann. Producing an even silver ground for underlying enamel. Sept. 30.

17,076. L. Albrecht. Tin-plate furnaces. Sept. 23.

18,081. C. P. Sherk, J. L. Rutter, and S. Weiss. Process and means for converting pig iron into malleable iron or steel. Sept. 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

20,505. H. Imray.—From R. J. W. Grindle. An improvement in electrodes for secondary voltaic batteries. Complete Specification. Sept. 16.

20,600. J. A. Deuther. Improvements in and relating to electrodes. Complete Specification. Sept. 17.

20,601. J. A. Deuther. Improvements in and relating to electric furnaces. Complete Specification. Sept. 17.

20,707. J. Greenwood. Improvements in coating tubes by electro-deposition. Sept. 18.

21,027. W. L. Wise.—From The Aluminium Industrie Aktien Gesellschaft. Improvements in electrolytic apparatus. Sept. 22.

21,273. J. E. Liardet. Improvements in or relating to electric storage batteries. Sept. 25.

21,509. J. G. A. Rhodin. An improved electrolyser or electrolytic apparatus. Sept. 29.

21,749. The Sussmann Electric Miners' Lamp Co., Ltd., and S. A. Rosenthal. Improvements in active material for secondary battery plates. Oct. 1.

21,826. T. Froggatt. Improved grids for plates in secondary electrical batteries. Oct. 2.

22,069. D. Young.—From La Société Anonyme "Accumulateur Éclair." Improvements in electric accumulators or storage batteries. Oct. 5.

22,129. H. Maxim. Improvements in methods or processes for electro-thermally treating materials for the manufacture of calcium carbide and the reduction of metals from their oxides or other compounds. Oct. 6.

22,423. L. Epstein. An improved manufacture of electrodes for secondary voltaic batteries. Oct. 9.

22,595. A. G. New. Improvements in electric accumulators. Oct. 12.

23,040. A. G. Adamson. Improvements in the construction of electrical accumulators and primary cells. Oct. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

17,745. H. H. Lake.—From C. Hoepfner. Electrolytic cells. Sept. 30.

19,669. A. Schanschick. Secondary battery plates. Sept. 23.

19,934. C. A. Burghardt and G. Rigg. Process and apparatus for the electrolytic production of metallic zinc and metallic copper from zinc ore containing copper, and oxygen gas as a by-product. Sept. 30.

20,828. W. Rowbotham. Primary electric batteries. Sept. 23.

20,843. C. P. Shrewsbury, F. L. Marshall, and J. L. Dobell. Electric batteries. Sept. 30.

22,207. C. Kellner. Electrodes suitable for electrolytic apparatus. Sept. 30.

1896.

17,549. J. B. Whittemore. Electrical primary battery. Oct. 21.

18,628. J. F. Baehmann, A. Vogt, C. C. Weiner, J. Kirchner, and A. König. Incandescence body for electric glow-lamps, and process of manufacture of the said body. Oct. 7.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

20,438. T. Coad. Improved means and apparatus for treating fat. Sept. 15.

20,755. C. Bilton. Improved lubricating composition for machinery bearings and the like. Sept. 19.

21,048. E. S. Wilson and E. Stewart. Improvements in the manufacture of soap. Sept. 23.

21,604. J. W. Hope. Improvements in or connected with the treatment of the residue or by-products resulting from the purification of cotton-seed and other vegetable or analogous animal oils, and the manufacture or recovery therefrom of certain valuable products or substances. Sept. 30.

21,999. J. W. Hope. Improvements in or connected with the refining of cotton and other seed or vegetable oils. Oct. 5.

22,390. J. Symons. An improved soap. Oct. 9.

22,424. A. G. Petty. Apparatus for purifying oils and fats. Oct. 9.

22,873. J. G. Hargrave and A. Hargrave. Improvements in processes for purifying and deodorising butter and other solid fats and oils. Complete Specification. Oct. 15.

22,981. T. H. Lawson and A. J. Lawson. Improvements in machinery or apparatus for cutting blocks of soap into slabs and bars. Oct. 16.

22,982. T. H. Lawson and A. J. Lawson. Improvements in and relating to vehicles for the transport of soap and soap frames in soap factories. Oct. 16.

23,025. F. W. Wright and The United Alkali Co., Ltd. Improvements in the manufacture and production of "dry soap" or soap-powder. Oct. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,760. S. E. von Graeve. New or improved process of manufacture of petroleum soap. Sept. 30.

21,557. P. C. D. Castle. New or improved detergent or tanning substance. Sept. 23.

22,332. J. B. McArthur. Liquid disinfectant soap. Sept. 30.

1896.

16,746. W. F. Haywood. Process and apparatus to be used in the manufacture of soap. Sept. 23.

16,766. J. Merz. Extraction of fats, oils, resins, sulphur colours, tanning materials, and the like by means of volatile solvents, and apparatus therefor. Oct. 7.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

20,295. H. Williamson. Improved means for mixing or blending pigments to obtain pigments of desired colour. Sept. 14.

20,753. H. Millington and T. H. Parry. An improvement in the treatment of india-rubber. Sept. 19.

20,932. P. Fenton. Improvements in the manufacture of artificial gutta-percha and caoutchouc-like substances. Sept. 22.

21,138. C. Thomas. An improved protective composition for application to galvanised and other iron, steel, and other metals as a foundation for painting, and to prevent rust. Sept. 24.

22,344. J. Jones. Improved manufacture of paint or similar composition. Oct. 8.

22,721. T. Storer. See Class X.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

19,130. P. C. D. Castle. New or improved chemical substance and the application thereof to industrial purposes, such as rubber, gutta-percha, or celluloid substitutes, insulations of electrical conductors, coverings for ships' bottoms, or wall or floor coverings. Oct. 14.

21,226. D. Z. Woods and W. P. Mackay. Improved composition for blacking and dressing leather. Oct. 7.

23,155. A. T. Hall. Preparation of colour wash or distemper paints. Oct. 7.

1896.

14,983. A. B. Browne. Manufacture of white lead. Oct. 21.

17,799. E. T. Dumble. Process for hardening bituminous substances. Oct. 7.

19,318. G. W. N. Hamilton. An enamel paint and combination of materials for composing same. Oct. 14.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

20,420. W. Dennison. Improvements in connection with the manufacture of leather. Sept. 15.

21,210. W. Clark.—From C. H. Boehringer and Sohn. Improvements in tanning hides and skins. Sept. 24.

21,774. H. Gardner.—From C. W. Luther. Improved manufacture of waterproof glue. Oct. 1.

22,103. J. Forster. Improvements in the method of and means for tanning hides and the like. Oct. 6.

22,965. F. Billing and A. Letalle. A new material to be employed as a substitute for leather, paper, and other analogous substances, and a process of manufacturing the same. Oct. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,879. L. A. Groth. Apparatus employed in tanning hides and skins. Oct. 7.

21,557. P. C. D. Castle. See Class XII.

21,720. C. D. Abel.—From The Chemische Technisches und Hygienisches Institut Dr. Popp and Dr. Becker. Improvements in lyes or liquors for preparing hides for tanning. Oct. 14.

23,310. A. Brogard. Process for the removal of lime from hides and skins after treatment in the lime bath. Oct. 7.

1896.

2993. A. Zendroni. A new adhesive and agglutinating substance. Oct. 7.

16,609. E. Avellis and E. Koster. Process for preparing chrome-dressed leather for dyeing purposes. Sept. 23.

20,154. R. W. James.—From S. Alimonda. Process for tanning hides. Oct. 21.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

20,509. A. Schlepitzky. A new or improved artificial manure or fertiliser. Complete Specification. Sept. 16.

22,666. C. H. Langdale and A. W. Langdale. Improvements in the treatment of ground slags intended for use as fertilisers. Complete Specification. Oct. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

18,635. T. Jamieson. Process for the manufacture of phosphates of ammonia and potash in an alkaline mixture suitable for manure. Sept. 30.

1896.

6405. N. F. B. de Merecy. Manufacture of manure. Oct. 21.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

20,434. L. F. Haubman. Improvements in apparatus for clarifying saccharine solutions. Sept. 15.

20,771. H. Helbing. Improvements in the manufacture of saccharine compounds. Sept. 19.

22,018. J. Cleave. An improved steam sugar boiler. Complete Specification. Oct. 5.

COMPLETE SPECIFICATION ACCEPTED.

1896.

18,138. C. F. Kastengren. Method of purifying molasses, syrup, or other solution of sugar by means of animal charcoal. Sept. 30.

XVII.—BREWING, WINES, SPIRITS, ETC.**APPLICATIONS.**

20,521. A. L. Burlin. Improvements in the manufacture of yeast. Sept. 16.

21,011. G. E. Jacquemin. A new or improved method of and apparatus for the manufacture of pure yeasts. Sept. 22.

21,022. A. E. Feroe. Improvements in a process and apparatus for treating malt liquors. Complete Specification. Sept. 22.

21,118. J. Kwiatkowski. New or improved process for adding iron to beer. Complete Specification. Sept. 23.

22,403. C. H. McEuen.—From J. T. Bennett. Apparatus and process for removing saccharine and other impurities from wine and spirits. Complete Specification. Oct. 9.

23,026. E. W. Walker. Improvements in the treatment or preparation of malt for brewing or other purposes. Oct. 16.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

17,611. J. Bradbury. Methods of utilising the waste products from breweries, distilleries, vineyards, and the like, including suitable machinery and apparatus for the same. Sept. 30.

18,296. J. W. Folkerts. Manufacture of yeast. Sept. 23.

20,130. R. Free. Preparation or treatment of beer. Sept. 30.

22,035. J. B. Grisez. A process for the aëration, oxidation, and oxygenation of wort. Oct. 7.

1896.

17,246. L. Prochazka. Process and apparatus for mashing and brewing. Oct. 21.

XVIII.—FOODS, SANITATION, ETC., AND DISINFECTANTS.**APPLICATIONS.****A.—Foods.**

22,696. T. O. Kent. A new or improved extract of coffee and the method of preparing the same. Oct. 13.

B.—Sanitation.

20,733. J. B. Petrie. A method or process and apparatus for the clarification and purification of liquid sewage or other foul waters. Sept. 19.

22,768. C. Fell. An improved filter for sewage effluent and the like. Oct. 14.

23,042. D. Cameron, F. J. Commin, and A. J. Martin. Improvements in apparatus for the treatment of sewage or other liquids. Oct. 17.

C.—Disinfectants.

20,792. W. O. Quibell, T. O. Quibell, O. Quibell, and W. B. B. Quibell. Improvements in sheep-dip powder. Complete Specification. Sept. 19.

COMPLETE SPECIFICATIONS ACCEPTED.**B.—Sanitation.**

1895.

17,828. C. Tellier. Manufacture of ice and the production of cold, and apparatus therefor. Sept. 30.

19,952. C. MacDonald. Manufacture of material for filtering water, sewage effluents, saccharine juices, alcoholic liquors, illuminating gas, and other liquids and fluids, and for use in the manufacture of steel. Oct. 21.

21,856. G. Watson. Furnaces for the destruction of town refuse. Sept. 23.

23,064. J. Hargreaves. Treatment of sewage and the obtention of valuable products. Oct. 21.

C.—Disinfectants.

1895.

20,355. G. C. Kinloch, C. Heap, and J. H. Butterworth. Production of compositions for treating sewage matters or other foul waters. Oct. 21.

22,332. J. B. McArthur. Liquid disinfectant soap. Sept. 30.

22,364. C. C. Whitaker. Manufacture of disinfectants and antiseptic compounds. Oct. 7.

1896.

1409. A. J. Boulton.—From F. Fritzsche and Co. Manufacture of an antiseptic disinfectant. Oct. 14.

XIX.—PAPER, PASTEBOARD, ETC.**APPLICATIONS.**

21,978. A. Masson. An improved method and means of drying and treating coated paper. Oct. 5.

22,848. R. A. McLaurin and Smith, and McLaurin. Improvements in the manufacture of paper. Oct. 15.

22,965. F. Billing and A. Letalle. See Class XIV.

23,094. C. E. Challis. Waterproof cellulose. Oct. 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,470. E. Margu. Cellulose compounds and articles manufactured therefrom. Sept. 30.

22,030. H. W. Reynolds. A new or improved material to be used in substitution of whalebone or horn, and process and apparatus for producing the same. Sept. 30.

1896.

13,242. W. Hankemoller. Process for manufacturing artificial whalebone. Sept. 23.

18,265. M. Honig. Manufacture of tannin extract from sulphite cellulose lyes. Oct. 7.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.**APPLICATIONS.**

20,622. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improved means of distributing formic aldehyde vapours. Sept. 17.

20,697. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. The production of a vinylacetonealkamine and of anaesthetics therefrom. Sept. 18.

20,773. J. J. A. Trillat. Improvements in the production of vapours of formic aldehyde, and apparatus for the same. Filed Sept. 19. Date applied for Feb. 25, 1896, being date of application in France.

21,026. W. L. Wise.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. Improvements in the manufacture of saccharine. Complete Specification. Sept. 22.

21,031. J. G. McIntosh. Improvements in the manufacture and application of terebenthene mono hydrochloride. Sept. 22.

21,106. G. B. Ellis.—From La Société Chimique des Usines du Rhone anciennement G. P. Monnet et Cartier. Improvements in the manufacture of vanillin. Sept. 23.

22,139. M. Dinesman. Process for the manufacture of substitutes for natural musk. Complete Specification. Oct. 6.

22,351. J. Y. Johnson.—From R. Koeppe and Co. Improvements in the manufacture or preparation of lactic acid. Oct. 8.

22,696. T. O. Kent. *See* Class XVIII. A.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,203. A. Eichengrün. New and useful bodies derived from iodoform. Sept. 30.

22,251. B. Zahorski, F. Hunter, and J. Brock. Improvements in the treatment of impure bisulph for refining the same. Sept. 30.

1896.

17,401. C. Fahlberg. Manufacture of saccharine or compounds thereof, or mixtures containing the same, and in the production and treatment of materials for use therein. Oct. 21.

XXI.—PHOTOGRAPHY.

APPLICATIONS.

20,307. M. Sappey. New or improved apparatus or means by which successive photographs can be produced. Sept. 14.

20,387. T. C. Marecau. Producing photographs in relief. Complete Specification. Sept. 15.

20,831. A. P. Okell. Improvements in apparatus for use in the development and treatment of flexible photographic films or tissues. Sept. 21.

21,495. W. S. Wain. Improvements in dishes or baths employed in developing and like photographic and chemical operations. Sept. 29.

22,680. W. Friese-Greene and J. Collings. Improvements in the production of coloured prints. Oct. 13.

22,689. W. Friese-Greene and J. A. Prestwich. Improved means for making and projecting kinetoscopic films. Oct. 13.

COMPLETE SPECIFICATION ACCEPTED.

1895.

22,757. A. Musker. Drying photographic negatives and the like. Oct. 7.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

20,537. A. G. Manifold. Improved matches, and cases for use in connection therewith. Sept. 17.

20,641. W. Norris. An improvement in the construction of blasting or other explosive cartridges or cartridge cases, thereby enabling explosions to which water is detrimental to be fired or exploded under or in water. Sept. 18.

20,675. M. Bielefeldt. Blasting cartridge. Sept. 18.

22,120. F. A. Halsey and W. C. Savage. Smokeless gunpowder. Complete Specification. Oct. 6.

22,162. J. C. Hamilton. Improvements in explosive compounds for blasting purposes. Oct. 6.

22,190. G. Kynoch and Co., Lim., and A. T. Cocking. Improvements relating to the manufacture of explosives. Oct. 6.

22,540. R. W. Streblener. A new or improved solvent or solvents for nitrocellulose, whereby improved solutions are obtained. Oct. 10.

22,717. G. Kynoch and Co., Lim., and A. T. Cocking. *See* Class VII.

22,718. G. Kynoch and Co., Lim., and A. T. Cocking. *See* Class VII.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,755. T. B. Wilson. Production of nitrogen compounds and apparatus therefor. Sept. 23.

21,995. W. F. Reid and E. J. V. Earle. Nitro-compounds. Oct. 14.

1896.

17,204. M. Bielefeldt. Process for the manufacture of explosives containing saltpetre. Oct. 14.

18,078. B. Wilcox.—From The Actien Gesellschaft Dynamit Nobel. An improved explosive or blasting composition. Sept. 23.

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NOTICES.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready about the end of the current year. It will contain both a subject-matter and authors' names portion and will be a volume of about 500 pages, uniform in size with the Journal.

The prices will be as follows:—

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Foreign and Colonial Members are reminded that the subscription of 25s. for 1897, payable on January 1st next, should be sent in good time to the Treasurer, in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation, should reach the General Secretary not later than January 15th, 1897.

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Goskirk, Alex., 28, Hillside Street, Edinburgh. Nov. 11th.

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Mr. Alf. E. Fletcher, F.I.C., F.C.S. "The Alkali Manufacture: An Historical Sketch."

Messrs. H. F. Hunt and L. J. Steele, A.I.E.E. "Spontaneous Oxidation of Aluminium in contact with Mercury."

Meeting held on Monday, November 2nd, 1896.

DR. R. MESSEL IN THE CHAIR.

THE PRODUCTION OF INOCULATING MATERIALS ("NITRAGIN") FOR USE IN AGRICULTURE.

BY J. AUGUSTUS VOELCKER, PH.D.

"NITRAGIN" claims to be a powerful agent capable of containing, as represented in a small bottleful, enough fertilising matter, and that of the right kind, for inoculating half an acre of the particular crop the name of which is marked on the bottle, with the organisms which shall enable it to utilise for itself the nitrogen of the atmosphere, and not only ensure an abundant crop of the particular plant, but also cause the soil, by its enrichment in stored-up nitrogen, to produce an after-crop of a nitrogen-loving nature, without the expenditure upon it of the considerable sums which it is usual to spend in the form of nitrate of soda and other nitrogenous fertilisers. This, then, is the purport of the introduction, and it is for us to see on what grounds the claim rests, whether there is reasonable probability of its success, and how far its production as a branch of chemical industry in the future is likely to be warranted. So far, I should say, "Nitragin" is confined in its application to crops of a leguminous nature, for they alone, according to our present knowledge, have the power of assimilating, under proper conditions, the atmospheric nitrogen. But it needs no great stretch of imagination to look to a possible development of the principle of inoculation of other agricultural crops by the fitting media. Before describing the actual commercial production of the article and its use, it is necessary, for a right understanding, to review the position of our knowledge as regards the nitrogen question and its practical application to agricultural ends.

After the successive rise and abandonment of the "humus" theory of Thaer and the "mineral" theory of Liebig, the "nitrogen" theory of Lawes and Gilbert became the prominent one, and has survived to this day in practical experience, as showing that it is pre-eminently nitrogen that is needed by agricultural crops, and that which they, as a whole, have the most difficulty in providing for themselves in sufficiency. Moreover, the experiments of Lawes, Gilbert, and Pugh, in 1857, under the particular conditions of their carrying out, showed that none of our ordinary field crops, the leguminous ones included, were able to directly assimilate the nitrogen offered to them in the atmosphere, but depended for their nitrogen on the supply of it to them in the form of manures, or as soil-nitrogen. So far as cereal crops and all others, except leguminous ones, are concerned, this belief has not been controverted

by any subsequent discoveries or experiments. But in regard to leguminous crops there had long been a divergence between theory and practice, and though the full explanation could not be given until a later date, when the famous experiments of Hellriegel and Wilfarth established a new truth, there was in the growth of leguminous crops and their influence on subsequent corn crops a something not explainable satisfactorily by the "nitrogen" theory. While corn crops and root crops clearly required nitrogen to be supplied to them beyond what was available for them in the generality of soils, leaving the soil subsequently the poorer in these constituents, clover and other leguminous crops not only thrive perfectly well without the application of nitrogenous manures, but left the surface of the soil far richer in nitrogen than it was before; in fact, a leguminous crop practically supplied a nitrogenous manuring for an after corn crop. And yet, in the face of Lawes and Gilbert's experiments as to the inability of crops to assimilate free atmospheric nitrogen, there was not sufficient explanation for this enrichment of the soil. But to the practical farmer the fact was perfectly well known and acted upon, as instanced in the beneficial working of a rotation of crops in which clover holds a place. Suggestions were now and again thrown out that, after all, the atmosphere might have something to do with explaining the seeming anomaly, and, as long ago as 1868, the late Dr. Voelcker, when showing how nitrogenous organic matter was stored up in the soil during the growth of a clover crop, and how it increased with the increase of the root fibres, went so far as to express the opinion that in some way that had not yet been explained the atmosphere *did* play a part in this storing up of nitrogen in the soil.

But it was not until the several years of steady work and patient enquiry in which Hellriegel had been engaged, culminated in 1886 with the pronouncement which he and his colleague Wilfarth were then able to make, that the true explanation of the influence of leguminous plants was supplied, and that it was then definitely shown that certain leguminous crops at least—among which were all the common field crops of this order—did possess the power, under favourable conditions, of assimilating and utilising the free nitrogen of the atmosphere.

This power, Hellriegel proved, they possessed through the medium of minute organisms, or bacteria, which existed in certain swellings or "nodules," as they were termed, found on the roots of these leguminous plants. The free nitrogen of the atmosphere held in the soil could be fixed by the organisms in the nodules, and in this way could be explained the storing of nitrogen by these plants, and the enrichment of the soil by their decay.

It is not necessary here to go in detail into the various steps by which Hellriegel and Wilfarth arrived at their conclusions, but it may be well to set out the principal lines of the inquiry. It had already long been noticed that the rootlets of leguminous plants growing luxuriantly in an ordinary fertile soil, bore on them certain swellings (the "nodules" already referred to), but their nature had not been investigated, nor had their possible connection with the question of the assimilation of free nitrogen been even hinted at. Hellriegel and Wilfarth, however, were the first to work out this connection. Their experiments were conducted on ordinary field crops, but grown in small pots filled with sterilised sand and kept moist as required, by distilled water free from nitrogen. A series of pots were arranged for each of the principal families of field crops, graminæ (cereals), crucifere (swedes), leguminosæ (peas, vetches), &c., and each was supplied with nutritive solutions containing the necessary phosphoric acid, potash, lime, &c., for plant growth, but containing no nitrogen whatever. Next, while to some of the pots in each series nothing else was added, to others a certain quantity of nitrogen in the form of a solution of nitrate of soda was added, to others double the amount, and so on. In the case of plants of the graminæ and all others except the leguminosæ, there was found to be no further development than could be accounted for by the combined nitrogen supplied. But in the case of the leguminosæ it was otherwise. Where no nitrogen had been supplied, the plants were mostly of stunted growth, having, it would seem, only

the nitrogen that the seed contained to live upon; but here and there were some that grew well, and, on examining the roots, Hellriegel and Wilfarth found that in the latter case nodules were present in quantity upon the roots, while there were none on the roots of the plants of stunted growth.

This observation set them to experiment further, and the next step was, by soaking up some fertile soil with distilled water and letting it settle, to make a water extract of it, and to add it to the pots containing the leguminous crops, but to which no nitrogen had been supplied. The plants in nearly all cases grew luxuriantly and formed nodules freely on their roots, but when the soil extract was sterilised before adding it, then there was no growth and no formation of root nodules. Peas, beans, vetches, clovers, &c., were found to act in this way, but certain others, such as lupins, serradella, &c., would not grow even with this soil extract. On watering them, however, with a similar extract, but made from a soil on which the particular crop was known to grow well, these plants, too, were found to flourish and to develop nodules, though failing to do so when the soil extract was previously sterilised.*

This observation of Hellriegel's has its counterpart in practice, inasmuch as it is known that lupins, for example, cannot be got to grow upon every soil, but that if some of the soil be taken from land on which they have been growing, and be spread as a top-dressing upon other land, then the crop may be able to establish itself. Hellriegel's experiment was, in effect, the obtaining of an extract which should contain the particular organism that favoured the growth of the particular crop, and he found that when that organism was present, the plant grew, produced nodules in abundance, and thrived proportionately, but that when the organism was excluded, by sterilisation or otherwise, there was no development of nodules and no growth. Neither Hellriegel nor his colleague Wilfarth was, however, a botanist, and it was left to Beyerinck, of Delft, Holland, to ascertain in 1888 what the precise nature of the nodules was, the result being that they were found to be bacterioid, and to contain specific organisms as bacteria.

Simultaneously with the growth and the formation of nodules came the accumulation of nitrogen in the plant, and this, being far in excess of any nitrogen supplied in seed or in extract, could, it was concluded, proceed only from the free nitrogen of the atmosphere held in the pores of the soil and fixed in the plant by means of the bacterioid nodules spoken of.

Hellriegel having thus established the connection between the development of nodules on the roots of leguminous plants and the fixation of atmospheric nitrogen, and having, moreover, shown that certain crops, such as lupins, required the presence of organisms peculiar to the soils on which these crops flourished, the way was open for the next development, that of Nobbe, the distinguished professor at Tharandt, Saxony, which is the one with which we are specially concerned now. Nobbe reasoned that if the successful growth of leguminous plants depended upon the development of the root nodules, and if certain of them could only be successfully inoculated by organisms which seemed peculiar to these individual crops, it would be well so to arrange that when a crop was grown one should make sure that the proper organisms were present. Each plant, he believed, possessed its particular kind of nodule, or, rather, these nodules contained within them bacteria which favoured, for that particular plant, the assimilation of free nitrogen. Hence he thought that by taking the nodules of healthy plants of each kind, and cultivating the organisms contained within them, he would prepare inoculating material which could be applied to like crops to that from which he had taken the nodules.

The plan of inoculating crops on the large scale by spreading over the surface of the area sown a top-dressing of soil from land where the particular crop had already been grown, was well known, though not the reasons for its success. Already for several years this had been done on a

large scale in Germany by Dr. Salfeld in his endeavour to reclaim vast tracts of moorland in the neighbourhood of Bremen, and it had been shown in Dr. Salfeld's practical field experiments that the best results attended the endeavour. But it was also known that this process of soil transference, besides being very costly, had certain disadvantages associated with it, notably, that not only would the desired organisms be transported, but that others also which were not wanted were introduced, while fungoid diseases, parasites, and other unfavourable elements might also be brought in at the same time. These difficulties Nobbe sought to avoid by adopting the method of "pure cultivation." This method consisted in taking the particular nodules, cleaning them thoroughly, breaking them open, and spreading their contents on a plate of specially prepared gelatin, on which they were then cultivated. After cultivation, one of the colonies was transferred to a second plate, and cultivation again proceeded with. This process was successively repeated, until at length what was believed to be a "pure cultivation" of the organism peculiar to the plant in question was obtained. This was, with the proper precautions, transferred to agar-gelatin contained in the bottom of a glass bottle or flask holding some 8 to 10 oz., and on this the pure cultivation was subsequently allowed to grow; the bottle was sealed, and the contents kept from the light. This is the form in which we have it before us to-day. To the material the name "Nitragin" was given, presumably from the Greek *αγειν*, Latin *agere*, "to make active." The name itself is rather an unfortunate one—at least in this country,—where its close resemblance in sound and writing to our word "nitrogen" may easily lead to its being mistaken for that. In Germany, however, where the word for nitrogen is "Stickstoff," no such confusion would be made.

Having thus secured what he believed to be the active nitrogen-fixing principle for the particular leguminous crops, Nobbe, together with his colleague Hiltner, proceeded to experiment extensively with it, and, having assured himself of its success, the next step was to introduce the material into agricultural practice and on a commercial scale. It was to a German firm—the well-known Farbwerke of Meister, Lucius, and Brüning, Höchst-on-the-Main, near Frankfurt—that the manufacture was entrusted. Dr. Pauli and Dr. Laubenheimer, the chief chemist, themselves conducted me over the works when I visited them in April last, and they kindly gave me every facility for seeing how "Nitragin" was prepared. There is, as I said, a separate department for this work, and in immediate charge of it was then Dr. Gesell, who had previously been working at Tharandt under Nobbe. Dr. Gesell was good enough to show me the methods by which, from the individual nodules of each kind of plant, the pure cultivations are prepared, and how, after they are obtained, they are bottled for use and distribution. He also showed me microscopical preparations of the different cultivations, and how the colonies are selected out for further cultivation.

It has accordingly come about that from the purely scientific work of Hellriegel, followed up by that of Nobbe, a new branch of chemical industry has been established which has for its object the rendering easier, by perfectly natural means, the fertilising of the ground for the growth of agricultural crops.

At Höchst there are separate preparations of "Nitragin" for each kind of leguminous crop, these being derived originally from the nodules of the particular plant. At the time of my visit there had been, so far, 17 different kinds of "Nitragin" prepared. But, inasmuch as Nobbe's experiments had further shown that bacteria from the nodules of certain plants did quite well also for inoculating plants belonging to families nearly related to the one taken, though they were not efficacious for those of families widely differing, the "Nitragin" preparations are classified into groups, and in the commercial practice each group is distinguished by a particular coloured label. Thus there are preparations of "Nitragin" for the common pea and for the field pea, of the pea family; for vetches and horse-bean, of the vetch family; for white, yellow, and blue lupins, of the lupin family; for red, white, and crimson clover, alsike, trefoil, cow-grass, and lucerne, of the clover family; for sainfoin, serradella, and lathyrus, while it was the intention

* This summary of Hellriegel's experiments is taken substantially from Lawes and Gilbert's paper, "The Sources of the Nitrogen of our Leguminous Crops" (Journal of the Royal Agricultural Society of England, 3rd series, vol. ii., part iv., December 1891).

shortly to add others.* The cost of a single bottle of any of the preparations is, in Germany, 2 M. 50 pf., equivalent to about half a crown here; and the contents of one bottle are supposed to be enough for inoculating half an acre of the crop which is to be grown. Accordingly, in addition to labour, the extra cost of the application would come to about 5s. an acre—a by no means large sum,—which one would be wise in incurring, if one could ensure that the crop to be grown would be able thereby to draw upon the plentiful store of atmospheric nitrogen waiting to be used free of cost.

The method of application of "Nitragin" is twofold. The simplest, and the one involving practically no cost beyond that of the purchase itself, is the method of inoculating the seed to be sown. The seed is put in a bucket, and water in sufficiency to just moisten it is poured over; the contents of the "Nitragin" bottle are made liquid by the air of very gentle warmth (not above 30° C.), and are then poured out into the water in the bucket, the bottle rinsed out with more water, and then the seed, water, and "Nitragin" are thoroughly mixed till every seed is moistened. After this the seed is dried up by adding a little of the soil from the field on which it is to be sown, or with dry sand, and is then ready for sowing in the usual way.

The other method, involving more labour, but believed to be the more effectual, is to inoculate, not the seed directly, but the soil of the field that is to be sown with the crop. This is done by taking for each half-acre of land that is to be cropped about $\frac{1}{2}$ cwt. of the earth from it, and, as before, pouring out the contents of the "Nitragin" bottle over it, and mixing the whole. It may be left exposed for a short time to dry, or more dry earth or sand may be added. Thus the soil becomes inoculated, and it is next spread evenly over the whole area to be cultivated, and should then be lightly raked or harrowed in to a depth of about 3 in., after which the seed may be sown in it as usual.

As between the two methods of inoculation—seed or soil—certainly has not yet been established as to which is the better, but Nobbe recommends that of soil inoculation, inasmuch as, though more troublesome and expensive, it would seem likely to be better, because the nodules, being developed on the root fibres, these would have a better chance to come in contact with the organisms thus distributed throughout the soil than they would if the organisms remained to some extent merely on the exterior casing of the seed. This is, however, a point to be tested by experience, though farmers would undoubtedly prefer the less cumbersome method of steeping the seed—one with which they are familiar, as in the so-called "pickling" of seed with sulphate of copper, &c., as a protection against rust and other pests.

Now there are certain very important precautions which have to be observed in regard to these "Nitragin" preparations, the neglect of which must result in failure, and which may, as they have already done, induce many to consider that "Nitragin" is of no use whatever. Trials made by practical farmers already have been known to fail through inattention to necessary details, and the Hochst-Fabrik has therefore recently issued a circular calling special notice to the precautions for use. The chief of these are: (1st) not to subject the "Nitragin" at any period to a higher temperature than that of the body, and (2nd) not to let the preparation be exposed to a strong light. In liquefying the contents only lukewarm water should be used to steep the bottle in, or merely taking it into a warm room for a short time is ample. The most practical way, as Dr. Pauli laughingly showed me, is to put the bottle for a few minutes in one's trouser pocket! The bottle, too, should be kept with a wrapper over it.

Another precaution that must be observed is not to allow either the inoculated seed or the earth that has been similarly inoculated to lie about for any length of time, nor exposed to any strong light, before applying it to the land. The operation of infecting seed or soil must be done just preparatory to application to the land, or failure will result. This should be carried out in a cool, shaded place, or the activity of the bacteria will be imperilled.

Another necessary caution in trying experiments with "Nitragin" is that, inasmuch as "Nitragin" only provides a nitrogenous manuring, the failure of it, where such is noticed, may be possibly due to the absence of a sufficient supply of mineral food in the form of phosphates, potash, &c. It is therefore advisable in such experiments to apply phosphatic and potassic manures as well, in order to make sure of their presence in sufficiency. Another mistake which I find farmers frequently make is to think that the application of "Nitragin" to an already established crop of clover, &c. will do good. It is at the early stages of the growth that the rootlets get the nodules formed upon them, and that their activity is greatest, whereas as the plant gets to maturity the nodules, as Lawes and Gilbert have shown, get used up, having parted with their nitrogen, and disappear.

As regards the duration of the activity of "Nitragin," it is believed that the bacteria will retain their efficacy for a period of about four months, and probably still longer, but, to be on the safe side, the preparation should certainly not be above two months old.

This is a fitting point at which to review the conclusions arrived at by Nobbe from his examination of the different "pure cultivations" and of their action in the case of individual leguminous crops.

Nobbe was led to conclude that each organism probably had its individual efficacy for the particular crop from which it was derived, and either none or a weakened one for other leguminous plants than that one. This he found by experiment to be in a more or less degree the case. When he took pure cultivations from the nodules of the pea plant he found that inoculating the pea plant with it produced excellent results, while if he tried it with vetches, the result, though good, was not so good as before; on the other hand, the inoculation with the pea cultivation did not produce any effect on clover, serradella, &c., and if he took pure cultivations from clover they would not do any good with peas, though very efficacious for plants of the clover family.

Thus the difference was one rather of degree, the activity being greatest for the plant from which the organism was derived, and diminishing gradually as one went to plants less nearly related to the original one. Further than this, Nobbe was led to conclude that the organisms under the influence of symbiosis with the particular plant underwent some change by which their descendants became so impressed by the plant as to be capable afterwards of only influencing to the full extent those plants which belonged to the same family as the parent one, but lost the power more or less for those not closely related to it. Hence, in the case of a soil heavily cropped for some time with a leguminous crop, the organisms might be so impressed with the character of the particular crop that, when another not nearly allied to it was put in, the bacteria were not able to influence it, and, in such a case, inoculation with bacteria of the kind derived from nodules of the new crop—in short, with the proper kind of "Nitragin"—might be required in order to produce the formation of nodules, the assimilation of nitrogen, and the healthy growth of the new plant.

Thus a state of things might quite well occur, as was shown to be the case with lupins, when, though leguminous crops had been grown and the soil had abundance of organisms in it, yet these were not of the right kind, through being too strongly impressed with the characteristics derived from the parent plant.

Nobbe also made experiments in order to determine in what condition of the soil the nodule-activity was most efficient, and he found that it was when the soil-nitrogen was nearly used up that the nodules showed the most activity, and that the difference between an inoculated crop and one not inoculated was the most marked. If there was abundance of soil-nitrogen, then it was quite likely that no difference would be found between plots inoculated and those not inoculated. It followed also from this that plants, such as peas, vetches, &c., which grew quickly and were likely to use up the soil-nitrogen in their rapid growth, would be better ones for showing the influence of inoculation than other more slowly-growing crops like clover.

I certainly came away from Germany with the impression that it was impossible, from microscopical examination of

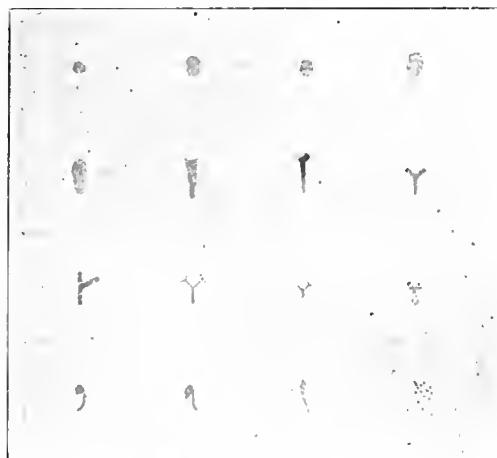
* Since the above was written I hear that the following have been added:—*Vicia villosa*, Bokhara clover, and kidney vetch.

the bacteria, to say definitely whether they had come from nodules of the pea, or lucerne, or clover, and so on. But I have since been told that this is not altogether the case; for, though without previous knowledge of their origin, one might not be justified in pronouncing distinctly that this is a red clover bacterium or the other a lucerne bacterium, yet there are certain distinctions in appearance which may serve to the identification of each, more or less closely. This has been communicated to me recently by Mr. F. R. Armytage, of Shrewsbury, who has been working at the subject for the last two or three years, and he has also sent me some photographs taken from cultivations of several different kinds. These he has allowed me to use, and certainly it would appear from them that there is not such a want of definition as I was led to suppose. The photographs, and especially that of gorse, do show distinctive features by which it would seem that they might quite well be differentiated. But on this point I have no personal knowledge, and merely append the photographs; they are taken at about 720 diameters, through the microscope. Mr. Armytage writes:—

"I especially invite your attention to the one of 'Gorse.' I have not found this form (No. 14 on the diagram) in the nodules from any other plant, the nearest approach being the zomna-shaped No. 13 from Broom. No. 15 represents what I invariably find on lucerne, and Bokhara clover (a near relation) affords organisms somewhat similar. No. 11 is very characteristic of a large number of slides of *Vicia sativa*—note the repeated branching. A form resembling No. 5, I always find on *Trifolium*."

FORMS OF ORGANISMS FOUND IN THE NODULES ON ROOTS OF LEGUMINOUS PLANTS.

Fig. 1.



[Copyright. Prepared and photographed by F. R. Armytage.]

Key Plan.

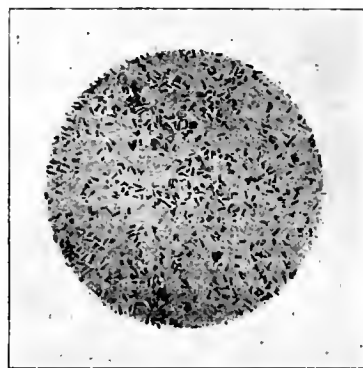
1. Micrococcus Form.	2. Diplococcus Form.	3. <i>Trifolium</i> .*	4. <i>Trifolium</i> .*
5. <i>Trifolium</i> .*	6. <i>Trifolium</i> .*	7. <i>Trifolium</i> .*	8. <i>Trifolium</i> .*
9. <i>Lathyrus Sylvestris</i> .	10. <i>Faba Vulgaris</i> (Broad Bean).	11. <i>Vicia Sativa</i> (Vetch).	12. <i>Trifolium Hybridum</i> (Alsike).†
13. <i>Cytisus Scoparius</i> (Broom).	14. <i>Ulex Europæus</i> (Gorse).	15. <i>Medicago Sativa</i> (Lucerne).	16. Spore-like Bodies.‡

* All these (3—8) are forms characteristic of the *Trifolium*, especially *Trifolium Pratense* (red clover) and *Trifolium Repens* (white clover). They probably represent different stages of growth, § being typical of fully developed organisms.

† The transparent spots are possibly spores.

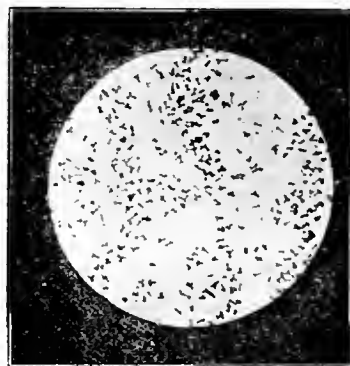
‡ From fully developed nodules.

Fig. 2.



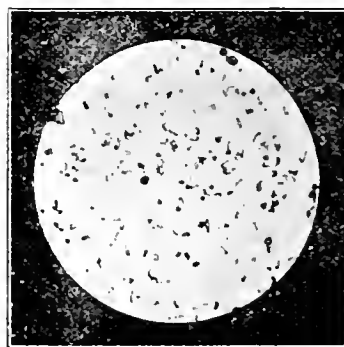
[Copyright.] ORGANISMS FROM *TRIFOLIUM PRATENSE* (RED CLOVER).

Fig. 3.



[Copyright.] ORGANISMS FROM *VICIA SATIVA* (VETCH).

Fig. 4.



[Copyright.] ORGANISMS FROM GORSE.

I have subsequently received independently from Mr. John Golding, of University College, Nottingham, some similar photographs, illustrating the differentiations which Mr. Armytage points out. Mr. Golding adds: "It is found that on cultivating these organisms on gelatin or other nutritive media the differences disappear, and the organisms cannot be distinguished from one another by the aid of the microscope." This is significant in view of what I heard from Dr. Nobbe.

We come next to consider what the results of experiment with "Nitragin" on a practical scale on ordinary agricultural soils, and not merely by pot culture in special soil,

have been. The obtaining of "Nitragin" in a commercial way not having been accomplished until the time of my visit to Höchst (April 1896), the season was already rather far advanced to enable many, even in Germany, to experiment with it. Still I did see two places where "Nitragin" had been applied to acre plots of crops of peas and tares on ordinary land, side by side being plots similarly sown, but not treated with "Nitragin." The most that I could say was that the treated plots looked just as well, perhaps a little better at this early stage, than the untreated ones, and on examining the roots there certainly appeared to be more nodules where "Nitragin" had been used. Through the kindness of the directors of the Höchst Farbwerke I was supplied with several bottles of the special "Nitragin" for the leguminous crops we generally cultivate in this country, and with these I arranged for the carrying out, so far as it was still possible, of some practical field trials with the new material, under ordinary conditions of farming. Of these I must give a short description, and exhibit also a few photographs, which show some of the crops at two different stages of their growth. But in mentioning these experiments I must do so with great reserve, for not only was the season too advanced for trying them satisfactorily, and so the results could at best be but tentative in character, for, as you all know, the summer was one of an exceptionally hot and dry character, most unfavourable in every way for the growth of clover and other leguminous crops, and for the carrying to any satisfactory issue of an experiment of this kind. So I can only give them for what they are worth, and with all reserve, but I have at least set them out just as they were given me, or found by me to be, whether good or bad, in favour of or against the theory put forward. One trial was carried on on a farm in Sussex, with vetches; on one half-acre of land the seed was first inoculated, and on the other half-acre not. In both cases the crop was an excellent one, there being no apparent

Fig. 5.



GREEN PEAS (June 9, 1896).

- I.—Soil treated with "Nitragin."
 II.—Seed treated with "Nitragin."
 III.—Not treated.

difference between them. The vetches were to be ploughed in as green-manuring for a crop of wheat, and so no weighing results are yet obtainable. I found, however, that the soil was one of a rich nature, and as the vetches grew exceedingly well when not inoculated, there was practically no scope for the "Nitragin" telling further, and, no doubt, there were already present in the soil the necessary organisms, as shown by the growth of the crop on the untreated plot. So this was not conclusive. At the Woburn experimental farm I was able, with considerable difficulty, in consequence of the prolonged drought, to commence a series of experiments myself; and, in addition, two other series were undertaken, with my supervision, by Mr. Howard Ryland, of Moxhull Park, Erdington, Warwickshire, and by Messrs. Sutton and Sons, at Reading. In every case, however, the drought so interfered with the sowing and coming up of the crops that, apart from its being a first year's trial, the experiments can only be regarded as of a preliminary nature.

Fig. 6.



FRENCH BEANS (June 9, 1896).

- IX.—Soil treated with "Nitragin."
 X.—Seed treated with "Nitragin."
 XI.—Not treated.

At the Woburn experimental farm I made experiments with the following crops:—Beans, peas, tares, lucerne, sainfoin, serradella, red clover, white clover, alsike, cow-grass, and trefoil. Of these, the beans, peas, and tares would be the only crops to finish in the one season, and as I only had the "Nitragin" early in May, the proper time for sowing the crops was virtually past. Moreover, there were only still available odd bits of ground, and not situated as I would like to have them for exact experiment. The land was ordinary agricultural land—a light sandy loam—and all three crops had been grown, at one time or another, in previous years, so that there was no difficulty, that we knew of, respecting their growth. I tried one half of each plot with soil inoculated with the "Nitragin" for the particular crop, and the other half untreated. Owing to the late sowing and the great drought, the plants did not come to

maturity at the proper time, and had to be cut green. All that I could really say about them was, that the inoculated plots were as good, but not better, than the untreated ones. When the plants began to grow, I had individual ones taken up, in order to examine the rootlets. In the case of the beans and peas, it certainly did seem to be the case that root development was greater on the "Nitragin"-treated plots than on the untreated, but nodules were plentiful on each. With vetches, the untreated plants seemed the better. On similar odd plots on the same field, lucerne, sainfoin, and serradella were tried, each in three ways:

Fig. 7.



BROAD BEANS (July 14, 1896).

IV.—Soil treated with "Nitragin."

V.—Seed treated with "Nitragin."

VI.—Not treated.

(a) soil treated with "Nitragin"; (b) seed treated with "Nitragin"; (c) untreated. Here, again, the drought seriously interfered, and from the newly-sown lots only small first cuttings could be obtained. In the case of both lucerne and sainfoin, rather the best plots were those where the soil had been inoculated previous to sowing, but to give the actual weights obtained would be misleading. These plots will continue for another year or more.

The more extensive series were the experiments on different clovers (red, white, alsike, cow-grass) and trefoil, but from these, more especially in such a dry season, no cutting would be obtained the first year, and the plots must stand another season before anything can be concluded from them. The plots here were on land that was known, by previous experience, to be "clover-sick," it having been found impossible to keep any of the clovers growing on it for above two years. The principle on which the plots were arranged was that there were seven small plots in each of the five crops (*viz.*, four clovers—red, white, alsike, cow-grass—and trefoil). One plot was left untreated, one sown with mineral manures (superphosphate, sulphate of potash, and gypsum) and nitrate of soda, but not inoculated. On a third plot the seed was inoculated with the appropriate "Nitragin." On a fourth the soil was similarly infected, while the other three plots were given soil inoculated with "Nitragin" of kinds other than that specially designed for it. Red clover, for example, had white clover,

trefoil, and lucerne "Nitragin" respectively; trefoil had red clover, white clover, and lucerne "Nitragin," and so on. This plan was, of course, devised not only for telling whether inoculation was beneficial, but whether soil or seed inoculation was preferable, and whether inoculation with "Nitragin" from plants other than the particular one grown would be effectual or not, as well as whether an equal result could not be obtained by using nitrate of soda along with mineral manures, and without inoculation.

Mr. Howard Ryland, of Moxhull Park, Erdington, Warwickshire—a member of the Council of the Royal Agricultural Society—carried out this year also some similar experiments on a garden soil. The crops tried were green peas, broad beans, sweet peas, and French beans; while, in a further trial, green peas were grown in builders' sand. The inoculating "Nitragin" was here, in all cases, that of "*Pisum sativum*," the pea. Sowing could not be done before May 16th, and the drought interfered most seriously with the results. Soil inoculation and seed inoculation were tried, as against no treatment. Plants were taken up from the different plots on two occasions, *viz.*, on June 9th and on July 16th, and these were photographed. The photographs, which I set out here, will show how far any deductions may be drawn. Taking them as a whole, it may be generally said that inoculation of the soil proved the most efficacious, and that both it and inoculation of the seed were superior to no treatment, although there were one or two cases where the untreated plants were the better, and two cases where there was nothing to choose. Green peas, broad beans, and sweet peas were benefited; in the case of French beans, the result was doubtful. Enlarged photographs of the roots of the plants were also taken, and here, too, the treated broad beans, sweet peas, and green peas show the better developed roots and more nodules. The greatest difference was in the sweet peas, the growth of top, and also the root development, being much greater where the soil was inoculated than where it was not.

The last set of English experiments that I have to mention is one kindly undertaken by Messrs. Sutton and Sons, of Reading, on their ordinary trial ground. This is a long series, and includes the following 15 crops:—Sainfoin, lucerne, red clover, white clover, kidney vetch, vetch, serradella, *lathyrus silvestris*, yellow lupin, blue lupin, melilotus, trefoil, trifolium, peas, and beans. Here again the inoculation of the soil and that of the seed have been compared, and "Nitragin" has been used for other crops than those for which it was primarily intended. In all, there are 45 different plots, and what gives additional interest to the trial is, that on the plots sown with single-year crops—like peas, beans, tares, &c.—a corn crop (wheat) will be grown after them, in order to see if the result of the inoculation has been an increase in the amount of nitrogen accumulated in the soil. As at the other experimental spots, the dry season militated most severely against success, and the trial must be considered here, too, as mainly of a tentative character. Sowing was done from May 14th to May 22nd, and notes of the appearances of the different plots have been regularly taken by Messrs. Sutton, while I inspected the experiments myself on July 3rd. At this time I examined, in company with Mr. Leonard Sutton, individual plants from each plot, chiefly with a view to seeing if there was more root growth and more nodule formation on the inoculated plots than on those not so treated. The general conclusion arrived at on that date was that, taking the crops generally, there was no marked increase visible so far as top growth went, except in one or two cases, though the treated plots were, on the whole, the better; but that, as regards root growth, this was decidedly stronger on the inoculated plots, and nodule formation was more active. Thus, out of the 15 different crops, in the case of 12 of them there was more root growth on the treated than on the untreated plots, while in three instances only was the reverse the experience. The three exceptions were kidney vetch, peas, and beans, the last two inoculated with "Nitragin" from lucerne and also from vicia faba. It should be stated, however, that beans had previously grown on the land, and hence it was most probable that the organisms suitable for bean and pea growth were already abundantly present. Of the crops that were sufficiently advanced to give a crop or cutting the first year,

the following are the comparative results obtained in October on the small experimental plots:—

Crop.	Not Treated.	Treated with appropriate "Nitragin."	Treated with "Nitragin" of another Crop.
	Green Weight, Lb.	Green Weight, Lb.	Green Weight, "Nitragin," Lb.
1. Lucerne.....	30½	35½	(Sainfoin) 29½
2. Red clover.....	50½	57	(White clover) 59
			(Lucerne) 101½
3. Yellow lupins.....	51	..	(Red clover) 86
			(White clover) 74
4. Bokhara clover....	80	..	(Lucerne) 82
5. Crimson clover.....	28	..	(Red clover) 31
6. Serradella.....	175½	..	(Lucerne) 145
			(Red clover) 165
7. Trefoil.....	91½	..	(White clover) 78½
8. Broad beans.....	Seed. 3½	Seed. 3	(Sainfoin) 4

I have given the foregoing results just as they have been obtained, without any selection whatever of what seemed to tell in favour of the theory advanced. Another point is noticeable, that, my object being primarily to see whether the method of soil and seed inoculation was likely to be of any value in practical agriculture in this country, I did not select soils which were the most likely to respond favourably, but such as would be in ordinary cultivation. Though I am free to allow that, chiefly owing to an adverse season, the experiments at none of the three stations can be considered as fully satisfactory or as in any way conclusive, yet as a first year's trial, under conditions most unfavourable, I think you will agree with me that there are sufficient indications that the practice will be one attended with benefit. How far that benefit will extend must depend largely upon the nature of the soil and what has been previously cultivated on it. The general conclusion may, I think, so far, be fairly drawn that inoculation of leguminous crops, while not giving lesser but frequently increased growth, does certainly, as a rule, produce greater root development and more nodule formation. As between seed and soil inoculation there is not conclusive evidence, but the balance seems to be in favour of soil inoculation. Nor does the necessity for inoculation with the "Nitragin" derived from the same crop as that to which it is applied come out at all forcibly. Granted that there is more root development, the interesting point to determine is whether the after-crop will be better—whether, in fact, the storing up of nitrogen can be utilised. This will be the work of another year, as also the elucidation of the main question by a wider series of practical trials.

DISCUSSION.

The CHAIRMAN having invited discussion,

Dr. H. E. ARMSTRONG said that as he had visited the works where "Nitragin" was produced, in September last, he might say a few words about it, merely in order to start discussion. He agreed with Dr. Voelcker that the manufacture of such a product was a striking exemplification of German chemical enterprise at the present day. He did not know a chemical works anywhere which, in so small a compass, showed such an extraordinary amount of originality and enterprise as did that of Messrs. Meister, Lucius, and Brünig. "Nitragin" was only one of their new products: it was well known that they had recently taken up the manufacture of diphtheria serum on a large scale, and they were manufacturers of antipyrine, as well as of aniline colours. He might refer also to the use they made of formic aldehyde, the manufacture of which had risen from the infinitesimal quantity produced in 1867, when it was discovered by Hofmann, to many tons at the present day. These were illustrations of what was done at Höchst with the aid, not of forty chemists, as stated by Dr. Voelcker, but of over a hundred; and there was no doubt that the

results obtained amply justified the policy of the company in question. Turning to the paper under notice, he would remark that all the observations made by Hellriegel had been confirmed by Lawes and Gilbert at Rothamsted. Rothamsted had throughout taken an important part in this work, which had been one of the greatest surprises brought to the notice of chemists in recent years. Nitrogen was generally regarded as an element of extraordinary inactivity; but there could be no question that atmospheric nitrogen was absorbed by the nodules which had been described, although no one at present had the faintest idea how. No case was yet known to chemists of gaseous nitrogen being absorbed or entering into association with any other element at low temperatures. The action therefore must be one of a very unusual and striking character, and difficult to understand. No doubt great discoveries would await the further investigation of the subject in that direction, for if we could succeed in combining atmospheric nitrogen with hydrogen or oxygen, and so make artificial ammonia or nitrate, it would be a most important achievement for agriculture. From that point of view the further investigation of the low-temperature chemistry of nitrogen was of the deepest interest to the Society. Probably, however, the nodules performed some other function besides that of merely leading to the absorption of nitrogen, for apparently leguminous plants could not grow without them. Directly the soil was infected with the nodules—provided the necessary mineral constituents were present—a vigorous growth set in, which was accompanied by absorption of nitrogen. Under normal conditions the plant, apparently, to a large extent, availed themselves of the soil nitrogen, and only when that failed them did they assimilate atmospheric nitrogen. So the function of the nodule was a complex one. The great question with regard to the use of the different "Nitragins" as fertilisers to be answered in the future was, how soon would exhaustion, or one or other of the varieties of leguminous sicknesses, set in? What had been done so far did not at all explain the cause of clover sickness. Sir J. B. Lawes had been growing clover in his own garden for forty-five years, yet in his fields he could not sow two crops in succession. That was good evidence that the failure of the plant to prosper was not due to the exhaustion of the organisms. The only difference between the two plots was that the one in the garden had been manured as a kitchen garden for many generations, and there was a huge accumulation of the proper food in the soil, whereas apparently in the neighbouring field, as there was no such store of available nutriment, the supply was soon used up, and it took a long time before the conditions were such as to enable another crop of the same sort to be raised.

Dr. G. SCHACK-SOMMER said that there could be no doubt of the importance of the discoveries brought forward by the author. At the same time he was unable to see how, from a practical point of view, they could be made useful in agriculture. If the discovery had been made in the 'Seventies, when sulphate of ammonia was 24l. per ton, it might have been of great value, but with sulphate at 6l. 17s. 6d. it was quite another thing. Nothing that Dr. Voelcker had said indicated any advantage in bringing the nitrogen into the plants by means of these bacteria, in distinction to taking it from the soil to which it had been brought in the form of manure. It was therefore only a question of pounds, shillings, and pence. True, the author had referred to the soil itself being enriched by the organisms; but that was only in case they allowed the plant itself to decompose there—a practice which was followed on the Continent long before agricultural chemistry had reached its present condition. If, however, plants were removed as a crop, they would take with them all the nitrogen they had gathered from the air. He could therefore only regard the discovery brought before them in the light of a very interesting experiment.

Dr. W. SOMERVILLE had made experiments with "Nitragin" at about the same time as the author, namely in May last. He had tried it on various crops, *viz.*, red clover, white clover, lucerne, peas, and beans, and had used the utmost care in following the treatment recommended by Meister,

Lucius, and Brüning. He had used it in the two ways described by the author, namely, by adding it directly to the soil, and by mixing the liquefied "Nitragin" with water and then applying the liquid to the crop by means of an ordinary garden can. He had tried it on peas in his own garden, in which such plants had grown for years; on clover in pots and in the open; on lucerne in pots and in the garden; and on a field of lucerne sown two years before. This lucerne, sown in 1895, was looking sickly in the spring of 1896, and was apparently pining for something, possibly the required organism. He regretted to say, however, that in every experiment, with the single exception of the peas, he had failed to get any good results from the use of the "Nitragin." He further regretted to note that the firm interested in the production of the material had already found it necessary to more or less discount failures by issuing a letter to the German press in which they explained that the failures which were so frequently referred to by correspondents were due either to exposing the material to too much light or too much heat, or keeping it too long. From this, and from his own experience, he concluded that "Nitragin," however interesting from a scientific point of view, was not likely to prove the salvation of English agriculture.

Dr. H. E. ARMSTRONG wished it to be clearly understood that Dr. Somerville had applied the "Nitragin" by watering growing plants, and he thought it unjust that he should sweepingly condemn the invention when he had used it in such a way as to give him no right to expect good results from it.

Dr. SOMERVILLE replied that his experiments were not confined to watering growing plants. He had also applied the "Nitragin" by mixing it with the seed and with the soil, and in no case did beneficial results follow.

Dr. VOELCKER wished it to be clearly stated whether Dr. Somerville had applied the "Nitragin" to growing crops, or whether it was used when the seed was sown.

Dr. SOMERVILLE replied that he had used it both on crops actually growing and on crops sown in the spring, and also, in the case of lucerne, on the crops sown in the spring of 1895, as well as in the spring of 1896.

Dr. VOELCKER was still not clear on one point. Dr. Somerville had said he had applied "Nitragin" to crops sown in the spring of 1896. Were the crops sown previous to the application of the "Nitragin," and, if so, how long previous?

Dr. SOMERVILLE replied that they had in some cases taken the seed and actually mixed it with the solution of "Nitragin," adding just sufficient soil to bring the seed into condition for sowing as recommended. They had also applied "Nitragin" to other plots by means of an ordinary garden watering-can.

Dr. S. RIDEAL could not claim to have any special knowledge of the subject before the meeting, but would like to mention that he had recently met Dr. Clark, the lecturer on Rural Economics at Leeds University, who was then conducting experiments with "Nitragin," from which he had obtained very favourable results. It might be desirable to ask Dr. Clark to state these results in the form of an addendum to the paper. He would suggest also that the failure to obtain equally good results in all cases might be due to the fact that the organisms concerned degenerated, owing to artificial reproduction. He would like to ask the author if any experiments had been undertaken to ascertain whether any such degeneration during the cultivation of the organisms on gelatin took place. It was possible, too, that these organisms, as they seemed to be capable of living on gelatin without atmospheric nitrogen, might prove useful, not only in agriculture, but as a means of breaking down nitrogenous substances in sewage filter-beds. With regard to the variation of the organisms in form, it struck him that that might be accounted for by a difference in the age of the organisms, it being well known that that was the case with respect to other bacteria. Referring to Dr. Armstrong's remarks that certain English hospitals had obtained diph-

theria serum from the manufacturers of "Nitragin," it was satisfactory to know that that body was now being manufactured in this country, and that the serum produced here was much more powerful than that supplied from Germany.

Dr. BERNARD DYER considered that the most important aspect of "Nitragin" was its possible bearing upon clover sickness. The nature of that sickness was still involved in mystery, but there was a growing feeling that there was probably some connection between it and the organisms treated of in Dr. Voelcker's paper, and that probably the solution of the question might be found in connection with their further study. One difficulty, however, in the way of accepting this view was this: If red clover, for instance, had its special organism, and if that particular organism had no other function in the soil but to ensure the nutrition of red clover, one would imagine that, in the ordinary rotation of crops, the organisms would be more likely to exist in sufficient number and vigour every four years rather than in every eight years. Such, however, was not the case. Possibly the organisms themselves might be subject to diseases or parasites, causing them to die out or become weaker in their action, and the reinforcement of the soil from a new stock might thus become necessary. Such was undoubtedly the case in other and higher forms of vegetable life. In the light of the facts brought before them by the author it was easy to understand how lupins were difficult of growth in this country, while on the Continent they could be grown almost anywhere. Reference had been made to the classical researches of Dr. Voelcker's father in 1868 on the benefits of a clover crop as a preparatory crop for wheat. He would like also to refer to another paper by the same author of considerably earlier date, *viz.*, in 1850, on the subject of lupins, showing how he had made an effort to get lupins acclimatised and taken up in this country, and had given a most interesting account of his experiments. On one farm he grew them without difficulty, while on another they could not be induced to grow, no doubt because the special microbes were absent. There was one point upon which he would be glad to be further informed. In making his comparative experiments with ordinary seed and seed treated with "Nitragin" by soaking, did Dr. Voelcker also soak the untreated seed? It was a well-known fact that the mere soaking of seed, apart from any other treatment, often had a most important effect on the germination of that seed, and this might affect in some cases the subsequent vigour of the plant.

Mr. T. ROYLE remarked that it was a common practice in South Carolina to prepare land for the cultivation of wheat or other grain by sowing it with cow peas, and ploughing the crop in to act as a fertiliser.

Mr. P. DVOROVITCH wished to draw attention to one point which had not been referred to in the paper. It was, he considered, highly important for the success of experiments with such fertilisers as "Nitragin," to analyse the soil in every case, in order to determine whether the various constituents required for success were present and bore the proper relation one to another. It was most important, for instance, that the soil should contain the necessary mineral constituents. If these bore the proper relation to the "Nitragin," the results would, he thought, be better.

Mr. LEONARD SUTTON agreed with the author that in arriving at an opinion as to the advantages of using this fertiliser, it was desirable to weigh the crops produced. He did not gather from Dr. Somerville's remarks that he had subjected his results to that test, and thought that probably, had he done so, he might have found a decided difference in them over those produced by untreated soil or seed, though the difference might not be very apparent to the eye.

Dr. SOMERVILLE replied that all the crops to which he referred were carefully weighed and tested, and although he had not the weights with him, the meeting might take his word that everything he had said was warranted by the actual results obtained.

Dr. J. A. VOELCKER, in reply, thanked the meeting for the kind attention which they had given to his paper. He

did not expect to find their opinion unanimous, and his only object was to put facts impartially before them, so that each might judge for himself. It certainly seemed to him that the discovery had great possibilities before it. The practical application of the work of Hellriegel and Wilfarth was this: it was established that certain leguminous plants thrive well when they got on their roots a certain nodular development, and it was further found that this development did not occur unless the roots came in contact with certain organisms. What one had to do, therefore, was to make sure that these conditions were fulfilled; and Nobbe had, he thought, conclusively shown that the application of "Nitragin" would fulfil them, thus enabling the crop to take the nitrogen from the air and use it for its own benefit. There might be something in Dr. Rideal's suggestion, that degeneration of the organisms occurred from age or from other circumstances, but he had no evidence on that point at present. The principle of the discovery seemed to him perfectly rational and scientific, and if its application was not yet the best attainable, no doubt someone would, by further study of the question, enable them to arrive at the best method, and he hoped that that result would be attained in England. He was much obliged to Dr. Armstrong for calling attention to possible further developments in regard to the absorption of nitrogen under conditions of low temperatures. He was also obliged to Dr. Dyer for his suggestions. "Clover sickness" was one of the great questions in agriculture which had not yet been solved. Some of the experiments related had been carried out on land known to be "clover-sick." Dr. Schaack-Sommer was perfectly correct in his remarks about the decline in the price of ammonium sulphate. He would point out, however, that if "Nitragin" was possessed of the virtues attributed to it, farmers could by using it get, at a cost of five shillings per acre, what they would have to pay 3*l.* for in the shape of sulphate of ammonia. Reference had been made to his father's statements as to the advantage of preparing for a wheat crop by growing a crop of clover, and now one knew the reasons for this. The farmer who adopted this new fertiliser and was able to raise by it a crop of clover where he meant afterwards to sow wheat, would thus become independent of sulphate of ammonia at 6*l.* 17*s.* 6*d.* per ton. With regard to Dr. Somerville's remarks, he would point out that, unless one made sure first of all that the land to which he applied the fertiliser was without the required organisms, he could not say whether any advantage would result from using it, but here again he claimed that Hellriegel's experiments amply proved that where the organisms were not present, a considerable advantage accrued from inoculating the soil by means of "Nitragin." The question had also been raised as to whether the difference in appearance of the various organisms which he had been able, through the kindness of Mr. Armytage, to show them, was the result of age or of variety. He regretted that he was not able to express any decided opinion on that point, but could only put before them such evidence as he had, and it was a matter to which he would certainly devote further attention. Dr. Dyer had expressed the opinion that in control experiments it was desirable to soak the seed, whether it was treated or not. The purpose of the experiments, however, was to determine whether this discovery was adaptable in practice, and in practical agriculture it had not hitherto been usual for the farmer to soak his seed. Therefore, in his opinion, the proper course to adopt was to treat the one half in the usual way, and the other half in the way directed for the use of "Nitragin." He quite agreed with Mr. Dvorkovitch as to the importance of ascertaining that the mineral constituents were present in the soil and in sufficiency, and perhaps this point had some bearing on Dr. Somerville's results.

The CHAIRMAN promised that Dr. Rideal's suggestion should be duly considered. Dr. Voelker's paper had been treated in a scientific manner, and he hoped that, undaunted by isolated failures, the experiments would be followed up, and that yet one more chemical industry might be based on the achievements of bacteriological science, to which chemists had so largely contributed. Chemists were scientific detectives, and could disregard no clue which might assist their inquiries.

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SESSION 1896-97.

Dec. 2nd, 1896:—

Mr. A. Carey. "Rescue Apparatus for Use among Noxious Gases."

Mr. D. Herman. "Notes on Poisoning by Carbonic Oxide."

Jan. 13th, 1897.—Dr. F. Hurter and Dr. Zahorski. "On the Efficiency of an Electrolytic Cell."

Feb. 3rd, 1897.—Mr. S. Stein. "Recent Improvements in Sugar Refining."

Meeting held Wednesday, November 4th, 1896.

DR. C. A. KOHN IN THE CHAIR.

THE SYNTHESIS OF PHYSIOLOGICALLY ACTIVE ORGANIC COMPOUNDS.

CHARLES A. KOHN, PH.D., D.S.C.

Lecturer on Organic Chemistry, University College, Liverpool.

THE relationship of pure science to its practical application stands on a very different footing to-day from that of the past. No longer does the manufacturer base his work on changes already studied in the chemical laboratory; but from his investigations new light has been repeatedly thrown upon subjects of the greatest theoretical importance, and from him suggestions as to new lines of inquiry have often come.

The work of the pure scientist and of the technologist are inseparable, and the fact that this Society of Chemical Industry has always welcomed teachers of science amongst its members is a happy sign, for their mutual advantage.

Whilst, therefore, I express my appreciation of the honour you have done me by electing me to the chairmanship of this, the oldest section of the Society, I feel also that you have honoured this College with which I am connected.

Few sections of the Society have maintained the stability and the even prosperity of the Liverpool Section, and I gladly take this opportunity of attributing our success to the continued help and unabated interest we still enjoy from those who have preceded me in this chair, and to whom the inception of the Society itself was primarily due.

To follow such men, whose work is recorded for all time in the chemical industries of this district, is no easy task; and whilst I ask for your indulgence, let me also claim your aid to keep the status of this section and the standard of its work at least on a level with the past.

The industrial developments of organic chemistry stand out among the most marked achievements of applied science. From soap to explosives, from brewing to hutter, the science of organic chemistry has played its part with marked success. The hydrocarbon formed by the direct union of the elements is now prepared on a manufacturing scale for the enrichment of illuminating gas; the successful developments of the aniline colour industry need no accentuation; and more recently electrolysis has come to take its share in the preparation of organic compounds. The field of industrial organic chemistry is comparable in extent with that of the so-called "heavy chemicals"; and if in the choice of a subject for my address I have taken one

of the less known and less prominent branches of organic chemical industry, it is partly because I believe it is one in which important developments are likely to occur, and also because it to-day lies somewhat nearer than other branches to my natural home—the chemical laboratory.

The synthesis of physiologically active organic compounds may be regarded as dating from Liebreich's investigations on the action of chloral in 1868. The discovery that led Liebig in 1832 to the preparation of chloroform formed the basis for Liebreich's work. The importance of knowing whether a substance is decomposed or not on passing through the body, and, if decomposed, of knowing further, not only the decomposition products, but also their therapeutic effect, are the points laid down by Liebreich as fundamental for pharmacological investigations. How clearly he recognised this is evident in the choice of chloral and of tri-chloroacetic acid for his experiments. Such considerations still guide the pharmacologist; their far-reaching import has extended, not only to the preparation of new drugs, but also to the recognition of valuable therapeutic properties in substances like acetanilide, which for so many years reposed innocently on the shelves of our chemical museums. True, that side by side with success there are many failures to record; but permit me to remind you how exceptionally difficult and arduous a form of experimental inquiry devolves upon the physiologist in the investigation of the therapeutic action of drugs.

The complexity of the animal body, the many functions it exercises, the innumerable and mutually dependent processes which take place in it—these are all factors that contribute to the difficulty of investigation. These difficulties are not so much in regard to the tracing of any final effect a drug may produce, but, in attributing its action to the correct function or process by which the observed result has been attained.

To enter into any detailed considerations in regard to such inquiries is beyond my purpose and powers, but a few of the more simple causes that may complicate the physiological effect of a drug may not be out of place.

The physiologist distinguishes between the direct and the indirect action of a drug. For instance, curare kills by paralysing the ends of the motor nerves; this is its direct action. But under certain circumstances death is preceded by convulsions due to a secondary, or indirect, reaction of the drug.

Again, a drug exerts a local action on that part of the body to which it is applied. But this action may give rise to symptoms in other remote parts of the body: a secondary effect, which in many cases—as in the use of quinine as an antipyretic—is of such a nature as to prevent its application in practice.

The effect of a drug varies also with the quantity. Atropine, for instance, in small doses slows the pulse, in larger quantities it quickens the beating, and in very large quantities again slows it. Further, the quantity of a drug required to produce a certain result is no absolute value. What has to be considered is the quantity of the drug acting, and this is related to the weight of the body acted upon, to the rapidity with which the drug is absorbed in the system, and the proportion this bears to the rapidity of excretion.

The mode of administration also effects the action of a drug. Thus kairine and antipyrine injected subcutaneously have a much greater effect than when taken into the stomach by the mouth.

Such are a few among the many points the physiologist has to weigh in assigning to a drug what is called its "action," or better, its "reaction," with the body acted upon. The importance of such considerations are fully dealt with in the "Croonian Lectures" for 1889, by Prof. T. Lauder Brunton.

Within the last 14 years some 200 synthetically prepared organic compounds have been introduced for therapeutic purposes. Comparatively few of these have "come to stay," but they have all added their quota in developing a knowledge of the relation of chemical constitution to physiological action—a knowledge without which the therapeutic value of such bodies as antipyrine, antifebrine,

and phenacetine would never have been recognised. Most of these drugs may be conveniently grouped under the three headings of—

- (1.) *Narcotics.*
- (2.) *Antiseptics.*
- (3.) *Antipyretics.*

The properties of some assign them to more than one of these groups.

I do not propose to detail to you the long list of substances which this classification includes, but to attempt to show, in some of the best investigated instances, along what lines chemical synthesis has advanced in the preparation of physiologically active compounds.

Narcotics—bodies which have the power of retarding the nerve functions—include anaesthetics and hypnotics.

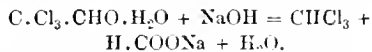
Among the simpler derivatives of the hydrocarbons a similarity in physiological properties is found to run side by side with an analogous constitution. The primary alcohols of the aliphatic series have all a toxic effect. Their main action consists in paralysing the nerve centres, and this effect increases in intensity with an increase in the molecular weight of the alcohol, until the solid alcohols are approached, when, owing to their insolubility, and consequent too sparing absorption by the system, they cease to have any physiological effect at all.

Narcotics act upon the most highly organised nerve centres first, whilst the most simple and at the same time most automatic and stable centres are affected last. The order in which these nerve centres are rendered inactive differs amongst the various members of the alcohol group. Some induce sleep as the first result of their action, which only passes into anaesthesia when large doses are employed. Such bodies are valuable as hypnotics; their action is weak but prolonged. Others act rapidly and more energetically, so that, provided they are quickly eliminated, and cease to act very shortly after being administered, they fulfil the conditions required by a good anaesthetic. Consequently bodies of low molecular weight and high volatility are included in the latter group, whilst the former contains substances having a relatively high molecular weight, and which are only slowly absorbed by the blood. This is illustrated in the value of tertiary amyl alcohol (amylen hydrate) $(\text{CH}_3)_2\text{C}(\text{OH})\cdot\text{C}_2\text{H}_5$, as a hypnotic; it boils at 102.5°C . It passes through the system just as ethyl alcohol does, being converted into carbon dioxide and water. Its more prolonged action is to be directly traced to this decreased volatility and solubility.

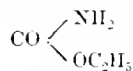
The halogen substitution products of the lower aliphatic hydrocarbons are characteristic anaesthetics, the well-known properties of chloroform being shared by methyl- and methylene-chloride. The volatility of the former has restricted its use to that of a local anaesthetic, and methylene-chloride, CH_2Cl_2 (first recommended by Richardson as an anaesthetic) has not found much favour. Ethylene di-bromide, $\text{C}_2\text{H}_4\text{Br}_2$, B.P. 131°C ., whilst retaining the hypnotic effect of bromine, appears to have very little anaesthetic action. This again illustrates the influence of a high molecular weight and boiling point. Donath has recommended its use as an anti-epileptic from the standpoint that the chronic poisoning effects, that are produced when potassium bromide is employed, are due to the metal, and that this would be obviated by introducing the bromine in combination with an hydrocarbon residue, which would be readily and completely oxidised in its passage through the body. Its value for this purpose requires confirmation.

The oxidation products of the alcohols, the aldehydes, preserve the hypnotic power of the former, but they exercise an objectionable irritant action on the mucous membrane, especially in the case of the lower members. The lowest member of the group presents, consistently with its chemical behaviour, some marked differences to its higher homologues. Both formaldehyde and its polymer possess antiseptic properties, and a 40 per cent. solution of formaldehyde is now used to a considerable extent, under the name of "formalin," as an antiseptic, and especially as a preservative. Paraldehyde, $(\text{CH}_3\text{CHO})_3$, is a hypnotic, which, although its depressant action upon the heart is less than with chloral, gives rise to irritation and vomiting.

By substituting the hydrogen atoms in acetaldehyde by chlorine their narcotic power is much increased, and in *chloral hydrate*, $\text{CCl}_3 \cdot \text{CHO} \cdot \text{H}_2\text{O}$, a valuable and largely used hypnotic is obtained. As already mentioned, Liebreich was led to the investigation of the physiological properties of this body from a consideration of its decomposition products by means of alkali. Chloroform and sodium formate result, even with extremely dilute alkaline solutions; chloral is soluble and readily absorbed; when absorbed it enters into the blood, which has an alkaline reaction, and there Liebreich expected it to be decomposed into physiologically active chloroform, and practically innocuous sodium formate.

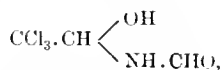


These expectations as to the utility of chloral as a hypnotic have been fully answered, but whether the action is direct or not is somewhat doubtful. Experiments by Hammersten point to a direct action, and although the greater portion of chloral which is absorbed is eliminated in the urine as urochloralic acid, $\text{C}_2\text{H}_5\text{Cl}_3\text{O}_7$, a certain small proportion is not accounted for; and it may be that this fraction plays an important part in the action of the drug, being decomposed, according to Liebreich's view, with the liberation of "nascent" chloroform. One disadvantage, however, accompanies the use of this, as of many simple aldehyde derivatives: it has a depressing action upon the heart, and therefore its application becomes dangerous in all cases of cardiac feebleness. To overcome this objection, Schmiedeberg (1885) suggested the use of *urethane*, ethyl carbanate—



as a hypnotic—a body which he regarded as likely to combine the stimulating action of ammonia with the narcotic effect of an alcohol radical. The therapeutic properties indicated by theory have been realised in this drug, so much so, indeed, that Hübner and Sticker have pointed out the necessity of avoiding large doses (above 2 grms.), owing to the stimulating action of the amido-groups overcoming the narcotic power of the hydrocarbon residue under such conditions, and thus preventing instead of producing sleep. The presence of the carboxyl residue, with the introduction of which a decreased toxicity is always associated, is an additional factor in determining the therapeutic value of chloral hydrate. Binet has recently shown that the hypnotic power of the urethanes increases with the molecular weight of the alkyl radical amongst the lower members, and that by replacing a hydrogen atom in the amido-group by acetyl, the physiological action is preserved whilst the toxic power is lessened.

The knowledge that halogens increase the narcotic effect of aldehydes has led to a further development of Schmiedeberg's ideas in the preparation of *chloral formamide* (chloralimide)—

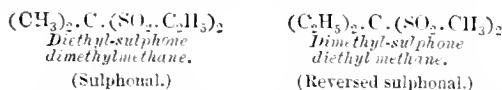


an aldehyde derivative, in which the hypnotic powers of the aldehyde group are increased by the substitution of chlorine by hydrogen, whilst its depressant action upon the heart is corrected by the presence of the amido-group. Like urethane, it has been found to possess to a large extent the therapeutic properties indicated by theory.

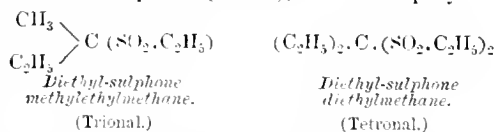
The *ketones*, chemically so closely allied to the aldehydes, also act as narcotics, and Dujardin-Beaumetz has suggested the use of *acetophenone*, $\text{CH}_3 \cdot \text{CO} \cdot \text{C}_6\text{H}_5$ (*hypnone*), as a hypnotic. *Sulphonals*, which belong to the group of aliphatic disulphones, is derived from acetone being obtained by the oxidation of the corresponding mercaptol. The original investigations of Kast on the therapeutic value of sulphonals as a hypnotic have been amply confirmed, and it is now recognised as a safe drug for the production of sleep, and as one free from bad secondary actions. Its reliability is, perhaps, somewhat questioned, marked variations being shown in the time required for its effect to be

produced. A substance boiling at 300°C ., and soluble only in 500 parts of water, will of necessity be only slowly absorbed by the system.

The physiological action is to be traced primarily to the ethyl groups present, and it is immaterial whether these are directly in combination with the methane carbon or not, for sulphonals and "reversed sulphonals" act similarly.

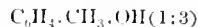


The sulphone with four methyl groups is perfectly inactive, whilst the triethyl- and tetra-ethyl sulphonates are stronger narcotics than sulphonals. *Trional*, which is more soluble than sulphonals (1 : 320), acts more rapidly—



Baumann and Kast regard the SO_2 group as inactive in these compounds, but it is not unlikely that the absence of marked contra-indications with sulphonals are to some extent due to the presence of this radical, for it is well known that the sulphonic acid group decreases the toxicity of aromatic compounds.

Antiseptics.—The majority of the antiseptics are to be found amongst aromatic compounds. *Phenol* has powerful antiseptic properties, but it is also an irritant poison. Its homologues (the *cresols*) are still more powerful antiseptics, but they are less poisonous. *Meta-cresol*—

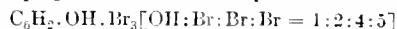


for instance, which is the most powerful antiseptic of the three isomers, is four times less poisonous than phenol. Many cresol preparations are now employed in antiseptic surgery, such as *creolin*, *lysol*, *solveol*, and *solutol*—more or less impure mixtures prepared from coal-tar—and also pure products, such as Liebreich's "*Tri-cresol*," a mixture of the pure cresols.

By replacing a second hydrogen atom in benzene by hydroxyl, both the antiseptic and the poisonous properties are increased. The extent of the change depends, however, upon the relative position of the hydroxyl groups. In *catechol* the action is most powerful, in *resorcinol* weakest, *quinol* occupying an intermediate position.

By further replacement of hydrogen, the lethal activity may be further increased, *phloroglucinol* being more poisonous than *quinol*, and also more poisonous than its symmetrical isomer *pyrogallol*. The rapidity of action of these drugs is in inverse ratio to their toxic power: phenol acts more quickly than resorcinol, and this than phloroglucinol—an effect said not to depend upon their solubilities, for phenol is the most sparingly soluble of the three (Lauder Brunton). Certainly the reducing actions of these phenols on the blood must be the chief factor in their relative toxic effects and their solubilities, not in water, but in the gastric and pancreatic juices, and especially in the blood—the chief consideration in regard to the rapidity of their action.

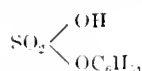
The antiseptic power of the halogens is brought out in such organic antiseptics as iodoform, tetra-iodo-pyrrol (iodol) and di-iodo-thiophene. The halogen derivatives of the phenols are more powerful antiseptics than the phenols themselves, as one would naturally expect: at the same time they are less poisonous. Of the *mono-chlorphenols*, the para-compound $\text{C}_6\text{H}_4 \cdot \text{OH} \cdot \text{Cl}$ (1:4) has the most powerful antiseptic properties, whilst tribromophenol—



has, owing to its insolubility, been recommended by Grimm as an intestinal antiseptic.

A study of the changes phenol undergoes on passing through the system has given rise to the preparation of numerous phenol derivatives for therapeutic use. A portion of the phenol absorbed disappears entirely; it is probably oxidised completely to carbon dioxide and water. A second portion is oxidised to dihydroxybenzenes, chiefly quinol, a

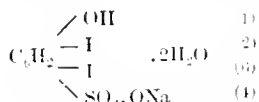
third portion combines with glycuronic acid in the system, and a small quantity, especially when large doses are given, appears unchanged in the urine. But the most interesting change from a pharmacological standpoint is the elimination of the remainder of the phenol as an ester of sulphuric acid, *phenyl sulphuric ether*—



the form in which it is always excreted in pathological conditions. Such esters are not poisonous, their salts are readily soluble, and they pass through the system unchanged. Hence the application of salts of phenyl sulphuric acid as antiseptics. The very closely allied phenol-sulphonic acids behave similarly. The antiseptic power of *ortho-phenol sulphonic acid*, $\text{C}_6\text{H}_4(\text{OH})\text{SO}_3\text{OH}$ (1:2), is somewhat less than that of phenol, it is also less toxic and very soluble.

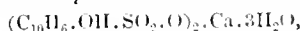
With the view of obtaining more powerful antiseptics, still retaining the advantages of the sulphonic acids, Trommsdorf prepared the so-called *sozo-iolol salts*, the di-iodo-substitution products of para-phenol sulphonic acid. In these compounds the irritant action of the iodo-phenols is attenuated by the presence of the sulphonic acid group. With the exception of the mercury salt, which is of value in syphilitic cases, they are perfectly innocuous and readily soluble. They have no smell—an advantage over iodoform; and since their introduction in 1887, they have been largely used for the most varied antiseptic purposes. From the returns kindly supplied by H. Trommsdorf and Co., the sale of these sozo-iolol preparations has increased from 168 kilos. in 1887, valued at 630*l.*, to 1,152 kilos., in 1895, valued at 1500*l.*

The sodium salt is the most soluble of these compounds (1 to 14 at ordinary temperatures); its composition is represented by the formula—

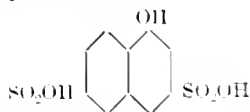


Di-iodophenol sodium sulphionate.
(Sodium sozo-iolol.)

The naphthols, especially the β compound, are, like the phenols, powerful antiseptics, and the advantageous influence of the sulphonic acid group has been made use of in the preparation of naphthalene derivatives corresponding to the above. *Asaprol*, the name given to the calcium salt of β -naphthol- α -monosulphonic acid—



has been recommended as an antipyretic rather than as an antiseptic—an application due to its non-poisonous character, and also to its passing through the system unchanged. A more interesting instance is the use of the *aluminium salt of β -naphthol disulphonic acid*—



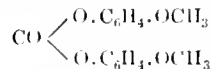
as an antiseptic and astringent.

The objection to the metallic salts employed as astringents is due to their precipitating albumen, and therefore, when applied to an ulcer or other inflamed mucous membrane, of forming an insoluble coating on the surface of the structure, thus preventing the antiseptic from reaching the inflamed parts in the more deeply situated tissues. Aluminium salts possess the property of dissolving in excess of albuminoid secretions, but their tendency to form basic salts again presents the obstacle they are otherwise suited to overcome. This fact led Heinz and Liebrecht to look to the aluminium salts of organic acids as substances likely to possess the advantageous properties of the base without the disadvantage shown by the acetate and other aluminium salts previously employed. In the disulphonic acid of β -naphthol they found an antiseptic without poisonous properties, and its aluminium salt has the penetrating powers

of the base satisfactorily preserved. 40 per cent. aqueous solutions prepared with hot water remain quite clear on cooling, and in the treatment of ulcers and similar wounds it has proved a valuable antiseptic.

In another group of phenol derivatives—the phenol ethers—many interesting examples of the synthesis of physiologically active compounds occur. *Guaiacol* and its derivatives are probably the most important of these. Sahli was the first to recognise that the value of creosote in phthisis was due to the contained guaiacol, and this methyl ether of catechol, $\text{C}_6\text{H}_4(\text{OH})\text{OCH}_3$ (1:2), is now largely used in the treatment of this disease. Guaiacol, like catechol, is a powerful antiseptic, but the contractile action of the latter, and its effect in diminishing the blood pressure are much decreased by replacing the hydroxyl-hydrogen by methyl. The action of guaiacol in phthisis is attributed by Sahli to its effect upon the stomach, as a stomachic, and not to any direct effect of the absorbed guaiacol in the blood upon the tuberculosis bacilli of the lungs. The work of the chemist in this case is an important type, for the practitioner has to thank him for a product of reliable purity, on the action of which he knows he can always depend.

With the view of overcoming the irritant action of guaiacol on the digestive functions, several esters, such as *benzoylguaiacol* (benzosol), $\text{C}_6\text{H}_4(\text{OCH}_3)\text{O} \cdot \text{CO} \cdot \text{C}_6\text{H}_5$, have been prepared. Such bodies prepared on the type of salol, to which I shall presently refer, pass through the stomach unchanged, and undergo decomposition in the intestines. Benzosol acts as an intestinal antiseptic, but is of no value in phthisis—a confirmation of Sahli's view of the action of guaiacol. Of many other esters, *guaiacol carbon* etc—



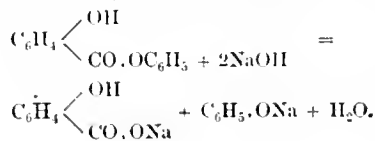
has proved the most valuable. Although, like the benzoyl ester, it passes through a healthy stomach unchanged, it is said to undergo decomposition there in presence of parasitic bacteria.

What the exact work of guaiacol in phthisis is, appears capable of receiving much elucidation from a comparative study of the actions of guaiacol and of its carbonic ester.

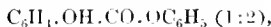
Antipyretics.—Antipyretics, or febrifuges, include those substances which reduce the temperature of the body in fever. They may either lessen the production of heat or increase the loss of heat. The majority of the synthetically prepared antipyretics, in common with quinine, decrease the production of heat. Antipyrine is an exception. According to Gottlieb the production of heat is increased 5–9 per cent., and the loss of heat increased 10–20 per cent.; it therefore reduces the temperature because the increased loss of heat exceeds its increased production.

The commercial success of antipyrine has been followed by a veritable boom in the preparation of antipyretics, but the rush has been too rapid to have been carefully planned, with the result that the lives of many of them have been conspicuously fleeting.

It has been shown by Nencki and Boutmy that the introduction of the carboxyl group into a large variety of aromatic compounds markedly decreases their toxic action. Benzoic acid is much less poisonous than benzene; salicylic acid than phenol. Kolbe was the first to direct attention to the antiseptic and non-poisonous properties of salicylic acid, and Buss subsequently showed that it had a marked and specific antipyretic action in cases of muscular rheumatism. The use of salicylic acid and its salts as anti-rheumatics is well known, but their value for this purpose is seriously diminished by the disturbance of the digestive functions which they may occasion. The esters of salicylic acid, like those of the phenols, pass through the stomach unchanged, and are decomposed in the duodenum by the pancreatic juice and alkali into salicylic acid and the phenol with which they are combined, e.g.:—



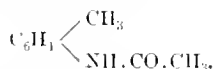
Salol the phenol ester of salicylic acid—



has proved to be the most valuable of these compounds. As an anti-rheumatic it claims special advantages over salicylic acid in all cases of weak digestions, but it is as an intestinal antiseptic that it has proved most useful. Such a chemical combination of physiologically active substances has often been repeated, but not always with success. Unless the physiological action of such compounds can be localised, their resultant effect, additive or the reverse, is mere chance.

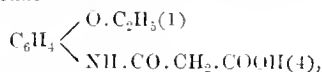
Whilst the replacement of a hydrogen atom in the aromatic hydrocarbons by the hydroxy group increases their antiseptic properties, an increase in their antipyretic powers accompanies the introduction of the amido group. Aniline has a paralysing effect on both muscle and nerves; it has a powerful toxic action, and is eliminated in the urine—partly unchanged and partly as para-amido-phenol-sulphuric ester.

In *acetanilide* (antifebrine), $C_6H_5.NH.CO.CH_3$, this toxic effect is much decreased whilst the antipyretic properties remain. It is a widely-used antipyretic, largely on account of its low price, but bad secondary symptoms are said to occur unless judgment be exercised in its application. Its homologues, the *acet-toluides*—



do not all preserve this antipyretic action: the 1:4 compound is quite inactive, the 1:2 compound has no antipyretic action, whilst the 1:3 isomer is the only one that preserves the antipyretic action of acetanilide. When, however, the methyl group replaces the second amido-hydrogen, instead of a hydrogen atom in the ring, an interesting therapeutic change has been observed by Dujardin-Beaumetz and Bardet. *Acet-methyl anilide* (Exalgine), $C_6H_3.N(CH_3).CO.CH_3$, is a valuable analgesic; its antipyretic action is much less than that of acetanilide, in fact, it only appears when almost toxic doses are given (Fraser).

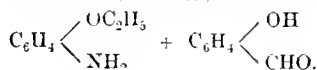
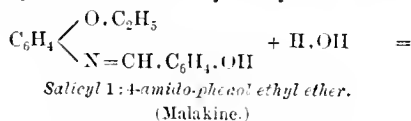
Although both aniline and phenol are powerful poisons, the amido-phenols are comparatively innocuous; from chemical considerations such a mutual influence of the substituting groups would be expected. By the introduction of alkyl- or acid aliphatic radicals into 1:4-amido-phenol a number of useful antipyretics have been prepared, of which *phenacetine* and *lactophenine* are types. The carboxylic acid of phenacetine—



has been shown by Nencki and Boutmy to pass unchanged through the body—a point of interest, because in *phenocoll* a methyl hydrogen of the acetyl group is replaced by the amido group, whilst in *thermodine* an added carboxyl group is present. This latter, which is really a urethane derivative, is regarded by v. Mering as the best antipyretic of the amido-phenol group.

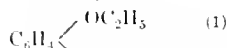
The steps that have guided the chemist to the preparation of these compounds are full of interest, and I regret that the time at my disposal does not permit me to detail them to you.

One derivative of para-amido-phenol deserves notice from a different standpoint—its condensation product with salicylaldehyde. This substance was introduced by Jaquet in 1893 as an anti-rheumatic, under the name of "*Malakine*." It is insoluble in water, but is decomposed by very dilute acids into para-phenetidine and salicylaldehyde.



This decomposition Jaquet regarded as likely to be effected by the stomach acids, and that the liberated aldehyde, oxidised to salicylic acid in the tissues of the body, would act as a powerful anti-rheumatic. Practice has justified this view. *Malakine* is a useful anti-rheumatic possessing certain advantages over salicylic acid, although whether as generally useful as the latter is somewhat questioned.

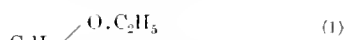
Antipyretics derived from Para-amido-phenol.



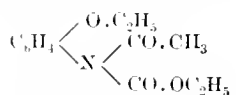
Acetyl amido-phenol (ethyl ether).
(*Phenacetine*.)



Lactyl amido-phenol ethyl ether.
(*Lactophenine*.)



Glycocoll amido-phenol ethyl ether.
(*Phenocoll hydrochloride*.)



Phenacetine carboxylic ester.
(*Thermodine*.)

In quite another group of bodies an interesting series of inquiries have led to the preparation of kairine, and indirectly to the recognition of the therapeutic value of antipyrine. Few substances are of more importance in medicine than the natural alkaloids, a class of nitrogenous substances characterised by their basic properties, and which until recently have successfully resisted the onslaught of the synthetical chemist.

In the various groups of the alkaloids a similarity in physiological action is to be traced, and it is amongst these very compounds that the earliest experiments on the relation of chemical constitution to physiological action were carried out by Crum Brown and Frazer in 1869. It is well known that a pyridine, quinoline, or isoquinoline ring forms an essential part of the molecule of many of the alkaloids, many derivatives of these bases having been obtained as their decomposition products. This relationship has been further borne out by a study of the physiological properties of compounds derived especially from quinoline.

Foremost amongst these substances stands *kairine*, which, although to-day eclipsed by newer antipyretics, has an exceptionally interesting history, on account of the complete nature of the researches of Otto Fischer and Filehne on this and closely allied bodies.

Quinoline itself possesses powerful antiseptic and slight antipyretic properties, but it causes so many unpleasant secondary reactions in the system that it is of very little value as a febrifuge.

By substituting a hydrogen atom by hydroxyl, 1-*hydroxy-quinoline* is obtained, which, together with its methyl ether and their respective tetrahydrides, has an antipyretic action akin to that of quinine, but which, owing to the tendency it possesses of decomposing the albumen, is unsuited for practical application.

The possible value of these artificially prepared drugs was clear to Fischer and Filehne, and they sought at once to eliminate the injurious secondary effects which accompanied their use. From chemical considerations they regarded the instability of the imido group, $=NH$, as the probable cause of the injurious effects referred to, and with the object of giving increased stability to the molecule they replaced the imido-hydrogen by an alkyl, *kairine* being the resulting product. The hydrochloride of this base was successfully employed as an antipyretic for several years after its discovery in 1883, in fact, until driven from the field by its own children.

Numerous derivatives of kairine have since been prepared—*Thalline* (3-methoxy-tetra-hydroquinoline), *Kairine* (N-methyl-tetra-hydroquinoline), and others. They all resemble kairine in their action and differ essentially in the time during which the antipyretic effect lasts. That of 1-ethoxy-tetra-hydro-N-methyl-quinoline lasts the longest.

By the action of ethylene-dibromide on 1-hydroxy-tetra-hydroquinoline a substance is obtained in which the two reduced quinoline rings are united by the divalent residue, $-\text{CH}_2-\text{CH}_2-$. It is not improbable that the cinchona alkaloids contain a quinoline ring, united to a second reduced quinoline ring, and hence considerable interest attaches to the physiological action of this product 1-hydroxy-tetra-hydro-ethylene-quinoline. It does act as an antipyretic, but, owing most likely to its feebly basic properties, its action is considerably weaker than that of kairine.

In looking back on the work done amongst this group of bodies, I should remind you that the first investigations on their physiological action were carried out by McKendrick and Dewar in 1874 (*Proc. Roy. Soc.* 1874, 22, 432), and this at a time when the synthetical methods now used for the preparation of quinoline and pyridine compounds were unknown.

One point of interesting comparison between these drugs and quinine is that the antipyretic action of the latter in malaria and other intermittent fevers is not shared by the artificially prepared bodies. There must be some portion of the quinine molecule to which this special action is to be traced. Chemically and physiologically a portion of the constitution of the complex quinine molecule has been revealed; such combined efforts will best lead to its complete elucidation.

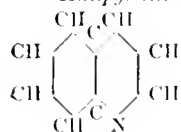
Antipyrine, discovered by Knorr in 1884, has had, as I need hardly tell you, a phenomenal career. As an antipyretic and as an anti-rheumatic in whooping cough and in cramp it has proved of immense value, whilst as a nerve tonic it is most widely, but not always wisely used, and too often without medical advice.

The money value of this drug consumed to-day is almost one-half of the total value of the newer synthetical remedies, and I was indeed surprised to learn from Dr. G. von Brünig that in addition to his own works, where antipyrine was first manufactured, there are now no less than 12 others where it and its derivatives are prepared.

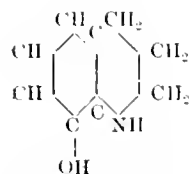
Knorr first regarded antipyrine as a quinine derivative, and as such it bore sufficient analogy to the physiologically active quinoline compounds prepared by Otto Fischer in the same laboratory as to suggest the investigation of its physiological properties—a work first undertaken by Filchne. More recent investigations have led Knorr to assign a different constitutional formula to antipyrine—that of a substituted pyrazolone; but it was its supposed relationship to kairine that first led to its being examined by the physiologist.

Several substances constitutionally allied to antipyrine are known to-day, which share its antipyretic action, but none of which have exceeded or even approached it in general reliability or utility.

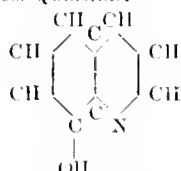
Antipyretics derived from Quinoline.



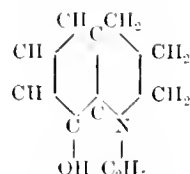
Quinoline.



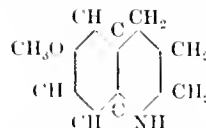
1-Hydroxy-tetra-hydro-quinoline.



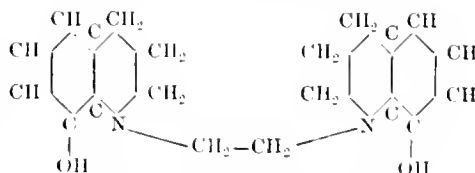
1-Hydroxy-quinoline.



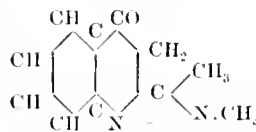
1-Hydroxy-tetra-hydro-N-ethyl-quinoline.
(Kairine.)



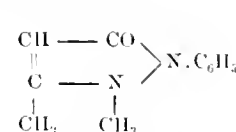
3-Methoxy-tetra-hydro-quinoline.
(Thalline.)



1-Hydroxy-tetra-hydro-ethylene-quinoline.



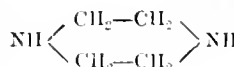
Dimethyl-oxo-quinizine.
(Original formula assigned to antipyrine.)



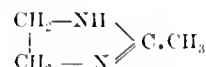
Phenyl-dimethyl-pyrazolone.
(Antipyrine.)

Of other cyclic nitrogen compounds *piperazine* and *lysine*, uric acid solvents, and therefore of value in the treatment of stone and other conditions associated with a separation of uric acid in the system, and the remarkable stomachic *Orexine*, prepared by Paul, deserve mention. This last, according to the investigations of Penzoldt, has the property of stimulating the feeling of hunger, but the earlier experiments made with the hydrochloride of the base were found to give rise to irritation in the stomach. The free base has since been recommended, which, despite its insolubility, satisfactorily retains the therapeutic value of its salt.

Uric Acid Solvents.

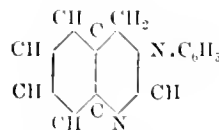


Piperazine.



Methylidihydroglyoxaline.
(Lysidine.)

Stomachic.



Phenyl-tetra-hydro-quinazoline.
(Orexine.)

I have attempted to bring before you some of the most typical examples of the manner in which the chemist and physiologist have mutually worked and helped in the preparation of therapeutically valuable products. There is much of the ground I have left untouched, but I hope what I have said is sufficient to show what a wealth of scientific material has been built up on the foundations laid by Crum Brown, Frazer, Liebreich, and Lauder Brunton. Most of this work has a life-history of little more than 15 years. No words are needed to accentuate the fact that it is but in its infancy, and that the combined labours of the chemist and physiologist will carry it far beyond its present limitations.

Interesting as this inquiry is to the pure scientist, I feel some need to justify my having chosen it as the subject for an address to a Society of Chemical Industry.

You may naturally ask, is the preparation of these drugs in itself worthy of rank as an important chemical industry,

or is their manufacture more or less casual in different works, according as raw materials or other conditions favour their production?

The fact that 13 manufacturers engage in the preparation of antipyrine and its derivatives is a partial answer to the question. I have attempted to answer it also from another standpoint.

The accompanying table shows the quantities of the most important of these new drugs used in the chief hospitals in the kingdom during the year 1895. There is every reason to suppose that such institutions are strictly

economical in the purchase and use of their medicines, and therefore that the returns given can be taken as a reliable register of the value of these newer preparations.

The total annual value of these seven products, as used in 17 hospitals containing 6,668 beds, is almost 600*l*. This figure applied proportionately to all the hospitals in the kingdom containing over 80 beds represents an annual value of nearly 3,000*l*.

In these figures I have purposely omitted salicylic acid and its salts, which have a very extended use, for they are hardly to be regarded as amongst the newer drugs.

HOSPITAL.	Number of Beds.	Quantities of Drugs used in 1895 (in ounces).						
		Antipyrine.	Antifebrine.	Guaiacol Carbonate.	Phenacetine.	Piperazine.	Salol.	Sulphonal.
LONDON.—London Hospital	776	552	..	6	156	8	160	112
St. Bartholomew's	745	199	2	64	76	30	224	48
Guy's	600	276	16	8	16	1	32	16
St. Thomas'	569	128	..	..	8	3	20	49
University College	208	64	2	24	60	1	112	2
Great Northern Central	155	20	6	20	18	1	122	58
LIVERPOOL.—Royal Infirmary	295	48	1	30	1	..	48	16
Royal Southern	200	52	12	6	8	..	3	52
LEEDS.—General Infirmary	394	64	8	4	8	1	320	8
BIRMINGHAM.—General Hospital	271	64	..	8	36	6	1	8
NEWCASTLE.—Royal Infirmary	270	48	16	72	8	..	160	16
BRISTOL.—Royal Infirmary	279	35	64	72	14	1	44	7
SHEFFIELD.—General Infirmary	200	69	1	5	44	2	22	28
NOTTINGHAM.—General Hospital	163	60	..	16	4	..	80	6
EDINBURGH.—Royal Infirmary	740	48	8	106	92	4	208	36
GLASGOW.—Royal Infirmary	582	188	96	64	64	2	96	64
DUBLIN.—Steeven's Hospital	230	12	2	..	1	..	16	24
Price .....	..	3 1 oz.	1 11 lb.	5 - oz.	1 3 oz.	10 6 oz.	10 - lb.	21 - lb.
Value .....	..	25 <i>l</i> .	1 <i>l</i> . 10 <i>s</i> .	12 <i>s</i> .	5 <i>l</i> .	31 <i>l</i> . 10 <i>s</i> .	12 <i>l</i> .	33 <i>l</i> .

Total value 598*l*. Hospitals contain 6,668 beds.

Total hospital accommodation in United Kingdom (excluding hospitals with less than 80 beds) 32,000 beds.

Total proportional value of above 7 drugs used in 1895, £2,870.

Whilst a sum of 3,000*l*. is expended by the hospitals on seven of these products, a far larger sum must represent their consumption through private practice.

From returns kindly supplied to me by the chief wholesale and retail chemists in Liverpool, I find that in this centre alone the value of these seven products sold is quite 5,000*l*. annually, and I believe I am well within the mark in estimating the total value for the United Kingdom from all sources at 250,000*l*. I do not regard these figures as anything more than the merest approximations, but I do not think they err on the side of excess, for the newer products so largely used in anti-septic surgery are not included at all.

Products which in this country alone realise annually a quarter of a million should, I think, merit the attention of the manufacturing chemist.

Paracelsus said the "object of the chemist is to make medicines, 'not to make gold'; it has been reserved for later generations to see the possibility of their combination. But this combination is not effected here. With the exception of acetanilide and some salol, the whole of the drugs are "made in Germany." And why; why does not this 250,000*l*. a year stay in this country?

I have already trespassed long enough upon your time, and do not propose to do more than refer you to a point in the address of the ex-president of the Society—a point of great importance to my mind, namely, the disadvantages under which industrial organic chemistry must labour in this country until the Government finds means for allowing the use of duty-free alcohol denatured according to the uses made of it, as is done abroad.

Mr. Tyrer's summary of this subject (this Journal, 1896, p. 496) is full of interest, and I am very glad to be able to add that the Advisory Committee recently constituted by the Council, on the suggestion of Mr. Tyrer, is at present giving the matter its most careful consideration. That this recently appointed committee has already taken in hand so important a subject is a matter for sincere congratulation. No more practical proof could be desired to show that the Council of the Society truly recognises the

interests of manufacturers, and most heartily can I wish the committee all success in its work.

Granted this equality with other nations, and a more thorough appreciation and practical recognition of the value of organic chemistry in works—for it is in the actual preparation of these products that the powers of the well-trained chemist and not the workman, despite all the technical classes in the world, are required,—granted these points, which the present condition of our industries should encourage us to secure, there is no valid reason why the manufacture of drugs and other closely allied industries should not meet with the same commercial success in this country which has characterised their development abroad.

In conclusion, I wish to express my best thanks to Prof. Oscar Liebreich for his kindness in directing my attention to much of the published work on this subject, to the dispensers of the hospitals who have kindly supplied me with the statistics recorded, and especially to the following firms, through whose goodwill and generosity I am able to show you an exceptionally complete collection of the newer drugs:—Chemische Fabrik von Heyden, Radebeul, Dresden; Farbenfabriken vormals Fr. Bayer, Elberfeld; C. F. Boehringer und Söhne, Waldhof; Farbwerke vorm. Meister, Lucius, and Bräuning, Höchst a. Main; Dr. W. Kalle and Co., Bielefeld; H. Trommsdorff and Co., Erfurt; and Chemische Fabrik auf Actien vorm. E. Schering, Berlin.

DISCUSSION.

Mr. EUSTACE CARLY proposed a vote of thanks to the Chairman for his interesting address.

Prof. CAMPBELL BROWN, in seconding the vote of thanks, said that he thought there must be amongst them all a feeling of amazement, not unminged with shame, that the magnificent array of specimens shown was not manufactured in this country, which produced such a large proportion of the raw material (coal-tar), and in which the first scientific investigation on the subject of the address had been carried out. Dr. Kohn had mentioned that the want of duty-free alcohol in this country had a great deal to do with it, and

that was the fault of the Government. The real fault, however, lay with the manufacturers and the people of this country, who were not sufficiently determined to have these things made in this country, and to compel the Government to give them duty-free alcohol. Why did not manufacturers care to manufacture those substances? Was not the reason something of this kind? Capitalists here preferred to manufacture compounds of which they could sell thousands of tons, and were not much interested in a substance which at first realised a sale of 600*l.*, rising in some years to 6,000*l.* But was that wise? He thought not. If they were to multiply the 600*l.* and the 6,000*l.* by one hundred different substances, the result would be worth the consideration of the large capitalists.

Dr. HURTER pointed out that in this country we had a liberal patent law, which allowed every foreigner to patent an article without compelling him to come into this country to manufacture it. The patent law of this country protected the foreign industry and did not promote the home one. If one of the younger chemists were to bring forward a new article, which could be protected, they might succeed with that, but to attempt to compete in the old articles with manufacturers who had years of experience, would be throwing money away. That was quite as potent a reason for the absence of industrial organic chemistry, of the kind referred to, as the duty on alcohol.

Prof. CURRIE remarked that, although great progress had been due to the introduction of many of the drugs spoken of, yet one hesitated to accept everything that was adduced as proof concerning one or other of these bodies. He instanced a case in which very beneficial effects were stated to be due to piperazine—lauded as an excellent solvent of uric acid. In a case which had come under his notice, a calculus was discharged shortly after administration of piperazine, and the result was put down to piperazine, until it was ascertained that the calculus was an oxalate of calcium (not uric acid at all)—a substance on which piperazine has no action. He had himself found the action of piperazine, when allowed to drip on a uric acid calculus, no greater than that of water. But how was it that such a substance as, for instance, sulphonal, was so uncertain in its action? Its insolubility would not explain this; it sometimes acted extremely well. The answer to this question was very much needed. They often felt, when standing at the bedside of a patient suffering from heart disease, for example, that their hands were tied, for they did not dare to obtain sleep for the patient, owing to the possibility of ill-effects from the hypnotic. It was required to know the personal factor that would tend to make these drugs more active or inactive.

Dr. KOUX, in reply, expressed his hearty concurrence in the importance of the point raised by Dr. Hurter in reference to the disadvantageous effects of the law relating to the granting of patents without insisting upon manufacture. In regard to the therapeutic effect of piperazine, he had found so many conflicting opinions that he had omitted detailed considerations, but he had not heard its power of dissolving uric acid outside the system questioned. The opinions expressed differed more in regard to its solvent action in the system and especially in presence of urine.

The personal element referred to by Prof. Carter was one of the greatest practical importance, but he felt that it was to the pharmacologist rather than to the chemist that they must look for its solution.

Hon. Local Secretary:

J. Carter Bell,
Bank House, The Clif, Higher Broughton, Manchester.

SESSION 1895-97.

December 1, 1894:

- (1) Dr. Stevenson Macadam. "On Safe and Unsafe Mineral Oils for Lighting and Heating Purposes."
- (2) Dr. J. Lawkowitzsch. "Contributions to the Analysis of Fats."

Meeting held on Friday, November 6th, 1896.

CHAIRMAN'S ADDRESS.

It is not very difficult to find a subject to talk about in the domain of industrial chemistry, but to say beforehand that any selection of material would be universally interesting, is to say a great deal. The matters to which I desire to call your attention this evening scarcely come within the pale of laboratory practice, but that you will agree with me in saying they have universal interest, I do not doubt in the smallest degree. It is pardonable, I think, to allude to the present crisis in the commercial departments of the alkali trade and in those of heavy chemicals generally; and though not prescribing for the maladies from which we seem suffering, I hope it may lead those who are responsible for the present state of affairs to look at the subject in a reasonable light and to deal with the question in a statesmanlike manner.

In my last address to you I expressed my fears that a crisis was impending in the caustic-soda industry, and that fear has been realised. At that date 7*l.* 15*s.* could be realised for a ton of 70 per cent. caustic, but to-day caustic-soda of 70 per cent., made from ammonia alkali, can and has been purchased at 6*l.* 2*s.* 6*d.* per ton; and what is still worse, 77 per cent. has been offered *pro rata*, the difference of over 2*l.* per ton for higher-strength caustic having now practically disappeared. And this is not all; the value of salt-cake has declined from 1*l.* 7*s.* 6*d.* in January of this year to less than 18*s.* at the present moment, and bleach has receded from 7*l.* to 6*l.*, packed in softwood casks and placed free on rails at the makers' works.

The exact situation of the heavy chemicals trade is rather an intricate one to follow, or—perhaps it would be more correct to say—has been made intricate from the many different prices quoted in various places for the same product; but when the quoted values are stripped of the extra-manufacturing expenses, so as to level the products down to a "packed" and f.o.r. price, we have a set of figures of unusual interest to the trade which go to show that we are again approaching a like period to that when, in 1890, the leading heavy chemicals manufacturers banded themselves together to federate their works and to form one huge confederation therefrom.

In order to set forth clearly the changes that have taken place, the following table has been prepared, showing the values realised for each article enumerated in the past nine Januaries:—

PRICES OF ALKALI PRODUCTS IN JANUARY OF EACH YEAR.

	70 Caustic.			Bicarb.			58 Alkali.			Bleach.			Soda Crystals.			Salt- Cake.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1888	6	18	9	5	15	0	4	12	6	7	11	3	2	10	0	1	2	0
1889	7	0	0	4	15	0	5	0	0	7	5	0	2	7	6	1	1	0
1890	7	17	6	5	0	0	5	12	6	5	5	0	2	12	0	1	6	0
1891	15	5	0	7	5	0	6	12	6	6	12	6	3	7	6	2	0	0
1892	14	5	0	6	15	0	6	7	6	7	10	0	3	9	0	1	17	6
1893	9	10	0	6	10	0	5	7	6	7	10	0	3	2	6	1	10	0
1894	9	5	0	6	15	0	4	2	6	7	15	0	3	0	0	1	0	0
1895	7	17	6	5	12	6	4	0	0	7	5	0	2	5	0	0	17	6
1896	7	10	0	6	10	0	3	15	0	7	0	0	2	2	6	1	7	6
To-day	6	2	6	6	10	0	2	5	0	6	0	0	2	0	0	1	0	0

The year of lowest prices in 70 per cent. caustic was 1888, in which it was sold at 16*s.* 3*d.* more than can be obtained to-day; the year of lowest-price bleach was in

Manchester Section.

ROOMS OF THE CHEMICAL CLUB, VICTORIA HOTEL.

Chairman: George E. Davis.

Vice-Chairman: Peter Hart.

Committee:

E. H. Bowman.
R. Forbes Carpenter.
R. S. Dale.
R. Le Neve Foster.
R. W. Garland.
H. Grimshaw.
J. Grossmann.

J. M. Irving.
M. J. Langdon.
J. Lawkowitzsch.
E. Schunck.
W. Thomson.
D. Watson.

1890, when the price was 5 guineas, but the year of lowest-price salt-cake was not reached until the end of 1894, and lasted a long way into 1895. For this year (1895) 17s. 6d. is the quoted value, but that is quite a high figure, for very large quantities changed hands at as low as 12s. 6d. per ton at the maker's works. This, no doubt, was very encouraging to glass-makers and others who used salt-cake, and the low prices of caustic soda and bleach in their respective years were perhaps of assistance to the paper makers and bleachers; but we may pause to inquire whom these blessings have permanently benefited. The following table will show the loss of revenue to the alkali maker by the fall in prices from the normal, and are based upon the output from a works consuming 160 tons per week of 50 per cent. pyrites working by the best-known methods.

I have estimated that such a works as above will produce 200 tons weekly of sulphuric acid of 1.615 sp. gr., and this will produce not less than 200 tons of 97 per cent. salt-cake. Now, reckoning that 40 cwt. of salt-cake will make 1 ton of 70 per cent. caustic (a very fair average production), 100 tons of 70 per cent. caustic should be produced in such a works per week. In a works of this size the wages will not be less than 250*l.* weekly, including tradesmen and labourers. The table has been constructed on the foregoing basis, taken in conjunction with the values of Table I.

WORKS MAKING AND SELLING BLEACH AND CAUSTIC (70 PER CENT.), OR BLEACH AND SALT-CAKE ONLY.

TABLE II.

	Revenue from Bleach.	Revenue from Caustic.	Total.	Revenue from Bleach.	Revenue from Salt-Cake.	Total.
	£	£	£	£	£	£
1888	760	605	1,455	760	220	980
1889	725	700	1,425	725	210	935
1890	525	799	1,315	525	200	725
1891	660	1,125	1,785	660	400	1,060
1892	750	1,025	1,775	750	374	1,124
1893	750	950	1,700	750	300	1,050
1894	775	925	1,700	775	200	975
1895	725	75	1,510	725	174	899
1896	700	750	1,450	700	274	974
..	640	680	1,290	600	200	800

The bleach revenue of the foregoing table is based on a production of a ton of bleach from 36 cwt. of salt by the Davis-Weldon process, which, I am assured, has been obtained in at least one works, though I am of opinion that such a yield is an abnormal one; but still it serves as an easy and excellent mode of comparison, and will do just as well for our purpose as the more common and average production of 1 ton of bleach from 40 cwt. of salt.

A glance at the table (II.) will show us that the total weekly revenue in making bleach and caustic soda, until quite recently, reached its lowest point in 1890, after which there were four years of plenty, in comparison with what had gone before. The years 1891—1894 inclusive were fair years, but I think I am correct in stating that the profits of those years did not give the shareholders of the various manufacturing concerns more than the moiety of a parliamentary dividend as measured by the gasworks standard. To-day the total revenue from these sources in such a works as we have considered is 115*l.* per week lower than it has ever been during the decade, and 585*l.* less per week than when a small dividend was paid.

Turning again to a similar works, wherein only bleach and salt-cake are made and sold, the lowest total revenue from these sources was also in 1890, it having declined to 785*l.* weekly. In 1891 there was an increase of 275*l.* weekly, which by January 1892 had increased to 339*l.*, from which point it has steadily declined, until to-day it stands at practically the same figure as in 1890.

Some of you may be tempted to exclaim: "What a profit must have been made in 1891—1894, with such an *excess* of revenue over what can be obtained to-day!" or, arguing conversely, what a loss must be going on to-day when the revenue is so much *less* than it was in the years 1891—

1894! Neither proposition is correct. The old Weldon process, as it was worked in 1887, is obsolete. The profit (if any), or let us say the reduction in the cost of production, has been brought about by the lessened prices of the raw materials used in manufacture, by the sandwicheing in of more economical processes, by which less is made of that product (salt-cake) now produced and sold at an absolute loss, and lastly by the reduction in wages, whereby many workmen have been thrown out of employment, and the remainder reduced to a bare living wage. As a result, who has benefited? Is it St. Helens, which has almost become a barren wilderness? Or Widnes, or Glasgow, or the Tyneside? Are the workmen happy and in constant employment? Or are the shareholders in these concerns in the receipt of enormous dividends? If none of these blessings have come to the share of the chemical trade, to whom have they fallen?

I think it can be shown that a works such as I have already described, simply making and selling bleach and salt-cake, producing that bleach by the Weldon process, cannot make both ends meet by reason of the enormous loss on salt-cake. As before mentioned, salt-cake has been sold at less than 13s. per ton f.o.b. at the maker's works, whereas it could not be manufactured for less than 33s., leaving the general expenses of the establishment entirely out of consideration; and as at least 2 tons of salt-cake are produced for every ton of bleach made (in some cases considerably more), it seems to me to be utter folly to go on producing it in former quantities. But I believe things are on the change so far as this manufacture is concerned, and those who have so far secured forward supplies of salt-cake at low rates are to be congratulated on their foresight.

A change for the better must come, and I believe is much nearer than some suppose. The change from the Weldon to the Deacon-Blaschke process has been rapidly effected in many of the old works, and this has wonderfully restricted the production of salt-cake. The amelioration which this has brought about has been checked, however, by the diminished consumption for caustic making which has followed from caustic soda being made from ammonia-soda-ash, as it now is in large quantities. If there has been an over-production in the Leblanc soda industry, there has been also an over-production in the ammonia-soda manufacture; and the limit of sales having so far been reached for carbonate of soda, the ammonia-soda works have had to turn their attention to the production of alkali in other forms, one school causticising the carbonate with lime, the other school preferring to use oxide of iron. I do not believe, in the long run, there is much to choose from in these two processes, and no doubt they will hang over the line together like Kilkenny cats; but the position of the trade is certainly not calculated to induce new capitalists to enter the arena. But new processes have entered the field, and, judging from advertisements in the trade journals, there are partisans even yet of the older processes; though anyone acquainted with the subject must know that the ordinary alkali trade, with high-strength alkali at 2*l.* 5s. per ton f.o.b., bleach at 6*l.*, and salt-cake at 18s., is not change for a shilling.

Works managers who have only had the opportunity of looking into the manufacturing side of things, and perhaps even of but one process of an establishment, are sadly prone to neglect the general expenses of an undertaking, and in this way the costs of production emanating from such sources are usually sadly too low. The office expenses, the laboratory charges (for these works cannot be carried on with the rule-of-thumb supervision of 30 years ago), and the sundry expenses of the estate, are no small items; yet I have an estimate before me, prepared by a professedly well-informed man, in which none of these items appear. It is, in my opinion, these things that have wrought so much injury to the alkali trade.

But the chemical trade is not alone in its depression. The agricultural interest has, according to common report, been so depressed as to call forth parliamentary treatment and aid. A few moments ago, in speaking of the chemical depression, I asked: "Who has benefited by the low prices?" Has the farmer benefited? He has been able to purchase his nitrate of soda and sulphate of ammonia at prices never

heard of before. Sulphate of ammonia, which was 23*l.* per ton in 1879, can now be had for 7*l.* 2*s.* 6*d.*, and even less, and nitrate of soda has this year touched the lowest price on record; superphosphate has been cheap, and yet the farmer is supposed to have suffered so much as to call for Government reduction in his taxes. But how do things really stand? A farmer pays, say, 30*s.* per acre for the land he tills, and on a 100-acre farm will probably be called upon to pay 22*l.* a year in taxes; at 25 years' purchase this will give the value of the 100 acres as 5,500*l.* Now, supposing this 100 acres to be occupied by a manufacturing concern, directly the landowner is approached for the purchase of such a plot, his idea of its value rises considerably; his 37*l.* 10*s.* or 40*l.* an acre becomes 250*l.* or 300*l.* an acre; and, though he will probably net 25,000*l.* for the plot, which before was practically unsaleable at 40*l.* an acre, he makes no provision out of the fund for the protection of the other tenants of the estate. What does he care about them so long as he can sell his land at such fancy prices? A manufacturing firm occupying such a plot may spend a quarter of a million of money in developing it; the works may earn no dividend, owing to depression of trade; still the amount such a firm would pay in rates would be about, say, 3000*l.*, as compared with the 22*l.* paid by the tenant of the land who happened to be a farmer. Under such conditions as these I think you will all agree with me that it was a little out of place to single out the agricultural interest for special consideration by Act of Parliament.

The chemical trade is one that has been specially harassed—by Acts of Parliament, provisional orders, river inspectors, nuisance inspectors, medical officers of health, factory inspectors, and I wot not more. I say harassed advisedly, but I do not wish to imply by any means that the inspectors of this parliamentary band have been the delinquents. The harassing has been done by those busy-bodies who, outside the camp, fancy they know everything within it, and many are the bogies they have conjured up and have endeavoured to foist on a sensitive public as to the dangers and unhealthiness of the chemical trades. From the five-and-twenty years of experience I have had in the manufacture of many kinds of chemicals, I can conscientiously say that the men employed in the chemical trade are, for physique and general healthiness, equal to, even if they do not surpass, any other trade with which I have been brought in contact.

While on this subject I should like to say a few words upon "inspection." I do not mean inspection under any one particular Act of Parliament, but inspection generally. I believe I am not alone in the opinion that all inspection of whatever kind should be centralised in some Government Department, and that no more duties of this kind should be entrusted to local authorities. As an old inspector of the Local Government Board, and having a district that embraced nearly one-half of England, I may be accused of having some bias towards this method of administering Acts of Parliament; but on my tours of inspection I had ample opportunity of seeing the immense amount of damage done to local industries by petty and ineffective interference from the local authorities. In fact I can go as far as to say that of the many complaints it was my duty to investigate, there did not exist one single one that was not traced to personal jealousy, to municipal bickerings, or to political differences.

It will not be "telling tales out of school" if I recount to you a few of my experiences in this direction.

One instance. A plumber in business in a small town in the South of England persistently complained of the damage done to his garden by the fumes from a certain chemical works more than half a mile away. Many visits were made to this works, but everything was always found in order, and, moreover, I could never trace any damage to the complainant's garden. So after many investigations I decided to ask the Chief Inspector to go down with me, and he, after careful examination of every point, came to the conclusion that there was no damage going on, but that some other motive was at the root of these persistent complaints. The result of further investigations showed that the complainant was at one time employed by the works in question to do all the necessary repairs, but the management, finding this to cost them more than it would cost to keep a resident

plumber, made the change, to the discomfiture of our worthy friend, who was reported to have said that "he would have his knife into the works for throwing him overboard."

To take another case. The owner of a chemical works in a large town had a near relative as next-door neighbour, who made many complaints of these works—complaints which could not be traced to any substantial foundation. I placed myself at the disposal of the complainant to send for me by telegraph whenever the nuisance appeared. The eventful day arrived; I duly received a telegram: "Frightful smell; come at once," and I posted off in hot haste by the first express. The first thing to do was to visit the complainant, who told me direful tales about the gases which had come over that morning, and directed me to a worthy couple who lived on the opposite side of the road, who, on being seen, declared "that very morning the stink was so bad as to make them vomit up their breakfast." Armed with this information, I next visited the works, and much to my surprise found all stopped. There was one old man as caretaker, who told me they had not had fire to the steam boilers for over a week, and that nothing had come in or gone out of the gates, nor had work of any kind been done in the meantime—a statement confirmed by the proprietors and managers, and verified by the books of the firm.

Yet another instance. In another manufacturing town complaints were received persistently from one resident over a period of three years, and every attention was given to his letters. The chemical works selected for his attack were not the nearest to him, but for some reason or other the owners were specially objectionable to the complainant. It was pointed out to him that the works he complained of were in excellent order and excellently managed, but no argument would convince him that he was not undergoing loss of health from the close proximity of these works. There were other features in this case which I cannot disclose without furnishing a clue to the identity of the parties. Suffice it to say that I was so sure there was a motive in this systematic persecution that I determined to root this up also. It was found on inquiry that the late owner of the works had lent the complainant a considerable sum of money from the coffers of the firm, and the new owners having discovered this applied for repayment. It was a bad day's work for them, as from this time the borrower never failed to find the works a nuisance.

Now in each of the foregoing instances the men who so bitterly complained of their neighbours' doings were members of the local governing body, and they thus brought extra pressure to bear upon those they were anxious to consider as offenders; and there is no doubt that they did exercise a great deal of influence over their colleagues. The action of the majority of these local bodies towards manufacturing establishments generally does not inspire any student of the subject with confidence that fresh powers would be used with circumspection, and in this opinion I am strengthened by looking back at the records of local authorities in their attempts at smoke prevention.

Had the attempts to minimise the production of smoke been made by some Government Department specially charged with this specific object, and had the administration proceeded on the lines of the Alkali Acts, I verily believe we should have reached the age of smokeless fires long ago; so that I think it does not point to very great perspicacity on the part of our legislators and administrators of the law not to have discovered long before this that amelioration is not to be brought about by persistently hounding manufacturers before a bench of local magistrates who know nothing about these things. My impression is that manufacturers generally, and especially those who have to use furnaces other than steam-boiler furnaces, were very much to blame in allowing the smoke clauses of the Public Health Act to pass into law without forcing those who drafted the Bill to put their definitions into a more definite shape.

The smoke from steam boilers can be easily minimised and even reduced to *nil*. I have often pointed out how this can be done; but there are many process furnaces which in the present state of our knowledge cannot be made smokeless in all stages of the heating process and yet our

magistrates do not consider these things, but say they are sorry they have no alternative but to fine any offender brought before them on the *ipse dixit* of the nuisance inspector. It is quite sufficient for this man to go into court and, without any corroboration of his story, to secure the conviction of a score of manufacturers who, in the present state of trade, have quite enough to do to keep their heads above water, without spending their time in hanging for hours about a police court waiting for their cases to come on.

Do not imagine for one moment I am arguing for the continuance of the black smoke nuisance, but I say, as I have often said before, that if all the tall-chimney smoke was abolished to-day, the Manchester fogs would still be as bad as ever. I have often pointed out that our fogs are caused solely by the domestic smoke, and that will never be abolished until domestic smoke is brought under police regulations, as it is in many continental cities. To have domestic smoke under police supervision would no doubt be unpalatable to many of our citizens; but if it be so, let them cease to rail against those who are no parties to fog production. In many continental cities the combustion of bituminous coal is prohibited, and I see no reason why the same regulations should not be put in force here.

From steam boilers there should not be any black smoke, but as to its suppression from certain furnaces, I say most decidedly that the present means are ineffective, and that before any real good can be done, some radical change must be made. Take Manchester and Salford for instance: they have for many years systematically harassed all the manufacturers in the city, and in some cases have driven them out of it, yet the atmosphere of Manchester and Salford is as filthy as ever—some say even worse.

Second to the method of constituting a Government Department to take charge of this smoke-abatement question, I believe it would be better than the present system if every large corporation, or a number of them, appointed a man of high technical ability, and having a long practical acquaintance with many various processes, to whom all the complaints of the smoke inspector should be submitted. Let him then make inquiries into the why and wherefore of each case, and if he, after full investigation, advised a prosecution, it would more likely turn out to be a bad case needing a drastic remedy, than what we find under the present system.

Let us now turn our attention to another public question which has been badly treated in the past: I refer to the sewage-purification schemes which have cost local authorities so much money and anxiety, and which is further intimately connected with the pollution of our rivers. When one considers the enormous sums that have been spent upon sewage-purification schemes during the past quarter of a century, and the little good that has resulted therefrom, and the few reliable statistics available for comparison, we are sorely tempted to inquire whether this subject has been attacked in the right way. How many times have our large municipalities changed their "systems," and perhaps made a retrograde movement with every alteration instead of a progression? Who is to blame for this? Is not the true solution to be found in a letter sent by a certain corporation to the Mersey and Irwell Joint Committee only so lately as last month. The letter says: "We could not proceed with the work, owing to the change of surveyors; the new surveyor was not in accord with what his predecessor had done, and this, together with the change in the composition of the Sanitary Committee, has delayed the work; and, moreover, the Committee as now constituted is anxious to visit other works to see what is being done in them." All of you know well enough, without my telling you, of what value the opinion of such a committee (none of whom perhaps have had a technical training) is likely to be, and yet these are the people to whom a constituency entrusts the selection and carrying out of a highly technical problem, and who more often than not consult only their own peculiar fancies. I have had some peculiar experiences in this direction, and it is now long since I renounced the sewage problem from a business point of view as being a too delusive *ignis fatuus* to follow. It is an industry that has never tempted the right kind of industrial chemists within

its portals, and has therefore suffered. The man now who attempts to treat sewage generally evolves his process first and learns his chemistry afterwards, and not infrequently at the expense of those who expect the return of good drinking water from the sewage meted out to him to purify. There are possibilities in everything, but it does not aid in the solution of the problem to exact guarantees from a contractor he is never likely to perform; it may ruin him both in reputation and financially, but we are no nearer finally. I mention this more particularly as a case was recently brought before my notice in which a contractor had offered to purify the sewage of a large corporation at a certain price per million gallons, and offering to conform to a certain standard of purity in the effluent. I pointed out the standard was impossible of attainment in our present state of knowledge, but the reply I received was: "What does it matter to us so long as the responsibility is off our shoulders?" Is this the way to look at a problem of this kind? I say most decidedly not.

Now let us turn to the subject from another point of view,—that of a river conservator's. Is it not a wrong method to exact maximum results in purification before at least one half of the works in operation can be shown to have attained such a degree of perfection? I now specially allude to the action of the Mersey and Irwell Joint Committee in their dealings with the sewage polluters of their watershed. Their motives may be exceedingly praiseworthy, but unfortunately they have set about cleansing the Augean stable in the wrong way. A stream like the Irwell was one in which considerable latitude could have well been allowed, at the outset at any rate; but by following their mistaken policy they seem to be doing nothing but heap up a series of lawsuits at the ratepayers' expense. Let those who saw and smelt the Irwell in Jubilee year turn their attention to it now, and ask themselves if they can discern any improvement.

The first step towards promoting an amelioration would have been to have secured the adoption of any good precipitation process, and to have named a standard that could be obtained by such processes when fairly worked. If this had been coupled with an absolute prohibition of the entry of suspended matters into the river, it would for the present have been enough to ask for, and the various local authorities would have known how they stood, which is more than they do at the present moment. It is pretty well known that the sewage sludge is a difficult matter to deal with, and it is often found easier to precipitate by day and to do something else by night rather than let the sludge accumulate. It is very astonishing to find how much more sludge is now being obtained from certain works, owing to the frequent visits of the inspector.

But to return to the standard of sewage purification, it had been found by this city of Manchester such an intolerable burden that the Corporation actually contemplate spending a quarter of a million of money to avoid it. They cannot be blamed for this. As business men they see that it will be cheaper to incur this initial outlay than commence to experiment with land filtration on unsuitable land and restricted in area into the bargain. And here I may interpolate an objection to the proceedings of the Local Government Board in insisting upon the purchase of land for filtration purposes. Quite as good an effluent can be obtained with artificial filters as with the natural soil, and in many cases far better, but the Local Government Board do not seem to be aware of it. Between the Mersey and Irwell Joint Committee and the Local Government Board, those corporations who are anxious to improve the condition of things seem to be having a bad time of it.

Another subject I might dwell upon on an occasion like this is that of instruction in technical chemistry. We have now all of us become familiar with the jeremiads of many of our public men who never seem to miss the opportunity of declaring that the length and breadth of this land is a barren wilderness, and that if we want to find the veritable land of Goshen we must travel to Germany. While not wishing for one moment to disparage German methods and German industry, I say advisedly that we have still a few good men amongst us in the midst of our chemical industries

who are Britishers. That Germany has an excellent and cheap system of scientific education is known to everyone who has followed the subject, but I would join issue with those who think that anyone can be made a cooper to these spirits of industry whose originalities have revolutionised the world's methods, by a little scientific instruction—*"Made in Germany."*

We have now springing up in our midst—one in almost each of our large towns—palatial buildings called technical schools, which are supposed to be capable of exercising a huge influence upon our industrial operations in the near future, and they will no doubt be of use in winnowing the chaff from the wheat. A florist desirous of securing novelties in his business, sows the common seed broadcast, but he does not keep all his seedlings, and often enough uncommon means have to be pursued to secure the continuance of some original strain. Looked at in this light the technical school may be of use; it may select from among the class possessing but few opportunities, but from which all persons of note have ever sprung.

The technical school has in this quarter of a century become a necessity, mainly owing to the disfavour into which the system of apprenticeships has grown; the wages in many cases paid to apprentices or artied pupils being out of all rhyme and reason; and during the last years of an apprentice's "time," when he is doing the work of a skilled workman, to be receiving a paltry 12s. a week must be gall and wormwood to many an aspiring lad. Many firms will not take an apprentice; they have boys and youths working, but not under "indentures," and in many cases they are kept strictly to some monotonous routine.

Then again under the application of specialised machinery the sub-division of labour is so organised that in many shops the apprentice does not get an all-round grasp of a business, as he did in days gone by. It is here that the work of the technical school will come in, and such a school, if properly planned and equipped, will, in the future, be of immense value to our technical industries. Some few years ago I was shown round the new Polytechnicum at Zurich by Prof. Lunge, and marvelled at the completeness of the equipment. Here is an example that might well be followed by us: a good technical chemist at the head of affairs; he knows the details of which tuition and investigation are requisite, and the students' course is shaped accordingly. A man trained in such a laboratory will be of far more use to a manufacturer than if he studied in an ordinary laboratory under an non-technical professor.

It is the detail of industrial chemistry that requires study; the broad lines can be gathered from any technical treatise, but the detail and the investigation and cure of abnormal conditions can only be taught by one who has been through the school of adversity.

What we require in this country is a special chair of chemical engineering to prepare students for positions as works managers and superintendents of processes. It is strange how few chemists possess any knowledge of even elementary engineering, and fewer still any conception of practical mechanics; and yet an engineer will learn chemistry and apply his combined knowledge to the requirements of his profession. There is a field open here.

It was a bold experiment to place the funds necessary for technical instruction in the hands of local authorities with the full privilege of supplying whatever they deemed best. Let us hope the money will be better spent than it has been over the sewage problem, the annihilation of the smoke field, or even the prevention of the pollution of our rivers. If the precedent of these things be followed, we have as yet only reached the threshold.

I must say I have been astonished that the *cart-before-the-horse* principle seems to have been followed in many of these schools. The schools have been built and equipped with fixtures, and then, and only then, a director or professor has been deemed necessary. One would have thought the securing of a competent director or professor was the main point, and that he should be at hand during the building and the arranging and the fitting of the building which he is called upon to direct or to instruct in.

Fortunately Manchester—already possessing the nucleus of a technical school, with a director and instructors of no

mean ability, and assisted by such practical men as our late chairman, Mr. Levinstein—has not had the opportunity of making these mistakes; and I am of opinion that the Manchester Technical School, when it is finished, will be the exact thing required, which some of the other technical schools most assuredly are not. I have lately had an opportunity of forming some idea of what the Manchester school will be like when finished, and the only fault to be found is that in the very near future it will become too small for its work.

Has it ever occurred to any one of you that the number of highly educated technologists required yearly is comparatively but very few? But these establishments dotted over the country will produce many. What is then to become of them? This leads to the further question: For whom is technical education intended? I have a notion that it is for those who wish to become managers, overseers, or superintendents of processes in industrial establishments; but I am open to correction, as I know some people consider it to be provided for the rank and file. Of course it will be eligible for the rank and file, and so open out stepping stones for the eager and determined ones, but I fail to see how, in the majority of cases, the possession of a modicum of technical education will improve the work of the ordinary workman. There are many operations purely of a mechanical nature; the superintendent directs, the formula proceeds from the laboratory and director's office; the remainder could perhaps be executed in a better manner by a machine.

Do not think I am disparaging the spread of technical education—far from it, but I would warn you not to expect too much, in the near future at any rate; and in passing may just point out that I think the older teaching universities have been very remiss in days gone by in not supplying a curriculum rendered necessary by the progress of the age, and it is not at all to their credit that the technical education of the country should have been left to municipal corporations to supply.

In the earlier part of this address I pointed out to you the utterances of some of our public men, who have seemingly a very poor estimate of the power and industrial capacity of their own countrymen. Oddly enough they have a singular belief in those three magic words "*Made in Germany*," but as generally this expression is synonymous with cheapness on account of the low wages of the workers, I do not think we need trouble our heads about competition from this source. The day is coming, and very rapidly too, when Germany will have to pay her labourers much more reasonably, and then her costs of production will fall nearly into line with our own; but what I do fear is the coming competition with that remarkable race of English-speaking people, the Americans. America has made wonderful progress during the last quarter of a century, in mechanical devices mainly, but she is now turning her hand to chemicals, and a sad mess she has made already with English prices.

All new firms starting in this country for the supply of the American market should remember that America has a goodly supply of coal of all qualities, and that the price of labour is not inordinately high. The American chemical industries are manned by men who have a good scientific and industrial training, and to whom work is a pleasure. There are no works there left to an incompetent or underpaid all-round manager—a fact which we, sooner or later, will discover to our chagrin.

In my opinion, America cannot come to the front at once, owing to the strongly protective inclination of the majority of her legislators, and I do not see why our Cobden Club and other similar institutions should be so anxious to kick away the ladder just yet. For a market for our heavy chemicals we are largely dependent upon the United States, but so soon as the land of the Stars and Stripes becomes a Free Trade country we may begin to put our shutters up here. With Free Trade in the States we should no doubt have several years of unexampled prosperity, and then all would quickly vanish. America has all the raw material she requires; her coal, her oil, her natural gas, are all waiting for further development, which the natural industry of the inhabitants will not suffer to remain much

longer in repose. Of raw materials necessary for the chemical trade the States have abundance, while the adverse climatic conditions so often alluded to here, as being one great obstacle against the settling of the chemical trade in America, will yield to the ingenuity of the American people, who will quickly utilise the knowledge they have gained in their great technological institutions.

One lesson, I think, should have been well learned by this time, and that is, the folly of the different manufacturers of this country systematically underselling each other with the view of bringing the weaker to the wall. Even our greatest corporations will find out, if they have not done so already, that they are not improving their own positions by being ever on the consumer's doorstep with the promise to supply at lower prices than those offered by anyone else. It is like giving the consumer a blank cheque to fill in according to the dictates of his conscience, which, being rather elastic about the period of making his contracts, is not always to be depended upon. German competition becomes insignificant before this internecine warfare. There may be wisdom in it, but "the race is not to the swift nor the battle to the strong, but time and chance happeneth to them all."

On the motion of Mr. Harry Grimshaw, seconded by Dr. Grossman, a vote of thanks was accorded to the Chairman for his valuable address.

Yorkshire Section.

Chairman: Thos. Fairley.

Vice-Chairman: Christopher Rawson.

Committee:

H. E. Aykroyd.
J. Cohen.
J. R. Denison.
N. Farrant.
T. Glendinning.
A. Hess.

W. Leach.
A. G. Perkin.
F. W. Richardson.
A. Smithells.
Geo. Ward.
Thorpe Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, Yorkshire College, Leeds.

Meeting held on Monday, October 26th, 1896.

MR. THOS. FAIRLEY IN THE CHAIR.

THE DYEING PROPERTIES OF AROMADENDRIN AND OF THE TANNINS OF EUCALYPTUS KINOS.

BY HENRY G. SMITH, F.C.S.

In a paper read before the Royal Society of New South Wales on July last, I submitted the results of my investigations, so far as they had been completed, on the chemistry of *aromadendrin* ($C_{20}H_{26}O_{12} + 3H_2O$), a crystallisable body found existing in the "turbid group" of eucalyptus kinos. It was there pointed out that from the results of these inquiries, it was evident that *aromadendrin* had affinities, more or less marked, with catechin, obtained from cutch; but that in many respects it differed greatly from that body, and it was suggested that *aromadendrin* probably bore the same relation to the tannins of the eucalyptus of Australia as catechin bears to the catechin tannins. Thinking that perhaps the analogy might be further augmented by testing the dyeing properties of *aromadendrin*, I undertook a series of experiments in this direction, with the result that marked differences were found between it and catechin.

The results of this preliminary examination were left over until a future time for further investigation, only incidental mention being made in reference to it in the paper referred to above; attention was drawn to the fact, however, that when *aromadendrin* was heated to a little above its melting point (when decomposition takes place, although it melts without decomposition), a body was formed, almost insoluble

in cold water, soluble in hot water, exceedingly soluble in rectified spirit, and having great staining properties, dyeing cotton, &c. a fine yellow colour.

I named this substance *kino-yellow*, and considering its importance, left its investigation over until a future period. I was proceeding with the inquiry, when the June number of the Journal of the Society of Chemical Industry was received, which contains a paper by Messrs. J. J. Hummel and Reginald B. Brown on the "Dyeing Properties of Catechin and Catechu-Tannic Acid," a paper from which I have personally derived much information of the greatest use to me in carrying out this investigation. Thinking the results of my inquiries might be of interest to your Society, and have some value, I have submitted them with the hope that they may add somewhat to our knowledge of these bodies.

Before I make a short digression on the history of the eucalyptus kinos, I would refer to a portion of the paper by Messrs. Hummel and Brown, on page 426, where Mr. A. G. Perkin refers to the differences of the melting point of catechin as obtained by different observers, and remarks "that the higher melting products were difficult to understand." I had at first great difficulty in obtaining *aromadendrin* as a product of constant melting point, even when obtained from the same sample of kino, and by the same method; and it required to be obtained as white as possible by crystallisation from absolute alcohol before dissolving in hot water; if this be not done, the melting point will not be constant, even the slightest trace of impurity being sufficient to lower the melting point, and even repeated recrystallisation from boiling water does not successfully remove these impurities without much trouble. A portion of *aromadendrin* from the kino of *eucalyptus calophylla* was obtained, and its recrystallisation from absolute alcohol omitted, and although when crystallised from water it was quite white, yet it melted at $117^{\circ}C$. It was recrystallised no less than six times from water, and although the melting point was raised each time, it was not until the sixth time that a product having the correct melting point was obtained; whereas, by paying attention to the alcoholic crystallisation, at first, the white product, when afterwards obtained from water, usually melts near $216^{\circ}C$. the first time, and always after the second aqueous crystallisation, the melting point being more often above than below.

Eucalyptus Kinos.—The arboreal vegetation of Australia is largely composed of eucalyptus trees, belonging to the natural order *myrtaceae*, of which there are in the whole of Australia no less than 150 named species. These eucalyptus trees exude an astringent substance vernacularly known as "gum" (thus the term "gum-trees" as applied to the eucalyptus), but which is generally known as kino.

These kinos have been under investigation for some years at this museum, and a very fine and extensive collection has been got together. By this investigation we have been enabled to arrange them into some systematic order. We find that these eucalyptus kinos range themselves into three large groups or classes. First, those that contain about 35 per cent. of gum and are practically insoluble in alcohol, to this class belong all the exudations of the "ironbarks," and a few others. This group has been named the "gummy group," because of the gum present in the kino.

The second group has been named the "ruby group," because all these kinos are soluble in both water and alcohol, are ruby-coloured in thin pieces by transmitted light, and form ruby-coloured solutions. They consist almost entirely of a tannic acid and water, when freshly exuded, and contain neither gum nor *aromadendrin*. They embrace the exudations of the "stringybarks" and several others often with smooth barks. It is found however, that although the cortical classification of these kinos is useless, yet, the botanical sequence is complete so far as our knowledge goes.

The third group, known as the "turbid group," embraces all those kinos which are soluble in hot water but form turbid solutions on cooling. These belong to the "boxes," &c., and appear to contain all those kinos not included in the previous groups. It is this last group that is of interest to us in this investigation, as the bodies causing this turbidity have only been recently isolated and determined.

This turbidity is found to be caused by the presence of two bodies existing in these kinos, either singly or together, one named "eudesmin" ($C_{10}H_{16}O_2$), melting point $90^\circ C$, and aromadendrin. This latter body is the subject of this investigation, together with the kino from which it has been obtained, and also that of a specimen belonging to the "ruby group," while the affinities of "eudesmin" yet remain to be investigated. Very large quantities of these kinos are annually destroyed and lost. Very little has as yet been accomplished towards the commercial utilisation of very many natural vegetable products of this country. It is not my province in this paper to point out the errors that are passed on from one publication to another in reference to these eucalyptus exudates, but our knowledge is now such, that if properly collected and correctly classified, these kinos have great possibilities of commercial value and usefulness.

The Extraction of Aromadendrin.—The method whereby aromadendrin was obtained from these kinos is fully described in the papers submitted to the Royal Society of New South Wales, but it may be well perhaps to shortly recapitulate. The kinos were finely powdered, treated with a little water, and warmed; the particles thus disintegrate, and a pasty mass is formed; this is transferred to a separator, and, when cold, ether is added and continually agitated. No emulsion is formed, and the ether is readily removed; this treatment is continued with fresh ether, the several portions mixed, and the ether distilled off. The residue, which is usually reddish in colour, is then dissolved in the least possible quantity of boiling absolute alcohol, and allowed to stand some hours to crystallise; these crystals are then filtered off, drained on a porous slab, recrystallised again from absolute alcohol, drained, and dried; the crystals should be quite white; they are then crystallised twice from boiling water, when aromadendrin is usually found to be pure. Of course I refer to a kino in which "eudesmin" is absent.

The Dyeing Properties of Aromadendrin, &c.—The result of this investigation proves that pure aromadendrin in its normal condition has scarcely any dyeing properties when treated with copper sulphate and potassium bichromate, so that this body does not assist in dyeing when existing unaltered in the kino, thus differing from catechin. But when aromadendrin is heated to just above its melting point, and kino-yellow formed, it has marked dyeing properties when dissolved in boiling water and treated with $CuSO_4$ and $K_2Cr_2O_7$, or when dissolved in alcohol and the cloth dipped into the solution and dried before treatment with $CuSO_4$ and $K_2Cr_2O_7$. It is evident, therefore, that by turning aromadendrin into kino-yellow, it has dyeing properties somewhat analogous to catechin. Copper sulphate largely precipitates aromadendrin, but it does not precipitate the tannic acid, as exemplified with the kino of the "Blackbutt," *Eucalyptus pilularis*, which belongs to the "ruby group." I have not yet submitted the tannin of these kinos to comparative rigorous investigation, but there is little doubt from my researches that the tannin of all the eucalyptus kinos is identical. This being so, it follows that the copper salt being precipitated almost entirely by aromadendrin, but not by the tannin, only the tannin is of value when the copper salt is added directly to the solution of the kino; even if it is not so, it is proved by the experiments that aromadendrin has little dyeing properties with $CuSO_4$ and $K_2Cr_2O_7$ before heating. When aromadendrin is treated with ferric chloride solution, it is but little precipitated, and has very marked dyeing properties, but the tannin in the kino is wholly precipitated with $FeCl_3$, when in excess; so that in this experiment the dyeing properties of the kinos of the "turbid group" are almost entirely owing to the presence of aromadendrin in the kino. The kinos of the "ruby group" do not contain aromadendrin, and therefore have no dyeing properties with ferric chloride. $FeSO_4$ acts much in the same way and from the same reason. When the cloth is boiled in a solution of a ruby kino, and then in a solution of $K_2Cr_2O_7$, the tannin is oxidised as readily without the previous boiling in $CuSO_4$ as with it, the dye being just as dark; the only difference being that with the previous boiling with the copper salt, the dye has a slightly warmer tint. This

is so when $FeCl_3$ is added to the kino, but not in excess; so that it would be wasteful to add an iron salt, and the extra boiling in a copper salt assists but little in the process. It is thus seen:—

(a.) That neither $CuSO_4$ nor $K_2Cr_2O_7$ oxidises aromadendrin when in its normal condition.

(b.) That when changed to kino-yellow both $CuSO_4$ and $K_2Cr_2O_7$ are able to oxidise it, and also that the latter is able to do so without the previous boiling in the copper salt.

(c.) That $K_2Cr_2O_7$ oxidises the tannin of the kino without the previous boiling in the copper salt.

(d.) That the addition of $FeCl_3$ to a ruby kino has no effect, but that with a turbid kino, by acting with the aromadendrin, it assists by giving darker shades.

With $K_2Cr_2O_7$, the most successful experiment was when the cloth was boiled in the kino solution first, and then in the $K_2Cr_2O_7$ solution, because, although $K_2Cr_2O_7$ does not precipitate the tannin of the kino, yet it does not appear to act very energetically except when the chromate solution is in large excess; it readily oxidises the tannin upon the cotton when under the latter condition, but it acts very slowly when added to the kino solution directly. If it were possible to heat the kino to just above the melting point of aromadendrin without decomposing the tannin, the actual dyeing material would be greatly augmented in quantity; but it is not possible, as decomposition begins at a much lower temperature, and much of the tannin is destroyed at once. 36 specimens of dyed calico are submitted, illustrating the results obtained by the several treatments, and demonstrating the statements made above. The amount of material taken has been the same as given by Messrs. Hummel and Brown in their paper, *etc.*, 0.5 gram. of material made up to 50 c.c. in water, the size of the cloth being $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in., so that comparative results may be obtained if required; but the time taken has varied, as stated in the following descriptions. In no case was the cloth left in the bath until cold, it being removed at the expiration of the time taken for boiling. The following numbers refer to the numbers above the specimens of dyed calico submitted with this paper, on the six cards.

Specimens Nos. 1 to 6.—Pure aromadendrin was dissolved in boiling water and the cloth No. 1 boiled in the solution for $\frac{1}{2}$ hour, then taken out, squeezed, and boiled in a solution of $CuSO_4$ for $\frac{1}{2}$ hour. This process was repeated; the cloth was then transferred to a solution of $K_2Cr_2O_7$ and boiled for ten minutes. The resulting colour, after the cloth had been washed in clean water and dried, was a very light drab, showing that this process had very little effect indeed on the cotton. With No. 2 the process was repeated on half the cloth; the resulting colour was very slightly darker than that of the first specimen. Nos. 5 and 6 are specimens of another kind of cloth treated in the same way, but with this difference, that the cloth was boiled one hour in the copper solution; the resulting colour is but little different. With Nos. 3 and 4 a minute trace of kino-yellow was added to the bath, the treatment being the same as with Nos. 1 and 2; the result is seen in the slight darkening of the cloth. These experiments prove, as has been before stated, that aromadendrin has really no dyeing properties with the above treatment.

Specimens Nos. 7 to 12.—Pure aromadendrin was heated to just above the melting point until decomposition began, kino-yellow being formed; this was dissolved in alcohol. No. 7 was simply dipped in the alcoholic solution, squeezed, and dried; the result is a fine yellow colour. No. 8. The kino-yellow as above formed was dissolved in boiling water, and the specimen boiled in the solution; a yellow colour is the result. With No. 9 half the specimen No. 8 was boiled in the aqueous solution of kino-yellow, to which alum had been previously added; the alum does not precipitate the kino-yellow; a fine yellow colour is the result. No. 10 was a specimen the same as No. 7, and was boiled for $\frac{1}{2}$ hour in the same alum solution as No. 9; the resulting colour is a fine yellow, perhaps inclining slightly to orange. No. 11 was a sample of white cloth boiled in the alum solution of kino-yellow for $\frac{1}{2}$ hour; the resulting colour is not quite so pure as with either No. 9 or No. 10, having a slight tinge of brown. No. 12 was a specimen

the same as No. 7, but boiled $\frac{1}{2}$ hour in aqueous solution of kino-yellow to which SnCl_2 solution (dissolved in HCl) had been added; the result is a fine yellow, slightly darker than No. 10.

Specimens Nos. 13 to 18.—These specimens show that although pure aromadendrin does not dye the cloth, yet, when changed to kino-yellow, it has that property.

No. 13 was boiled in an aqueous solution of kino-yellow for $\frac{1}{2}$ hour, then in CuSO_4 for one hour, and then for 10 minutes in $\text{K}_2\text{Cr}_2\text{O}_7$. The resulting brown colour is warm, perhaps inclining to orange-brown. A portion of No. 13 was again treated by the same process, with the result that with No. 14 a darkening has taken place, a warm brown resulting. No. 15 was dipped in an alcoholic solution of kino-yellow, dried, and then boiled one hour in CuSO_4 and then in $\text{K}_2\text{Cr}_2\text{O}_7$; the result is a little lighter colour than No. 13. No. 16 is a portion of the previous specimen; it was boiled in an aqueous solution of kino-yellow before boiling in CuSO_4 for $\frac{1}{2}$ hour, and then in $\text{K}_2\text{Cr}_2\text{O}_7$; a decided darkening has taken place. Nos. 17 and 18 show that $\text{K}_2\text{Cr}_2\text{O}_7$ has the power to alter the kino-yellow to a brown dye. No. 17 was boiled in an aqueous solution of kino-yellow, and then transferred to $\text{K}_2\text{Cr}_2\text{O}_7$ directly and boiled; the result is a yellowish-brown. A portion of this specimen was again treated by the same process, when an orange-brown colour is obtained.

Specimens Nos. 19 to 24.—When pure aromadendrin is treated with $\text{K}_2\text{Cr}_2\text{O}_7$ no result is obtained. These specimens show the action of FeSO_4 and Fe_2Cl_6 upon unaltered aromadendrin. These salts do not precipitate aromadendrin to any extent, but have the power of acting upon it, the action of FeSO_4 forming much the same colour as when kino-yellow is treated with CuSO_4 , but the FeSO_4 acts more energetically at first. No. 19 was only boiled 10 minutes in the solution of aromadendrin, to which FeSO_4 had been added, and then boiled in $\text{K}_2\text{Cr}_2\text{O}_7$; the result is a light brown, differing but little in depth of shade from the kino-yellow specimens that had been boiled one hour in CuSO_4 . No. 20 was a portion of previous specimen again treated by the same process; the result is a warm brown of a clear colour. Nos. 21 and 22 are little different from the preceding two specimens, although boiled for $\frac{1}{2}$ hour in the FeSO_4 plus aromadendrin solution. Nos. 23 and 24 show the action of Fe_2Cl_6 when added to aromadendrin, boiling $\frac{1}{2}$ hour, and then in $\text{K}_2\text{Cr}_2\text{O}_7$. The resulting colours differ little from those obtained when FeSO_4 was used, being a little more dull. No. 24 was darkened by repeating the process.

Specimens Nos. 25 to 30.—We now consider the action of the kino from which aromadendrin was obtained. No. 25 was boiled in a solution of the kino for $\frac{1}{2}$ hour, then in CuSO_4 for $\frac{1}{2}$ hour, and repeated the process before boiling in the $\text{K}_2\text{Cr}_2\text{O}_7$; the resulting colour is a dark brown, which, by repeating the process with No. 26, becomes darker. When the CuSO_4 is added to the solution of the kino, and the cloth No. 27 boiled one hour, the resulting colour differs little from No. 25. By repeating the process with No. 28 the colour was but slightly darkened. With Nos. 29 and 30, Fe_2Cl_6 was added to a solution of the kino, and the cloth boiled for $\frac{1}{2}$ hour before treating with $\text{K}_2\text{Cr}_2\text{O}_7$; the colour is dark brown, slightly slaty in tint. By repeating the process with No. 30 the colour is darkened. Judging by the results obtained by aromadendrin with Fe_2Cl_6 , it must be considered that, although the tannin is precipitated by Fe_2Cl_6 , yet this must exercise some action in the bath, because the resulting colours are darker than the kino itself.

Specimens Nos. 31 to 36.—We now consider the action of a kino belonging to the "ruby group," and therefore containing no aromadendrin. The kino taken was that of the "Blackbutt," *Eucalyptus pilularis*. By treating Nos. 31 and 33 in the same way as Nos. 25 and 26 we obtain colours almost identical with that of the latter specimens. This was what we might expect, if the tannins are identical, because we have seen that this treatment with CuSO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ does not affect aromadendrin. Nos. 33 and 34 were treated in the same manner as Nos. 27 and 28, and the resulting colours are almost the same as those of the latter. No. 35 is a specimen boiled in a solution of this

ruby kino, to which a small quantity of Fe_2Cl_6 had been added, and then treated with $\text{K}_2\text{Cr}_2\text{O}_7$; the resulting colour is the same as obtained by boiling in the kino itself, and then in the $\text{K}_2\text{Cr}_2\text{O}_7$ directly, showing that the iron salt has little effect upon this experiment, except to destroy a portion of the tannin. No. 36 is an abnormal specimen; this portion of calico when boiled in CuSO_4 had the salt deposited upon the fibre, and when afterwards boiled with a solution of aromadendrin a yellowish-green colour was obtained. It did not matter which was used first, the resulting colour was the same. It was a portion of cloth that had been used, but I have not succeeded in obtaining this colour on any specimens of new cotton cloth that I have used. I have not attempted to trace the reason, but no doubt it was caused by some treatment the cotton had undergone. As it stands, it is more interesting, perhaps, than useful.

The specimens submitted have undergone no other process than washing in pure water after removing from the dye-bath.

I have much pleasure in submitting the above results to your Society, as the investigation is, I believe, entirely new, and in doing so I would like to mention that the Technological Museum of Sydney (which is a Government Institution) will be glad to furnish information respecting the products of Australia to correspondents who may be interested, and will also have much pleasure in disseminating knowledge respecting the same, as the object of the institution is not only the collection and exhibition of all substances used in the arts and manufactures, but the furthering of our knowledge respecting the indigenous products of the colony of New South Wales.

The paper was illustrated by specimens of aromadendrin, the kino from which it was obtained, a sample of a kino belonging to the ruby group, and 36 pieces of calico dyed with aromadendrin; and various kinos, alone and in conjunction with copper sulphate, potassium bichromate, ferrous sulphate, and ferric chloride.

DISCUSSION.

Mr. A. G. PERKIN had read the above paper on "The Dyeing Properties of Aromadendrin" and that dealing with the same substance in the Journal of the Royal Society of New South Wales, and congratulated Mr. Smith upon the interesting results he had obtained in this somewhat new direction. Recently, more attention had been paid to the nature of the colouring principles and allied substances contained in the natural dyestuffs, and this work was gradually tending towards the arrangement of these substances in distinct chemical groups. For some time past it seemed therefore reasonable to expect that substances analogous to catechin or kinoin should exist in nature, and the isolation of eyabomaculin from the *artocarpus integrifolia*, and the discovery of eudesmin and aromadendrin pointed to a partial fulfilment of this expectation. During the discussion on Messrs. Hummel and Brown's paper he had taken the opportunity of making some remarks upon catechin, which were intended merely as a preliminary notice for the purpose of reserving the investigation. The work was being continued, but it appeared better as yet to make no definite assertion upon the subject, until the results obtained were ripe for publication, which he trusted would be during the present session. Kinoin also had been prepared and examined to see if it possessed the property of combining with mineral acids, as is the case with quercetin, but with a negative result. He therefore looked forward with much interest to the further work of Mr. Smith upon his new substances, and it was highly probable that the independent result of both this gentleman and himself which would be obtained in the study of what appeared to be closely allied compounds, would be of service to each during the prosecution of further work. He was obliged for the suggestion as to the purification of catechin by crystallisation from alcohol; for, though he had already applied this as a test for the purity of one product, he had not as yet employed it with the cruder material. A point not mentioned by the author of the paper, though possibly known to him, was the fact that aromadendrin yields with aluminium-mordanted cotton a yellow shade, which appeared to be extremely suggestive.

New York Section.

Chairman: Charles F. Chandler.

Vice-Chairman:

Committee:

M. Alberg.	E. G. Love.
T. Lynton Briggs.	Thos. J. Parker.
G. T. Bruckmann.	Wm. Jay Scheffelin.
Vinzel Coblenz.	R. C. Schupphaus.
H. Endemann.	J. H. Wainwright.
W. F. Enerst.	D. Wesson.
Jas. Hartford.	

Hon. Treasurer: R. C. Woodcock.

Hon. Local Secretary:

H. Schweitzer, 139, Front Street, New York, U.S.A.

Meeting held on Friday, October 23rd, 1896.

OPENING ADDRESS BY THE CHAIRMAN,

DR. CHARLES F. CHANDLER.

I THINK it my first duty to congratulate the Section on the success which has attended these first years of its existence. I am informed by the Secretary that out of 420 United States members of the Society of Chemical Industry, 306 have already enrolled themselves as members of the New York Section, 10 of these having joined during the past year. I also find that we have had a considerable number of papers, many of which were extremely interesting, and contained valuable additions to chemical knowledge.

It is also very pleasant to have had the opportunity of entertaining so many distinguished foreign members of our Society during the past year.

In thinking over the subject of the future usefulness of this Section, I have very carefully studied the address of our late President, which I presume most of you have seen in the Journal. Mr. Tyrer drew attention to the part which the Society of Chemical Industry has indirectly been able to take in Britain with special reference to the interests of chemical manufactures; and he enlarged upon the further influence which the Society may exert for the benefit of chemical industries. He spoke particularly of what had been accomplished in trade matters in which chemistry was involved, where the Council and different committees of our Society in Britain had been in consultation with local authorities in regard to many subjects of a chemical character, such as river pollution; smoke abatement; sanitary nuisance abatements; British regulations for the safety of employes in factories in which chemical operations were conducted—regulations, for instance, for white lead factories, to protect the workmen from lead poison; bleaching-powder factories, to preclude them from the breathing of chlorine; protection to employes in match manufactories. They are subjects on which our Section might give valuable advice.

The British Sections have given considerable attention to the revision of the patent law, for the better protection of chemical inventors. The Council is now considering, in conjunction with the Chamber of Commerce, the laws regarding food and drug adulterations; and especially internal revenue regulations with regard to the use of alcohol in chemical manufacturing operations, and the denaturalisation of alcohol in different ways for different purposes.

The conditions and relations of such societies as ours to legislation are so different here, that I find it impossible to formulate any recommendations; and yet it occurs to me that it might be worth while for all the members to consider the directions in which our New York Section might be of use in this country in bringing about improvements and better regulations in some, at least, of the directions to which Mr. Tyrer alluded.

Another subject to which attention was called was the importance of establishing technical schools, and the influence which the Society of Chemical Industry might exert in advising, in the formation of such schools, so that they might be organised upon methods which would result in the advantageous expenditure of the means placed at the disposal of such movements.

There is quite a variety, as I presume you all know, of guilds in England—old guilds that have come down from a very early date. Many of these guilds have accumulated large amounts of property, which, by the increase in value, place them in a position to offer large support to technical education; and there have already been established in England quite a number of technical schools with the aid offered by these guilds or companies.

Little has yet been done in this country in the way of establishing technical schools. Perhaps on some other evening I may be able to present to the members of the Society some details with regard to some of the technical schools in England and on the Continent. I have visited quite a number of them, as, for example, the famous schools in Berlin; and this summer I visited quite a number of the textile schools—at Leeds, where there is a school for spinning and weaving; at Mulhouse, where there is the famous chemical school which is largely devoted to dyeing, under the direction of Prof. Noetting.

It is possible that our Section might accomplish something by interesting itself in this subject of establishing technical schools in this country.

Another topic to which the ex-President alluded is one which we might well consider. That is, the establishment of research laboratories. I spent a day with the son of Mr. Ludwig Mond in inspecting the famous Faraday-Davy research school, which Mr. Mond has established in London at an expense of a million dollars, under the control of the Royal Institution. Possibly some of our members may be able at some future time to act as liberally in the direction of establishing research schools. At all events, in order to get such schools established, the subject must be discussed and its importance impressed upon the public; and I think it might be well, perhaps, for our Society to consider some day the proposition of establishing research laboratories, and publish the facts in such a way that some wealthy person, who seeks to do something for the benefit of the community, might give that direction to his generosity.

With regard to the usefulness of our Section, we may say that it has already promoted friendly intercourse among the chemists of New York. It serves to bring us together, to make us acquainted, and it enables us to help each other; and in that sense, and for that reason, I think our Section has already been a great success, and I hope that it will continue to become more and more useful, not only to each of us individually, but to us collectively as a profession and to the community.

I see that Prof. Woodruff Wilson, of Princeton College, gave one of the addresses at Princeton University, and I found this little statement in his address:—

"It used to be taken for granted—did it not?—that colleges would be found always on the conservative side of politics (except on the question of free trade), but in this latter day a great deal has taken place which goes far towards discrediting the presumption. The college in our day lives very near indeed to the affairs of the world. It is a place of the latest experiments: its laboratories are brisk with the spirit of discovery; its lecture rooms resound with the discussion of new theories of life and novel programmes of reform. There is no radical like your learned radical, bred in the schools; and thoughts of revolution have in our time been harboured in universities as naturally as they were once nourished among the encyclopaedists. It is the scientific spirit of the age that has wrought the change. No man more heartily admires, more gladly welcomes, more approvingly reckons the gain and the enlightenment that have come to the world through the extraordinary advances in physical science which this age has witnessed. But I am a student of society and should deem myself unworthy of the comradeship of great men of science should I not speak the plain truth with regard to what I see happening under my own eyes. I have no laboratory but the world of books and men in

which I live; but I am much mistaken if the scientific spirit of the age is not working in us a certain great degeocracy, and breeding in us a spirit of experiment and a contempt for the past. It has made us credulous of quick improvement, hopeful of discovering panaceas, confident of success in every new thing.

THE DETERMINATION OF SULPHATE AND CARBONATE OF LIME IN WHITE PAINTS.

BY G. W. THOMPSON.

IN my paper on the analysis of white paints, read before this Section at its meeting, May 18, 1896, I overlooked a very peculiar reaction between carbonate of lime and sulphate of lead. It is well known that sulphate of lead when treated with the carbonates of the alkalis, as carbonate of ammonia, carbonate of soda, &c., is decomposed, with the formation of carbonate of lead and sulphate of the alkali; but as sulphate of lead is practically insoluble, and the same is the case with carbonate of lime, it was not supposed that on treatment with water any reaction between these two insoluble substances would take place, at least with any degree of rapidity or completeness. Our astonishment was great, therefore, on finding that sulphate of lead is completely decomposed by carbonate of lime in the presence of water, and that by complete washing all the sulphuric acid can be washed out as sulphate of lime, if the carbonate of lime is in slight excess. Sulphate of lime, therefore, cannot be determined in a paint containing sulphate of lead and carbonate of lime by washing with water. The problem we set ourselves to solve was how to determine carbonate of lime and sulphate of lime in the presence of lead compounds. This we finally succeeded in doing with perfect satisfaction, by dissolving out the carbonate of lime in the cold by a mixture of 95 per cent. of alcohol and nitric acid, 1.40 sp. gr., mixed in the proportion of nine to one. We treat 1 grm. of the finely powdered sample four times by decantation with this mixture, allowing to stand 20 minutes between each treatment, filtering, and washing the paper with the same mixture. We evaporate the filtrate to dryness to expel the alcohol, and, as oxalic acid appears to be formed by the oxidation of the alcohol, sulphuric acid is added in excess, with the addition of more nitric acid if necessary, and the heating continued until fumes of sulphuric acid appear. After cooling, take up with water, make alkaline with ammonia and acid with acetic acid, heat until complete solution is obtained, pass sulphuretted hydrogen boiling, to precipitate lead and zinc if present, filter, and determine lime in filtrate, after precipitation as oxalate. We determine the total lime in the usual manner, deducting from it the lime found as carbonate, that is, the lime soluble in the solution given, the remainder being the lime as sulphate.

Illustrating the reaction between sulphate of lead and carbonate of lime, Mr. F. P. Ingalls took three and three-hundredths (3.03) grms. of sulphate of lead and 1 grm. of carbonate of lime, both prepared by him and chemically pure, and placed them in a flask with 650 c.c. of water, which was calculated as being more than sufficient to dissolve all the sulphate of lime formed; the flask was corked, and agitated occasionally for four days. The solution was then filtered and the residue collected and weighed. It was found to weigh 2.815 grms. If all the lime and sulphuric acid had been converted to sulphate of lead and dissolved in the water, the loss in weight would have been 1.36 grms., the actual loss in weight being 1.215 grms. An analysis of the residue showed it to contain no lime soluble in the alcohol and nitric acid mixture. The lime and sulphuric acid found were equivalent to each other, so that we get the residue to contain—

	Per Cent.
Sulphate of lime, anhydrous	5.79
Lead, equivalent to lead carbonate	93.51
	<u>99.21</u>

This residue, in other words, contained no sulphate of lead, that substance having been completely converted to sulphate of lime and carbonate of lead. To make clear our

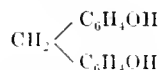
conclusion on this point we would say that in accordance with the method outlined above we found no lime as carbonate; all the lime present, therefore, is present as sulphate, and, as the sulphuric acid was just sufficient to satisfy this lime as sulphate, there was none left to be in combination with the lead as sulphate.

FORMALDEHYDE AS A REAGENT.

BY H. ENDEMANN, PH.D.

THAT formaldehyde and phenol unite is known, and no particular difficulty seems to attend this reaction, which results in the formation of bodies which may be described as diphenol-methane.

In the case of carbolic acid, the composition of the body is—



These bodies are colourless, but if they are treated with a dehydrating agent like chloride of zinc or concentrated sulphuric acid, coloured bodies are formed, which become colourless again on the addition of water. The colour produced depends upon the nature of the phenol. The evanescent nature of these colours makes it difficult or perhaps impossible to accurately determine the nature of this reaction, which takes place under dehydration; the fact, however, that colours are produced makes it probable that methane-hydrogen and phenol oxygen are involved in this reaction under a process of condensation similar to such as are recognised as being the cause of the colour of certain triphenyl-methane derivatives.

In order to produce the reaction I dissolve some phenol in commercial formaldehyde or formalin on the cover of a porcelain crucible. I then evaporate at low temperature, not quite to dryness, and add concentrated sulphuric acid. As far as examined the colour reactions with the various phenols are:—

	The Solid.	The Solution.
Phenol.....	Fuchsin coloured	Fuchsin-coloured.
Salicylic acid	Red	Fuchsin.
Eugenol	Brown, with shade of Bordeaux .....	..
Carvacrol	Orange to orange-red .....	..
Guaiacol	Violet, quickly brownish-violet .....	..
Resorcin.....	Scarlet-red	Orange.
Hydroquinone	Brown	Brown.
Thymol.....	Faintly fawn-coloured (due to impurity?) .....	..
α -Naphthol ..	Green	Brown.
β -Naphthol ..	Green, then black	Green.
Pyrogallol ...	Red .....	..
Haematein ..	Red, then brown .....	..
Tannin	No reaction .....	..

This reaction is not confined to formaldehyde, but is likewise produced by other aldehydes. The colours, however, differ; for instance, phenol and benzaldehyde give brown solid and brownish-yellow solution. While we may therefore use formaldehyde as reagent for phenols, we may use the phenols as a reagent for formaldehydes.

The journals brought us lately the news of a process of weighting silk by converting the sericin or silk gum into an insoluble body by means of formaldehyde. I have employed the above-mentioned reaction for the purpose of discovering this practice.

White silk, when treated with concentrated sulphuric acid in the cold, does not exhibit any striking reaction. The silk becomes at first yellow—so does the solution, then orange, and while the silk is dissolved and water is absorbed from the air, the solution assumes a faint violet tint.

If the silk has been treated with formaldehyde to set the sericin, it becomes, with sulphuric acid, quickly a rich brown, and, after standing under a gradual absorption of water, olive-green to green. The fibre, although losing in cohesion, seems insoluble.

Silk treated with formaldehyde and then repeatedly and thoroughly washed with hot water does not respond to the reaction.

Wool reacts likewise becoming a rich brown. Also, in this case, we remove the possibility of obtaining the reaction. Whether the test will be applicable for the discovery of this adulteration will depend therefore upon the subsequent treatment of the silk.

DISCUSSION.

MR. WM. JAY SCHIEFFELIN remarked that the paper tended to illustrate the power of formaldehyde, and he had recently noticed that it had been suggested and tried as a preservative of milk. Although very poisonous, it was so very volatile that it was supposed the milk could be heated when it was needed, and all the preservative would be given off. It did not work that way. Formaldehyde stuck to the milk after it was put in, and so the experiment was considered a failure, although he understood some people still used it.

Obituary.

ALFRED H. MASON.

(FIRST CHAIRMAN OF THE NEW YORK SECTION.)

WE regret to announce the death in New York on the 2nd November, from pneumonia, of Mr. Alfred Henry Mason. Mr. Mason was so well known to members of the drug trade on both sides of the Atlantic that the announcement of his death will come as a sad shock to very many circles and individuals. He was not registered as a chemist in Great Britain, but was a pharmaceutical chemist of Quebec. Born at Newcastle, in Staffordshire, 54 years ago, he served his apprenticeship with Messrs. Marsen and Son, of Stafford. Subsequently he managed a business in Liverpool, and from thence he passed into the service of Messrs. Evans, Son, and Co. He filled various positions in that house for nearly 20 years, and in 1884 took up his residence in Montreal as the manager of the associated firm of Evans, Mason, and Co. (Limited). He next became associated with Messrs. Seabury and Johnson, of New York, and from 1889 to the end of 1892 he conducted the English business of that firm. In the beginning of 1893 he went to New York to undertake, in association with Mr. Seabury and Mr. J. M. Peters, the general management of the business there, including the manufacturing, which had grown with extraordinary rapidity. He had not since returned to this country. Wherever located—in Liverpool, Montreal, London, and New York—Mr. Mason associated himself with, and took an active part in, the work of the pharmaceutical associations of the city. He was at one time president of the Liverpool Chemists' Association, and he read many papers before that body. He was the first chairman of the New York Section of this Society, and at the time of his death was Secretary of the New York College of Pharmacy. He was to be found at all pharmaceutical meetings and discussions, and he made and kept hundreds of warm friends. The cordial esteem in which he was held was abundantly evidenced by the large gathering of wholesale and retail pharmacists who joined in giving him a dinner at the Café Royal to bid him farewell and God-speed when he last left this country for the United States. To all these, and to many others, the loss of this warm-hearted and versatile friend is a painful experience, associated with keen regret that a life which always seemed so full of activity should have been so suddenly brought to a close. Mr. Mason leaves a widow, a son, and two daughters.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Filtering Apparatus [Waste Oil, &c.], *Impts. in.* C. Whitfield, Kettering. Eng. Pat. 19,968, Oct. 23, 1895.

THIS apparatus consists of a settling tank and a filtering chamber. The dirty oil, &c., collected from the bearings and other parts of machinery, &c., is fed into the bottom part of the former, where part of the dirt is deposited. It then passes up through the settling tank and then through the filtering chamber. The clarified oil is drawn off from the bottom of the latter. The claim is for the "combination of a settling tank with a filtering chamber." Not only dirty oils, but other liquids may be filtered, it is stated, by the use of such apparatus.—R. B. P.

Filtering Material, *Impts. in the Composition and Manufacture of.* A. Smith, London. Eng. Pat. 22,127. Nov. 20, 1895.

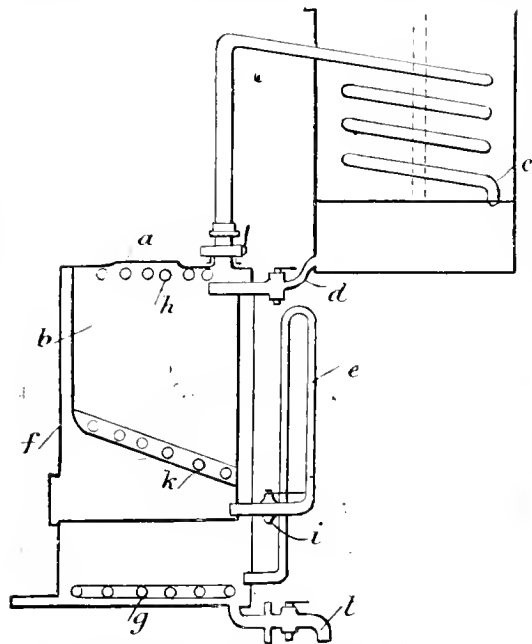
THE claim is for the construction of filtering blocks or plates, the surfaces of which consist of a layer of a composition consisting of a mixture of kieselguhr, Roman or Portland cement, or both, and any suitable liquid, and the inner parts of any suitable material of a sufficiently coarse or porous nature.—A. S.

Fats, Oils, Resins, Sulphur, Colours, Tanning Materials, and the like: Impts. in or relating to the Extraction of, by Means of Volatile Solvents, and Apparatus therefor. J. Merz, Brünn, Austria. Eng. Pat. 16,766, July 28, 1896.

THE removal of the last traces of solvent from the extracted material is sought in this process, which is carried out in the apparatus illustrated in the accompanying diagram. The material to be extracted is placed in the vessel *b*, and the solvent allowed to flow in from the condenser *c*, through the tube *d*. The solvent then flows through the tube *e*, to the bottom of the surrounding vessel *f*, and is here again evaporated by means of the heating coil *g*. The vapours rise between the walls of the vessels *b* and *f*, heating the contents of *b*, and condense at the worm *h*. The condensed solvent flows back into *b*, extracts the material further, and

* Any of these specifications may be obtained by post by remitting 8d.—the price now fixed for all specifications, postage included—to Sir Henry Reader Lack, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

flows again through *e* to *f*. This process is repeated until a sample drawn off through the cock *i* shows that the exhaustion of the material is complete. The condensing water is then shut off from the worm *h*, and steam of over



100° C. allowed to flow into the heating coil *k*. This has the effect of converting any liquid solvent remaining in the exhausted material into vapour, which vapour is driven over by steam. The steam and the vapour of the solvent are condensed in the condenser *c*, and the extract is finally drawn off through the cock *l*.—A. S.

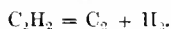
II.—FUEL, GAS, AND LIGHT.

Acetylene, Explosive Properties of. Berthelot and Vieille. *Comptes rend.* 123, [14], 523–530.

ACETYLENE is an endothermic compound, the decomposition of which into its elements produces about as much heat as the combustion of an equal volume of hydrogen. Berthelot has shown that it can be caused to explode by the action of fulminate of mercury. On account of the increasing industrial importance of acetylene, the authors have investigated the conditions under which it explodes and the precautions which should be observed in dealing with it.

I. *Influence of Pressure.*—When the pressure is constant and equal to the ordinary atmospheric pressure, the decomposition of acetylene does not tend to extend beyond the point where it is first provoked (whether by a spark or by fulminate). Maquenne and Dixon have published interesting observations on this point (*Comptes rend.* 121, 1895). But under pressures of two atmospheres and beyond, acetylene exhibits the properties ordinarily observed in the case of explosive mixtures. Even if the decomposition be simply started by a platinum wire heated by an electric current, it is propagated throughout the whole mass of gas.

II. *Decomposition of Gaseous Acetylene.*—When the decomposition is started as above by a heated wire, the steel tube in which the gas is contained is found after the explosion to be filled with pulverulent carbon, and the gas in it is found to be pure hydrogen. The decomposition takes place strictly in accordance with the equation—



According to theory the temperature attained during the decomposition (at constant pressure) should be 2,750° C., and from this it follows that the final pressure should be 11 times the initial pressure. At comparatively low pressures the cooling effect of the walls of the tube is so great

as to considerably reduce the ratio of the final and initial pressures: e.g., when the initial pressure is 2.23 kilos. per sq. cm. the final pressure is only about 4.3 kilos. per sq. cm. But when the explosion starts at 21.13 kilos. per sq. cm. the ratio of the final to the initial pressure is as high as 10.13, which agrees sufficiently well with the calculation. The effect of the higher temperature and pressure is to increase the speed of decomposition as the initial pressure is increased. This increase is very rapid as we approach the pressure at which acetylene liquefies. In his researches on the formation of ethers, Berthelot has shown that this relation is general.

III. *Decomposition of Liquid Acetylene.*—Decomposition is propagated in liquid acetylene under pressure as easily as in the gas, even when it is only started by a hot wire, and especially when the volume is kept constant, as in a steel cylinder. But blows and shocks do not of themselves start explosions in such receivers, e.g., when they are allowed to fall on hard surfaces. Even when a receiver containing gaseous acetylene is smashed (e.g., a steel receiver holding a litre, crushed by a weight of 220 kilos. falling from a height of 6 m.) no explosion occurs. But when similar receivers containing liquid acetylene are smashed, the blow is generally followed by an explosion after a short interval. This, however, is not a direct effect, but is due to the ignition of the explosive mixture of acetylene and air (probably by sparks caused by the friction of pieces of broken steel). Similar results have been observed in the case of cylinders containing hydrogen under great pressure. Gaseous acetylene (pressure 10 atm.) contained in a wrought-iron bottle was not exploded under the impact of a ball which pierced one side and dented the other side. An iron bottle containing liquid acetylene was shattered to pieces when an explosion was started by fulminate of mercury.

IV. *Calorific Effects.*—Pictet has observed an explosion caused by the action of a small quantity of water on an excess of calcium carbide in a closed vessel. Local elevation of temperature may produce cumulative effects, first causing formation of condensed polymers of acetylene (benzene, styrene, hydride of naphthalene, &c.) with evolution of heat, and finally causing such an elevation of temperature as may determine an explosion. Too rapid condensation of the gas, or the sudden opening of a stop-cock, may also cause local heating, resulting in an explosion.

Finally, the authors are of opinion that all the above-mentioned risks can be guarded against by proper care in the preparation and manipulation of the gas, and that they do not constitute a serious bar to its use as an illuminating agent.—D. E. J.

Acetylene [Mixtures with Air]. Experiments on the Combustion of. H. Le Chatelier. *J. Pharm. Chim.* 1896, 4, 313.

MIXTURES of acetylene and air containing less than 7.7 per cent. of the combustible gas burn with a yellow flame, the brightness of which increases with the proportion of gas. The combustion is complete. From 7.7 to 17.3 per cent. the flame is blue; carbonic oxide and hydrogen are formed in addition to water and carbonic acid. At 17.3 per cent., part of the gas remains unburnt and carbon is separated, which with proportions above 25 per cent., forms a black opaque cloud.

The mixtures containing between 2.7 and 67 per cent. of acetylene are explosive; mixtures of coal-gas and air are not explosive until the former reaches 8.1 per cent. Acetylene is much more inflammable than other gases, even than hydrogen, the temperature of ignition being about 500°. The velocity of propagation in the most combustible mixtures, containing from 5 to 15 per cent., is between 4 and 8 m.; at 25 per cent. it falls to 0.1 m. per second, and at the superior limit, 65 per cent., is only 0.05 m. In mixtures corresponding to the highest velocity, containing 8–10 per cent., the flame will travel in tubes of 1 mm. but not of 0.5 mm. bore. The temperature calculated for the flame of acetylene burning in air is 2,400°, that of coal-gas being 1,900°. The separation of carbon from the acetylene flame may be overcome by burning the gas under considerable pressure from burners with a fine orifice, or, more conveniently, by mixing the gas with its own or twice its own

volume of air. This does not reduce the illuminating power; the use of 10–20 per cent. of oxygen would be preferable to that of air. To obtain these mixtures, the principle of the Bunsen burner might be used to obviate the storage of mixtures. By reason of its low temperature of ignition and low limit of inflammability, acetylene is said to be particularly suitable for small gas motors.—A. C. W.

Acetylene for Lighting Purposes, Report on the Preparation and Use of. M. Vieille. J. Pharm. Chim. 1896, 4, 315.

THE French commission appointed to consider this question is of opinion that installations for the production of more than 10 cb. m. per day should be placed under the same regulations as apply to the manufacture of coal-gas for private use. Special regulations for smaller installations have been made. From the experiments of Le Chatelier (see preceding abstract), mixtures containing 3 per cent. of acetylene must be regarded as readily explosive. The maximum pressure corresponding to complete combustion in the case of acetylene (the mixture contains 7.8 per cent.) is 8 kilos., in the case of coal-gas (15 per cent.) 6 kilos.

Experiments in which steel cylinders containing liquid acetylene or acetylene at 10 atm. pressure were subjected to violent blows or were crushed by a weight of 250 kilos. falling 6 m., or a wrought-iron bottle was pierced by a bullet, proved that under these conditions the gas does not detonate, though the rupture of the cylinders was soon followed by the explosion of the mixture of acetylene and air formed.

The regulations for small installations state that acetylene generators must be placed in the open air, and not in cellars or basements; reservoirs must also be placed in the open air and protected from the direct action of the sun; they must be officially tested at a pressure double that at which the gas is to be stored, if this is less than 10 kilos., and one and a half times as much if the pressure is to exceed 15 kilos. The cylinders should be of wrought iron or very mild steel, tested at 250 kilos. per sq. cm., the test being made every three years. The taps must be protected by covers of the same metal as the cylinders. The weight of the empty cylinder and its full charge must be marked on it; the charge should not exceed 1 kilo. for 3 litres capacity.

—A. C. W.

Coal, Calorific Value of; Calculation by Dulong's Method. Arth. Bull. Soc. Chim. 15, [18–19], 1112–1116.

IN a former communication (Bull. Soc. Chim. 13, 820) the author showed that the calorific values of many coals, calculated by Dulong's method, agreed closely with the results obtained by combustion in Mahler's bomb. In this paper are given tables of similar results in the case of coals which in the hands of former observers had shown discrepancies between the calculated and the observed values. In all these cases the agreement is very close, seldom amounting to 0.5 per cent. of the calorific value. Tables of data and details of methods are given in the paper.—J. T. D.

Incandescent Gas Lights [Influence of Composition of Mantles]. C. Killing. J. für Gas-beleuchtung, 39, [43], 697.

MANTLES made of thoria emit almost no light, whereas those consisting of 98–99 per cent. of thoria and 2–1 per cent. of ceria emit a brilliant light, owing to their power of converting a great part of the heat of the flame into light. To produce this effect the oxides need not be in "molecular mixture," such as is produced on mixing two solutions; if a previously burnt mantle of pure thoria is dipped into a weak ceria solution and again burnt, the same effect is obtained. A brilliant light is also given out by a mantle consisting of thoria, 99.75 per cent., and uranium oxide, 0.25 per cent. If, however, instead of ceria or uranium oxide a small quantity of yttria or ceria be added to a thoria mantle, its illuminating power is but little increased.

The author believes that only bodies possessing more than one degree of oxidation are capable of so exciting the illuminating power of a thoria mantle, and concludes that their action is catalytic; that by their mere presence in small quantity they act probably as bearers of oxygen.

Iridium, platinum, gold, and other metals can also act as oxygen-bearers, and when present in minute quantity in a thoria mantle, very considerably increase its illuminating power. All metallic oxides which exist in several degrees of oxidation improve the light-emissive power of a thoria mantle, but these oxides (e.g., oxides of chromium, iron, cobalt, manganese, molybdenum, &c.) are too quickly volatilised to be of practical value.

These conclusions are applicable not only to mantles having thoria as a basis, but also to those made from zirconia or from several oxides. It is therefore a real chemical action, catalytic in character, which causes the conversion of the heat rays into light rays.—H. B.

Borneo Coal. Eng. and Mining J., Nov. 7, 1896, 436.

See under Trade Rep., page 837.

Metallic Carbides, Study of [Formation of Hydrocarbons]. H. Moissan. Proc. Roy. Soc. 60, 156.

See under III., page 797.

PATENTS.

[Hydrogen, Carburetted Hydrogen, &c.] An Improved Method or Process for use in obtaining Hydrogen Gas from Water, and means for obtaining by the aid of such Method or Process Carburetted Hydrogen and other Combinations of Hydrogen, and Apparatus for use in such Method or Process. J. Green, Wolverhampton. Eng. Pat. 13,510, July 13, 1895.

ACCORDING to claim, hydrogen gas is obtained from water by an improved process, "which consists in burning steam with hydrogen gas, or with carburetted hydrogen, or carbon monoxide within a suitable chamber."—R. S.

Fuel [Briquettes], Impts. in the Manufacture of. G. Hayeraft, Pontardulais, Glamorgan. Eng. Pat. 18,156, Sept. 28, 1895.

ARTIFICIAL and "practically smokeless" fuel is obtained by mixing small anthracite coal, waste charcoal, fine coke, coke breeze, and similar waste carbonaceous materials of a non-bituminous character with a proportion of small bituminous coal. The mixture is placed in a number of very narrow or shallow moulds, which are stacked in a series of ovens or chambers, into which heat may be introduced direct from a flue, or the connecting damper may be closed and the work performed by radiated heat alone. By this process an incipient coking of the bituminous coal takes place, which forms the cementing or cohesive medium in the fuel.—R. S.

Incandescence Bodies [Mantles] for Illuminating Purposes, Impts. in the Manufacture of. W. H. Wheatley, London. From C. Schmid, Brussels. Eng. Pat. 18,263, Sept. 30, 1895.

MANTLES are to be made in the usual way by impregnating a suitable fabric with aqueous solutions of the following salts, the fabric being afterwards burned off as usual:—

I. Lanthanum nitrate, 60.0 parts; strontium nitrate, 10.0; and silver nitrate, 0.25 parts.

II. Zirconium nitrate, 100.0 parts; strontium nitrate, 18.0; and silver nitrate, 0.5 parts.

III. Zirconium nitrate, 100.0 parts; calcium nitrate, 20.0; and uranium nitrate, 0.5 parts.—H. B.

New Burner, Blowpipe, or Bunsen Lamp, namely, an Appliance for Burning a Mixture of Air and Gas or Inflammable Vapours for the Production of Intense Incandescence of Mineral Substances employed for Incandescent Gas Lamps, known by the Name of "Auer Lamps," or "Von Welsbach," or other Analogous Lamps. [Air forced in.] J. de Brouwer, Bruges, Belgium. Eng. Pat. 20,697, Nov. 1, 1895.

IN this gas burner the air is admitted under pressure and draws the gas or inflammable vapours along with it, this being the reverse of burners at present in use. The apparatus consists of a cylindrical tube, swelled out or enlarged at its base, which is closed by a diaphragm at right-angles to the length of the tube. Through the centre

of the diaphragm, which is perforated with holes, passes the nozzle of the pipe admitting air under pressure. At right-angles to the air-pipe and to the cylindrical tube, the gas-pipe enters, its nozzle being in proximity to the nozzle of the air-pipe. The air forced in through the latter acts as in an injector, drawing the gas with it, gas and air supply being controlled by taps or regulators in the usual way. The Welsbach mantle or other incandescent body is fitted to the other end of the cylindrical tube by the ordinary arrangement.—H. B.

Incandescent Vapour Lamps, Impts. in. J. F. C. Jürgens, Altona, Germany, and A. B. Kisritz, Hamburg, Germany. Eng. Pat. 11,636, May 28, 1896.

An apparatus is proposed for burning petroleum and "liquid fuel rich in carbon" (as distinguished from spirit), so as to obtain a flame applicable to incandescent mantles of the ordinary type. Arranged in a circle are a number of upright tubes, each containing a wick, the lower end of which dips into the lamp reservoir. In the centre of the wick-tubes is a small petroleum suction-lamp, which, when lit, heats up the whole burner. The flame of this small lamp is prevented from communicating with the wicks, which surround it, by means of a circle of wire gauze, but the hot products of combustion vaporise the petroleum which has been sucked up by the wicks, so that a mixture results of petroleum vapour, the burnt gases from the small petroleum lamp, and the excess of air which the latter has drawn in. A further quantity of hot air is admitted through suitable openings in the lamp casing, and the gases are then intimately mixed by passing through a series of perforated discs, after which the mixture is burned beneath the mantle as usual. The air supply to the outside of the flame is previously heated by drawing it up through the double wall of the lamp. By means of a glass disc in the wall of the lamp, the heating flame can be watched, an outside metal knob serving to increase or lessen the latter. The gallery is arranged to slide up and down on the burner, so that the gas may be lit without the chimney having to be taken off.—H. B.

Incandescent Bodies or Mantles for Lighting Purposes. Impts. in the Manufacture of. [Using Crystalline Cerium Compounds, &c.] N. Caro, Rostrasse, Berlin, and W. Saulmann, Potsdamerstrasse, Berlin. Eng. Pat. 14,448, June 30, 1896.

THE light-emitting capacity of ceria-thoria mantles is not based on the existence of a compound of cerium-thorium oxide, but cerium in other than oxide form is capable of bringing the oxide of thorium, which in itself does not emit light, to incandescence. Compounds of cerium oxide with trivalent elements, such as arsenic, antimony, bismuth, boron, and vanadium, have the same effect as cerium oxide, and can be obtained, by solution, in a crystalline form upon the fabric itself. If, for example, a solution of cerium nitrate be mixed with a solution of arsenic acid, the mixture will remain clear; if it is boiled or steamed, the cerium arsenate will separate as a white crystalline precipitate. The patentee manufactures mantles by saturating the fabric with a solution of cerium nitrate and, say, arsenic acid. It is then dried, whereby arsenate of cerium separates in an insoluble form. The fabric is next saturated with thorium nitrate, dried, and burned off as usual. With boric acid, or acids of the other bodies above mentioned, the treatment is the same. Instead of the acids, other compounds of boron, &c. may be taken if these have the property of depositing from solutions in a crystalline form. Instead of cerium, other rare earths or their mixtures may be employed.—H. B.

Glow Lamps for Burning Vaporised Liquid Fuel, Impts. in. F. Schuchhardt, Berlin. Eng. Pat. 14,392, June 29, 1896.

In this device, the reservoir of liquid fuel (spirit, petroleum, benzene, &c.) is divided into two parts, the upper part communicating with the lower by means of a tube. From the lower container, rises a pipe (1), wherein the liquid is to be evaporated in order then to be carried off to the burner, which is at the upper end of the pipe. From the same container also rises, alongside pipe (1), a much

smaller upright pipe (2), serving to feed a heating flame. Pipe (2) is carried up to about the top of pipe (1), is then bent and carried down, and is bent up again with its mouth directed upwardly, so that when a flame burns at its mouth the flame plays upon both pipe (1) and pipe (2). When a flame has been applied to pipe (2), the vapours issuing from its mouth ignite, and thereafter evaporation goes on automatically, the "head" of liquid in the upper part of the reservoir maintaining the level of the liquid in (1) and (2) at about the level of the flame. The flame issuing from the mouth of (2) is sufficient, not only to produce enough gas for itself, but by heating (1) produces enough gas in it to supply the mantle burner.—H. B.

Incandescence Bodies [Mantles], Impts. relating to the Preparation of. W. P. Thompson, London. From R. J. Effe, London, and F. Meyer and Co., Berlin. Eng. Pat. 15,500, July 13, 1896.

CERTAIN oxides "are capable at high temperatures of taking up oxygen and yielding the same again." If small quantities (0.05 to 0.10 per cent.) of these "oxides of oxygen-conveying bodies" in a state of extremely fine subdivision be distributed throughout larger quantities of refractory (not oxygen-conveying) oxides, and the whole be exposed to the outer surface of a non-luminous flame, simultaneous reduction and oxidation takes place, and an intense light is emitted. The patentee makes, in the usual way, from a solution of the salts of the metals mentioned, an incandescence mantle consisting of oxide of calcium, about 27.5 per cent., oxide of zirconium, about 72.3 per cent., along with the "oxygen-conveyors"—oxide of vanadium, 0.10 per cent., oxide of ruthenium, 0.05 per cent., and oxide of rhodium, 0.05 per cent. He claims the use, in preparing incandescence bodies, of oxides of rhodium, ruthenium, and vanadium, singly or combined, in extremely fine division, and diffused throughout a compound of zirconia and calcium oxide.—H. B.

Electrical Glow Lamps, Incandescence Body for, and Process of Manufacture of the said Body. [Hollow Tubes.] J. F. Bachmann, A. Vogt, C. C. Weiner, Dr. J. Kirehner, and A. König, Vienna. Eng. Pat. 18,628, Aug. 22, 1896.

IN lieu of the ordinary filaments, the incandescence bodies for glow lamps are made of an intimate mixture of graphite or retort carbon and non-conducting refractory oxides (oxide of magnesium, calcium, or of chromium), or silicic acid or alumina, reduced to powder and intimately mixed together, first in the dry state, and then in a kneading machine with heat, and the addition of some binding agent, such as gum or tar. Whilst hot, the mass is pressed into the desired hollow form—say tubes of 3 mm. in diameter. These tubes are cut into suitable lengths, hardened in the air, and are then embedded in graphite in a cradle, which is heated to incandescence for 48 hours, either in a gas blow-pipe flame or in an electric furnace. Connection is made with the platinum or nickel, leading in wires, by means of middle contact pieces formed of small tubes of carbon, burnt after being moulded into shape, and then inserted into the unburnt incandescence body and raised to incandescence with it.—G. H. R.

Acetylene Gas, An Improved Method of and Apparatus for Generating and Regulating the Consumption of. J. C. Bayley, Bournemouth. Eng. Pat. 19,771, Oct. 21, 1895.

AN apparatus for the production and supply of acetylene gas, consisting of a gas generator, with removable perforated trays, in combination with a water tank.—A. S.

Acetylene Gas, Impts. in Apparatus for Generating. [Automatic Valve.] J. H. Exley, Huddersfield. Eng. Pat. 20,453, Oct. 30, 1895.

THE combination with an acetylene gas apparatus, of a valve located in the gas passage from the generator to the holder, and adapted to close automatically when a definite quantity of gas is stored in the holder, and remain closed until such quantity of gas is more or less consumed. (See Eng. Pat. 12,344, 1895; this Journal, 1896, 531.)—A. S.

Acetylene Gas, Impts. in Apparatus for Generating. [Connected Generators.] J. H. Exley, Huddersfield. Eng. Pat. 20,727, Nov. 2, 1895.

THE patentee claims the construction and arrangement of acetylene gas apparatus, whereby a second generator may be automatically brought into operation, and also the combination with acetylene gas apparatus of two check valves in the gas passages. (See Eng. Pat. 12,344, 1895; this Journal, 1896, 531.)—A. S.

Gas [Acetylene], Apparatus for Automatically Generating. G. Webb, Kennington, and W. Kelly, Finsbury Pavement, E.C. Eng. Pat. 5905, March 17, 1896.

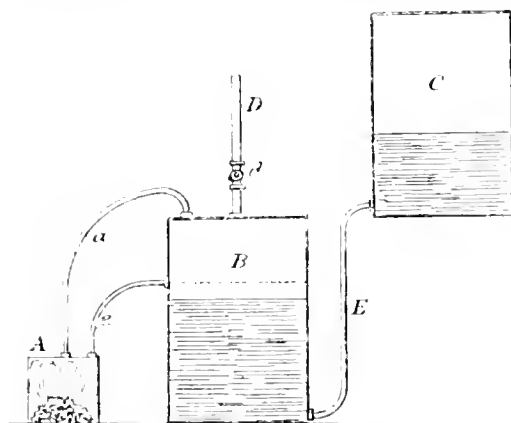
THE apparatus, for generating acetylene from calcium carbide by the action of water, and for stopping the production thereof when the gas pressure increases, consists of two cylinders. The first or generating cylinder has a central tube open at both ends, an inner, removable receptacle for calcium carbide, and a close-fitting cover. It is connected to the second cylinder, or gas holder, by two short tubular connections having valves, one connection being above the carbide, the other near the bottom. The second cylinder is about twice the height of the first. It is divided into an upper chamber open to the air, and a lower closed one. The upper chamber contains water, which flows down a tube to the bottom of the lower compartment, and thence through the lower connection to the carbide. The gas generated passes through the upper connection to the lower compartment, and thence through a valved tube for use. If the valve is closed, the pressure of gas accumulates in the generator and in the top of the lower compartment, and drives the water from both to the upper compartment, thereby stopping the action of the generator.—R. S.

Acetylene, An Apparatus for Automatically and Safely Generating and Storing. [Ball- or Float-Valve.] E. Appleby, Leyton, and H. F. Harris, London Fields. Eng. Pat. 5976, March 17, 1896.

THE combination of a ball or float with a cock or valve placed in the pipe admitting gas from the gas generator to the gas holder, which ball at the proper time cut off the supply of gas from the generator into the holder.—A. S.

Acetylene Gas, Impts. in [Automatic] Apparatus for Producing. F. P. J. Ackermann, Marseilles, France. Eng. Pat. 14,278, June 27, 1896.

THE apparatus is arranged so that the generation of the gas is regulated automatically according to the amount consumed. It comprises a gas holder B, a water cistern C connected with the gas holder by the tube E, and one or more gas generators A, each connected with the gas holder by two tubes *a*, *c*, arranged at different levels. The water



is supplied to the generator through the gas holder B and tube *c*, and the gas generated passes through the tube *a* to the gas holder. The supply of water is automatically cut

off when the gas is generated in sufficient quantity to force the water in the holder B below the level of the tube *c*. When two (or more) generators are employed, the connections are such that the second comes into use after the first has been exhausted. A generator divided into compartments arranged to act on the same principle is also described.—R. A.

Acetylene Gas, Apparatus for Production of. R. Haddon, Strand, W.C. From A. Boter, Barcelona, Spain. Eng. Pat. 16,345, July 23, 1896.

THE gas generator is provided internally with a water reservoir, and above this reservoir with a number of shelves, on each of which a parcel containing "a determined quantity" of calcium carbide is placed. Above these shelves is arranged a revolvable arm or lever, which is connected through pawl and ratchet mechanism to the bell of the gasometer, so that as the bell sinks, the arm is rotated, and pushes off one of the parcels of the carbide into the water. The parcels may be replaced by tipping boxes, &c., the fastenings of which are released by the rotating arm.—R. A.

Acetylene Gas, Impts. in the Production of, and in the Means or Apparatus employed therein. A. J. Boulton, 111, Hatton Garden, Middlesex, From F. Alexandre, Paris. Eng. Pat. 16,728, July 28, 1896.

THE gas is produced by the action of moisture or aqueous vapours on carbide of calcium without bringing the latter into direct contact with the liquid. The carbide is placed in a porous receiver, which is provided with a suitable tap and burner, and is surrounded by another receiver filled with sponge, &c. The water is fed to the outer receiver by means of a siphon, and the vapours given off from the liquid pass through the porous receiver and decompose the carbide. The gas is produced as long as consumption takes place and the saturation of the absorbent mass is sufficient, but the action ceases when the consumption of the gas ceases, in consequence of the pressure of accumulated gas effecting the expulsion of the liquid from the absorbent material.—R. A.

Acetylene Gas, Apparatus for Generating. W. C. Clarke, New York. Eng. Pat. 17,450, Aug. 7, 1896.

THE apparatus comprises a tubular generating chamber having removable end caps, a water vessel adapted to be inserted in the chamber above the charge of carbide, a valve in the water vessel, and a projection on one of the end caps operating to open the valve as the cap is secured in place. By this means the water is not brought into contact with the carbide until the chamber is closed, so that no gas can escape.—R. A.

Fluid Hydrocarbons [Spray-Jet], Apparatus for the Burning of, for Lighting and Heating Purposes; Impts. in and relating to. J. McL. McMurtrie, 21, Prince's Street, Pollokshields, Glasgow, and Luce, Ltd., 121, West George Street, Glasgow. Eng. Pat. 21,089, Nov. 7, 1895.

THESE improvements are applicable to the apparatus described in Eng. Pat. 16,701, Sept. 5, 1893 (this Journal, 1894, 937), granted to J. M. McMurtrie, wherein steam or the vapour of light hydrocarbon oil is projected through a central jet or nozzle, which is surrounded by an annular chamber containing fluid hydrocarbon. The latter is thus "atomised" and passes to the burner. The fluid hydrocarbon is raised to the annular chamber from the tank containing it by means of compressed air.

According to the present invention, instead of forcing the oil up to the burner from the tank by pressure of air, the injector action of the steam, air, or hydrocarbon vapour is utilised to draw up the oil. The oil-supply pipe from the tank is connected with a tube extending from and concentric with the central nozzle through which the steam or vapour issues, so that the rush of the latter produces a partial vacuum, and the oil so drawn up is converted into spray by means of the jet. Three simple forms of nozzle are described.—H. B.

Manufacture of Gases [Oxygen and Hydrogen, by Solar Heat], Impts. in the. W. Calver, Washington, U.S.A. Eng. Pat. 21,468, Nov. 12, 1895.

THE decomposition of water into hydrogen and oxygen by the action of concentrated solar rays in presence of finely divided iron is claimed, and apparatus for effecting this described.—R. B. P.

Artificial Fuel [Briquettes], A New Adhesive and Agglutinating Substance for Use in Making. A. Zendroni, St. George's Avenue, London. Eng. Pat. 2993, Feb. 10, 1896.

THE following materials are introduced into a rotating steam-jacketed cylinder kept at a temperature of about 200° C.:—500 kilos. of pitch, 50 kilos. of resin, 100 kilos. of naphthalene, 100 kilos. of calcium carbide, 50 kilos. of lime, and 800 kilos. of well-ground coal. The mixture is used as the agglutinating material in the manufacture of briquettes.—R. S.

Automatically Producing and Burning Vapour, Impts. in and relating to Apparatus for, from Oils and Hydrocarbons. R. A. Poitrimol, Paris. Eng. Pat. 9366, May 2, 1896.

REFERS to Eng. Pat. 6245 of 1895 (this Journal, 1896, 344). A heavy or light oil or hydrocarbon is caused to pass to a vaporiser, either by capillarity with the aid of wicks, or by causing the liquid to traverse a filter-box by the aid of pressure, or by the aid of an apparatus for regulating the feed proportionately to the quantity of gas consumed by the burner, and for resisting counter pressure. The vaporiser is heated at first by any suitable means, but after the process is once started, it is heated by the flame from the burner only. The vapour formed is conducted by one or more tubes through the tube leading to the burner, whereby it is superheated. It then escapes through a jet in the centre of the tube leading to the burner, and, passing to the latter, carries with it a sufficient quantity of air, with which it intimately mixes, to form carburetted air, before its arrival in the burner. For feeding with liquid a series of such burners, a flexible feeding tube is placed in the liquid reservoir, and the free end of it may be raised out of or lowered into the liquid at will, so as to stop or start the flow thereof to the burner. An inclined pipe upon which the several parts of the apparatus are branched, leads from the reservoir, and the branches are also connected to another lower and smaller reservoir by means of a second inclined pipe, with the object of emptying the pipes thereinto when the feed has been arrested, and of obviating leakage.—R. S.

Vaporising and Burning Liquid Fuel [Liquid Blow-Pipe Burners], Impts. in Means for. G. Shenton, London, and D. A. F. de Villepigue, Paris. Eng. Pat. 16,425, July 24, 1896.

A BLOW-PIPE burner is used, intended to transform into vapour and to burn in this state and at a high temperature, essences, mineral oils, and liquid hydrocarbons in general. This apparatus consists of a vaporising chamber or tube, preferably horizontal, which is heated to start the process, by a lamp beneath. It is connected at one end with an overhead liquid receiver by a tube of small diameter, helically wound for some distance. The liquid passes from this tube through narrow passages, which can be shut by an external screw, and enters the vaporising chamber. It escapes, as vapour, under pressure, from the other end of the chamber to a burner provided with tubular passages and a plug perforated along its axis and terminating in a capillary tube forming the actual jet. A tube of about the same diameter as the vaporisation chamber, is fixed on the end of the burner, and is furnished with openings for providing air for combustion, and at the end remote from the burner with a converging cone. The latter in use becomes red hot, and the heat is conducted back to the chamber, whereby the liquid is vaporised without applying external heat. The flame is extinguished by shutting off the supply of liquid.—R. S.

Illuminating Gas [Carburetted Water-Gas, &c.], Impts. in the Treatment of. J. N. Knapp, Omaha, Nebraska. Eng. Pat. 17,729, Aug. 11, 1896.

THIS invention relates to the removal or extraction of tar, condensable vapours, &c., from illuminating gases, such as, for example, carburetted water-gas. The gas is first cooled to about 125° F., to condense the tar, &c., and is then passed through a centrifugal wheel, which causes it to impinge on baffle plates arranged to separate the tar, &c. The centrifugal wheel may also act as an exhaustor to draw the gas from the generator.—R. A.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Kerosene Shale of New South Wales. C. E. Bertrand. Comptes rend. 123, [16], 615—617.

AS a rule the Australian boghead deposits consist of the remains of a single alga, *Reinschia australis*, the sole exception being that of Doughboy Hollow, where *Pila australis* is also present, although only to the extent of some 9 per cent. At the period of deposition the algae developed rapidly and formed immense quantities of gelatinous material, which subsided, enveloping the thalla along with a number of eocoidal bodies, such as minute vegetable detritus, spores, and pollen. The satiny appearance of the shale is due to this gelatinous matter, which has become changed into a yellow transparent body of vitreous and lustrous fracture, contrasting with the dull coal from the underlying humic material. Beyond traces of borings through the substance of the gelatinous material of the thalla, no indications of bacterial agency have been detected.

The boghead at Hartley is less rich in gelatinous matter, 43—54 per cent. instead of 84 to 91 per cent., and this decreases in the upper layers to about 1·5 per cent., so that spores, pollen, humified detritus, and mineral matters preponderate, forming a sporopolleniferous shale instead of an algal coal. The *Reinschia* are present in smaller quantity and less mature condition, and in the casing a foot above the boghead the gelatinous matter is only one millionth part of the amount found in the boghead itself.

The spores and pollen were derived from a very few species of plants, but their deposition was continuous during the formation of the coal, and gave rise to yellow lamella in the mass; their proportion amounts, however, to only about $\frac{1}{2}$ per cent. of the mass in the upper layers of boghead. The vegetable matter already in a humified condition at the time the boghead was formed, constitutes, according to the degree of alteration sustained, soft charcoal, or (if less modified) has absorbed bitumen and formed a bright coal, both these conditions being encountered side by side.

The bituminous matter has undergone but little condensation. By infiltration, subsequent to the deposition of the gelatinous mass, it penetrated and filled all the interstices formed therein, and thus came into contact with substances it was able to impregnate and colour.

Considerable shrinkage of the thalla is observed in all the specimens from these shales, those found in the Hartley deposit being only between 1/24th and 1/12th of their original volume.—C. S.

Metallic Carbides, Study of [Formation of Hydrocarbons]. H. Moissan. Proc. Roy. Soc. 60, 156—160.

IN this paper an account is given of the metallic carbides obtained in the electric furnace devised by the author. At the high temperature obtained, the metals gold, bismuth, lead, and tin do not dissolve carbon; liquid copper takes up a very small proportion, though sufficient to change its properties, such as malleability; silver at its boiling point dissolves a small quantity of carbon, which separates on cooling in the form of graphite. This melt of silver thus obtained possesses the curious property of increasing instead of decreasing in volume in passing from the liquid into the solid state.

A large number of metals combine with carbon, under the conditions studied, to form definite crystalline compounds. Thus the alkaline and alkaline earth metals yield substances of general formula $C_2M'_2$ or C_2M' , decomposed on contact with cold water, quantitatively into the hydrate and acetylene. The aluminium compound, C_2Al_3 , which crystallises in hexagonal laminae, yields methane when decomposed with water; while those of the cerium group of metals of composition C_2M' yield a mixture of acetylene and methane; while those of manganese, CMn_3 , and uranium, C_3U_2 , give mixtures of methane, hydrogen, and ethylene.

The second class of carbides, such as those of molybdenum, tungsten, and chromium, which form opaque crystals with metallic lustre, are not decomposed by water at ordinary temperatures.

The author considers that the decomposition of these carbides, with formation of hydrocarbons, generally gaseous, but in some cases liquid or solid, may serve to explain the formation of petroleum and of asphalt, as also of various volcanic phenomena.—V. H. V.

Methylated Spirit.

See under Trade Rep., page 838.

PATENT.

Coal-Gas, Impts. in the Manufacture of. J. T. Thomas, Bisham, Berks, and A. V. Hunt, Upper Thames Street, London. Eng. Pat. 18,395, Oct. 2, 1895.

In order to utilise the tar produced in the distillation of the coal, that tar, collected in the usual way, is mixed with a suitable proportion of inert matter, such as fine house-ashes, flue ash, and dust from furnaces, &c., and the mixture is subjected to distillation in the retorts along with the usual coal from which the gas is produced.—R. A.

IV.—COLOURING MATTERS AND DYES.

The Action of Light upon Dyed Colours. Report of Committee, consisting of Prof. T. E. Thorpe (Chairman), Prof. J. J. Hummel (Secretary), Dr. W. H. Perkin, Prof. W. J. Russell, Captain Abney, Prof. W. Stroud, and Prof. R. Meldola. (Drawn up by the Secretary.) Read before the British Association (Section B), Liverpool Meeting, 1896. (See this Journal, 1894, 803—807.)

DURING the past year (1895—96) the work of this Committee has been continued, and a large number of wool and silk patterns, dyed with various natural and artificial blue and green colouring matters, have been examined with respect to their power of resisting the fading action of light.

The general method of preparing the dyed patterns, and the manner of exposing them under glass, with free access of air and moisture, were the same as already adopted in previous years.

The thanks of the Committee are again due to James A. Hirst, Esq., in whose grounds the patterns were exposed at Adel, near Leeds.

Each dyed pattern was divided into six pieces, one of which was protected from the action of light, while the others were exposed for different periods of time. These "periods of exposure" were made equivalent to those adopted in previous years by exposing, along with the patterns, special series of "standards," dyed with the same colouring matters as were then selected for this purpose. The standards were allowed to fade to the same extent as those which marked off the "fading period" in previous years, before being renewed or before removing a set of dyed patterns from the action of light. The patterns exposed during the past year are therefore comparable, in respect of the amount of fading action to which they have been submitted, with the dyes already reported upon.

The patterns were all put out for exposure on July 19, 1895, certain sets being subsequently removed on the following dates:—August 12, September 3, September 20, 1895; April 1, July 9, 1896. Of these five "periods of exposure" thus marked off, periods 1, 2, 3 were equivalent to each other in fading power, whereas periods 4 and 5 were each equivalent to four of the first period in this respect; hence five patterns of each colour have been

submitted respectively to an amount of fading equal to one, two, three, seven, and eleven times that of the first "fading period" selected—viz., July 19 to August 12, 1895.

The dyed and faded patterns have been entered in pattern-card books in such a manner that they can be readily compared with each other.

The following tables give the general result of the exposure experiments made during the year 1895—96, the colours being divided, according to their behaviour towards light, into the following five classes:—Very fugitive, fugitive, moderately fast, fast, very fast.

The initial numbers refer to the order of the patterns in the pattern books. The S and J. numbers refer to Schultz and Julius's "Tabellarische Uebersicht der künstlichen organischen Farbstoffen."

In the case of colouring matters requiring mordants, the particular mordant employed is indicated in brackets after the name of the dyestuff.

BLUE COLOURING MATTERS.

CLASS I.—VERY FUGITIVE COLOURS. (WOOL.)

Many of the colours of this class have faded so rapidly that at the end of the first "fading period" (July 19 to August 12, 1895) only a very faint colour remains, and at the end of the fifth period (one year) all traces of the original colour have disappeared, the woollen cloth being either white or of a yellowish or greyish appearance.

Triphenylmethane Colours.

Wool Book IX.

Basic Colours:—

10. Victoria Blue R. Constitution not published.
11. New Victoria Blue B. Constitution not published.
12. Victoria Blue B. Hydrochloride of phenyl-tetramethyl-triamido-diphenyl- α -naphthyl-carbinol. S. and J. 274.
13. Night Blue. Hydrochloride of *p*-tolyl-tetra-ethyl-triamido-diphenyl- α -naphthyl-carbinol. S. and J. 275.
14. Victoria Blue 4R. Hydrochloride of phenyl-pentamethyl-triamido-diphenyl- α -naphthyl-carbinol. S. and J. 276.

Safranine Colours.

Basic Colours:—

24. Neutral Blue. Phenyl-dimethyl-*p*-amido-pheno-naphthazonium chloride. S. and J. 354.

Orazine Colours.

Acid Colours:—

9. Gallaniline Indigo PS. Sulphonated product of the action of aniline on galloeyanine-anhydride-anilide.
24. Fluorescent Blue. Ammonium salt of tetra-brom-resorufin.

Basic Colours:—

5. Capri Blue GON. Dimethyl-tolyl-ammonium-dimethyl-amido-phenoazoxazine chloride.
7. Cresyl Blue 2BS. Dimethyl-tolyl-ammonium-amido-phenoazoxazine chloride.
19. Nile Blue. Dimethyl-phenyl-ammonium- α -amido-naphthoxazine chloride. S. and J. 344.
20. New Methylene Blue GG. Dimethyl-phenyl-ammonium-dimethyl-amido-naphthoxazine chloride.

Thiazine Colours.

Basic Colours:—

3. Thionine Blue GO. Zinc double chloride of diethyl-dimethyl-thionine.
4. Methylene Blue B. Zinc double chloride of tetramethyl-thionine.
8. Gentianine. Hydrochloride of dimethyl thionine.
9. New Methylene Blue N. Hydrochloride of diethyl-tolyl-thionine.
- , Toluidine Blue. Zinc double chloride of dimethyl-tolyl-thionine. S. and J. 351.

Azo Colours.

Wool Book X.

Direct Cotton Colours:—

1. Diamine Sky Blue. From diphenitidine and amido-naphthol-disulphonic acid II.
2. Chicago Blue 6B. Constitution not published.
3. Brilliant Benzo Blue 6B. Constitution not published.
8. Diamine Blue 6G. Constitution not published.

NOTES.—Certain colours in this class—*e.g.*, Gentianine, &c.—fade during the first period to a grey colour possessing a moderate degree of fastness. Neutral Blue is characterised by fading to a dull reddish colour. Gallaniline Indigo PS and Diamine Blue 6G, when completely faded, leave the wool of a pronounced yellow tint.

CLASS II.—FUGITIVE COLOURS. (WOOL.)

The colours of this class show very marked fading at the end of the second "fading period" (August 12 to September 3, 1895), and after a year's exposure they have entirely faded, or only a tint remains.

Triphenylmethane Colours.

Wool Book IX.

Basic Colours:—

1. Turquoise Blue. Constitution not published.
2. Turquoise Blue 2B. Constitution not published.
6. Glacier Blue. Zinc double chloride of dicblor-dimethyl-diamido-ditolyl-phenyl-carbinol.

Acid Colours:—

5. Cyanol extra. Sodium salt of *m*-oxy-diethyl-diamido-phenyl-ditolyl-carbinol-disulphonic acid.

Thiazine Colours.

10. Thioearmine. Sodium salt of diethyl-dibenzylthionine-disulphonic acid.

*Orazine Colours.**Basic Colours:—*

27. Muscarin J. Dimethyl-phenyl-*p*-ammonium- β -oxynaphthoxazine. S. and J. 343.
28. Metamine Blue B. Dimethyl-phenyl-*p*-ammonium- β -naphthoxazine. S. and J. 342.
29. New Fast Blue H. Constitution not published.
30. New Fast Blue F. Constitution not published.

Acid Colour:—

27. Azine Blue. Constitution not published.

*Safranine and Induline Colours.**Basic Colours:—*

15. Basle Blue B. Dimethyl-amido-tolyl-amido-tolyl-pheno-naphthazonium chloride.
16. Diphen Blue R. An induline colour.
17. Indazine M. Tetra-methyl-diamido-diphenazine-phenyl-chloride. S. and J. 364.
26. Metaphenylene Blue B. Tetra-methyl-di-*o*-tolyl-diphenazonium chloride.

*Natural Colouring Matters.**Acid Colours:—*

1. Indigo Carmine. Sodium salt of indigotin-disulphonic acid.
2. Indigo Purple. Sodium salt of indigotin-mono-sulphonic acid.

Azo Colours.

Wool Book X.

Direct Cotton Colours:—

9. Benzo Cyanine 3B. Constitution not published.
11. Indoin Blue 2B. From Safranine and β -naphthol.
12. Metazurin B. Constitution not published.
14. Benzo Blue 3B. Constitution not published.
15. Benzo Red Blue G. Constitution not published.
16. Columbia Blue G. Constitution not published.
17. Chicago Blue R. Constitution not published.
18. Naphthazurin. Constitution not published.

23. Diamine Blue 2B. From benzidine and amido-naphthol-disulphonic acid II.
24. Diamine Blue 3B. From tolidine and amido-naphthol-disulphonic acid II.
25. Benzo Cyanine R. Constitution not published.
26. Indazurin. Constitution not published.
27. Direct Blue B. From dianisidine, dioxynaphthoic-sulphonic acid, and α -naphthol-*p*-sulphonic acid.
28. Heligoland Blue 3B. Constitution not published.
29. Benzo Azurine G. From dianisidine, and α -naphthol-mono-sulphonic acid NW. S. and J. 210.
30. Benzo Red Blue R. Constitution not published.
31. Columbia Blue R. Constitution not published.
32. Benzo Azurine 3G. From dianisidine, and α -naphthol-mono-sulphonic acid L. S. and J. 213.
33. Brilliant Metazurin OOO. Constitution not published.
34. Diamine Blue BX. From tolidine, α -naphthol-mono-sulphonic acid NW, and amido-naphthol-disulphonic acid II.
35. Diamine Blue B. From ethoxy-benzidine, β -naphthol- δ -disulphonic acid, and α -naphthol-mono-sulphonic acid NW. S. and J. 205.
36. Heligoland Blue R. Constitution not published.
37. Oxamine Blue 3R. From tolidine, β -amido- α -naphthol- β -sulphonic acid, and α -naphthol- α -sulphonic acid.
38. Diamine Blue 3R. From ethoxy-benzidine, and α -naphthol-mono-sulphonic acid NW. S. and J. 206.
39. Azo Blue. From tolidine, and α -naphthol-mono-sulphonic acid NW. S. and J. 187.
43. Azo Navy Blue. Constitution not published.
45. Direct Blue Black B. Constitution not published.

Acid Colours.

23. Azo Acid Blue B. Constitution not published.

*Natural Colouring Matters.**Mordant Colours:—*

Logwood (Al). Wood of *Hæmatoxylon campechi-anum*.

NOTES.—Azo Acid Blue acquires, on fading, a very red shade; Turquoise Blue 2B and Glacier Blue change to a green during the first period. Basle Blue B and Benzo Blue 3B lose their bloom of colour during the first "fading period," the remaining dark greyish colour being moderately fast. Direct cotton colours, 12, 17, 18, 23, 24, 25, change from blue to grey during the first "fading period," and Nos. 15, 16, and 26 to 39 all acquire a marked reddish tint. On this account these colours might almost equally well be placed among the "very fugitive colours."

CLASS III.—MODERATELY FAST COLOURS. (WOOL.)

The colours of this class show distinct fading at the end of the second period (August 12 to September 3, 1895), which becomes more pronounced at the end of the third period (September 3 to September 20, 1895). A pale tint remains at the end of the fourth period (September 20, 1895, to April 7, 1896), and at the end of a year's exposure the colour has entirely faded, or, at most, mere traces of colour remain.

Triphenylmethane Colours.

Wool Book X.

Mordant Colours:—

1. Chrome Blue (Cr). Oxy-carboxy-tetra-methyl-diamido-diphenyl-naphthyl-carbinol.

Wool Book IX.

Acid Colours:—

3. Patent Blue A. Calcium salt of *m*-oxy- (or *m*-amido)-tetra-alkyl-diamido-triphenyl-carbinol-sulphonic acid.
4. Patent Blue superfine. Ditto.
12. Alkali Blue. Sodium salt of mono- and di-phenyl-rozaniline-mono-sulphonic acid.

13. Alkali Blue 6B. Sodium salt of tri-phenyl-rosaniline-mono-sulphonic acid.
14. Hoechst New Blue. Calcium salts of tri-methyl-tri-phenyl-*p*-rosaniline, di- and tri-sulphonic acids.
15. Methyl Blue MB1. Sodium salt of tri-phenyl-*p*-rosaniline-tri-sulphonic acid.
16. Water Blue 6B extra. Sodium salt of tri-phenyl-rosaniline-tri-sulphonic acid.
17. Bavarian Blue DBF. Sodium salt of diphenylamine blue-tri-sulphonic acid. S. and J. 360.
18. Bavarian Blue DSF. Sodium salt of diphenylamine blue-di- and tri-sulphonic acid. S. and J. 299.
19. Alkali Blue D. Sodium salt of diphenylamine blue-mono-sulphonic acid. S. and J. 298.
20. Alkali Blue R. Sodium salt of mono-phenyl-rosaniline-mono-sulphonic acid.
22. Soluble Blue pure. Sodium salt of tri-phenyl-rosaniline-tri-sulphonic acid.

Orazine Colours.

Wool Book X.

Mordant Colour :—

5. Galloxyanine DII (Cr). Chloride of dimethyl-phenyl-ammonium - dioxy - phenoxazine - carboxylic acid. S. and J. 340.

Wool Book IX.

Acid Colour :—

35. Gallaniline Blue R. Constitution not published.

Induline Colours.

Wool Book IX.

Acid Colours :—

26. Milling Blue. Sodium salt of anilido-iso-naphthyl-rosinduline-mono-sulphonic acid.
28. Naphthyl Blue. Sodium salt of anilido-phenyl-naphthinduline-sulphonic acid.
29. Naphthazine Blue. Sodium salt of tetra-methyl-dianilido - dinaphthyl-diphenazonium - di - sulphonic acid.
30. Induline NN. Sodium salt of sulphonic acid of a Spirit Induline. S. and J. 366.
31. Indigen F liquid. Sodium salt of sulphonic acid of a Spirit Induline. S. and J. 365.
32. Induloe 3B. Sodium salt of sulphonic acid of a Spirit Induline. S. and J. 366.
37. Fast Blue B. Sodium salt of sulphonic acid of a Spirit Induline. S. and J. 365.

Basic Colours :—

22. Toluyene Blue B. Constitution not published.
23. Indamine Blue N. Hydrochloride of *p*-amido-phenyl-amido-derivatives of a Spirit Induline.
31. Paraphenylene Blue R. Hydrochloride of amido-phenyl-induline.
32. Indophenine extra. Constitution not published.
33. Indophenine B. Constitution not published.

Azo Colours.

Wool Book IX.

Acid Colours :—

38. Blue Black B. From β -naphthylamine-mono-sulphonic acid, azo- α -naphthylamine and β -naphthol-disulphonic acid R. S. and J. 134.
39. Indigo Blue powder. From toluene-azo-naphthylamine and β -naphthol-sodium-disulphonate.

Wool Book X.

Direct Cotton Colours :—

5. Brilliant Sulphon Azurine R. Constitution not published.
6. Sulphon Cyanine. Constitution not published.
7. Sulphon Azurine. From benzidine-sulpho-disulphonic acid, and phenyl- β -naphthylamine. S. and J. 182.
10. Sulphon Cyanine 3R. Constitution not published.
13. Brilliant Azurine 5G. From dianisidine and dioxy-naphthalene- α -mono-sulphonic acid. S. and J. 215.
19. Naphthyl Blue 2B. From *o*-amido-diphenylic acid, and benzoyl-amido-naphthol.

20. Benzo-Indigo Blue. From dianisidine, α -naphthylamine, and dioxy-naphthalene- α -mono-sulphonic acid (1:8).
21. Diamine Blue Black E. From ethoxy-benzidine, β -naphthol- δ -disulphonic acid, and γ -amido-naphthol sulphonic acid.
22. Blue JCR. Constitution not published.
40. Benzo Black Blue R. From tolidine-diazo- α -naphthylamine, and α -naphthol-mono-sulphonic acid NW. S. and J. 226.
41. Congo Fast Blue B. Constitution not published.
42. Benzo Black Blue G. From benzidine-disulphonic acid-diazo-naphthylamine, and α -naphthol-mono-sulphonic acid NW. S. and J. 225.
44. Congo Fast Blue R. Constitution not published.

Natural Colouring Matters.

Wool Book X.

Mordant Colour.—Logwood (Cr.) Wood of *Hematoxylon campechianum*.

NOTES.—The Patent Blues become darker during the first two fading periods. Brilliant Sulphon Azurine R acquires a decided reddish tint during the later stages of fading. The Sulphocyanines and Galloxyanine DII appear to be faster than the rest of the colours placed in this class, and do not change in hue during the fading process. The fastness of the Alkali Blues is probably greater than is usually supposed to be the case. The blue given by logwood with chromium is much faster than that obtained with aluminium mordant.

CLASS IV.—FAST COLOURS. (WOOL.)

The colours of this class show comparatively little fading during the first, second, and third periods. At the end of the fourth period a pale shade remains, which at the end of the year's exposure still leaves a pale tint.

Triphenylmethane Colours.

Wool Book X.

Mordant Colour :—

9. Gallein (Cr). Oxidation product of pyrogallol-phthalain. S. and J. 335.

Wool Book IX.

Basic Colour :—

25. Gentiana Blue 6B. Hydrochloride of tri-phenyl-rosaniline.

Orazine Colours.

Wool Book X.

Mordant Colour :—

7. Gallamine Blue (Cr). Product of action of nitroso-dimethyl-aniline-hydrochloride on gallamine acid. S. and J. 346.

Azo Colours.

Wool Book IX.

Acid Colour :—

36. Naphthol Blue Black. From *p*-nitraniline, aniline, and amido-naphthol-disulphonic acid II (1:8).

Induline Colours.

Acid Colour :—

33. Fast Blue 6B for wool. A sulphonated induline.

NOTE.—That Gentiana Blue 6B has proved to be fast is very remarkable, since the basic colours, and particularly those of the triphenylmethane group, are usually so fugitive. During the first fading period the bloom of the colour disappears, but the remaining colour fades very little, even throughout the period of a whole year.

CLASS V.—VERY FAST COLOURS. (WOOL.)

The colours of this class show a very gradual fading during the different periods, and even after a year's exposure a moderately good colour remains.

Oxazine Colours.

Wool Book X.

Mordant Colour :—

6. Cælestine Blue B (Cr). Constitution not published.

*Thiazine Colours.**Mordant Colours* :—

10. Brilliant Alizarin Blue R (Cr). Constitution not published. A derivative of oxy-naphtho-quinone-imide.
12. Brilliant Alizarin Blue G (Cr). Constitution not published.

*Oxyketone Colours.**Mordant Colours* :—

2. Alizarin Blue WX (Cr). Di-oxy-anthraquinone-quinoline. S. and J. 255.
3. Alizarin Blue S powder (Cr). Sodium bisulphite compound of Alizarin Blue. S. and J. 256.
4. Anthracene Blue WR (Cr). Hexa-oxy-anthraquinone.
8. Alizarin Cyanine R (Cr). Penta-oxy-anthraquinone. S. and J. 249.
11. Alizarin Cyanine G (Cr). Action of ammonia on intermediate product in making Alizarin Cyanine R. S. and J. 250.
13. Anthracene Blue WG (Cr). Constitution not published.
15. Alizarin Indigo Blue SW (Cr). Sodium bisulphite compound of tetra- and penta-oxy-anthraquinolin-quinone-sulphonic acid. S. and J. 257.
16. Alizarin Cyanine Black G (Cr). Constitution not published.

Natural Colouring Matters.

Wool Book X.

Direct Colour :—

1. Vat Indigo Blue.

*Additional Colouring Matters.**Acid Colour* :—

2. Prussian Blue.

NOTES.—The great fastness of the Brilliant Alizarin Blues is remarkable, since they belong to a group of colouring matters which has not hitherto furnished fast colours. The same remark applies to Cælestine Blue, although this colour is not so fast as the foregoing. The fastness of the various Alizarin Blues (oxyketone colours) is proverbial, and along with the colours just named they may well be regarded as worthy competitors of indigo for the production of fast blues. The chief difference of behaviour of Indigo Blue and some of the Alizarin Blues is that the latter tend to acquire a reddish tint, whereas the former does not.

The remarkable fastness of Prussian Blue on wool is such that the medium blue colour experimented upon has not perceptibly faded during a whole year's exposure, and it may be justly considered as the fastest blue on wool with which we are at present acquainted; unfortunately it is sensitive to the action of alkalis.

GREEN COLOURING MATTERS.

CLASS I.—VERY FUGITIVE COLOURS. (WOOL.)

Wool Book XI.

Basic Colours :—

1. Capri Green G. Constitution not published.
11. Solid Green 3B. Zinc double chloride of dichlor-tetra-methyl-diamido-triphenyl-carbinol. S. and J. 265.
13. Iodine Green. Zinc double chloride of chlor-methyl-hexa-methyl-rosaniline-hydrochloride. S. and J. 284.
15. Methylene Green. Nitro-tetra-methyl-thionine. S. and J. 349 (foot-note).
18. Aldehyde Green. Quinoline derivative of rosaniline. (?). S. and J. 377.

Natural Colouring Matters.

Wool Book XI.

Lo-kav (on cotton). Chinese dyestuff derived from *Rhamnus utilis*.

CLASS II.—FUGITIVE COLOURS. (WOOL.)

Triphenylmethane Colours.

Wool Book XI.

Acid Colours :—

1. Light Green SF (yellow shade). Sodium salt of diethyl-dibenzyl-diamido-triphenyl-carbinol-tri-sulphonic acid. S. and J. 268.
2. Helvetia Green. Sodium salt of tetra-methyl-diamido-triphenyl-carbinol-mono-sulphonic acid. S. and J. 266.
3. Light Green SF (blue shade). Sodium salt of dimethyl-dibenzyl-diamido-triphenyl-carbinol-tri-sulphonic acid. S. and J. 267.
4. Guinea Green BV. Sodium salt of nitro-diethyl-dibenzyl-diamido-triphenyl-carbinol-di-sulphonic acid. S. and J. 270.
5. Guinea Green B. Sodium salt of diethyl-dibenzyl-diamido-triphenyl-carbinol-di-sulphonic acid. S. and J. 269.
6. Fast Green extra. Sodium salt of tetra-methyl-dibenzyl-pseudo-rosaniline-di-sulphonic acid. S. and J. 286.

Basic Colours :—

3. Methyl Green. Zinc double chloride of chlor-methyl-hexa-methyl-p-rosaniline-hydrochloride. S. and J. 283.
4. China Green cryst. Tetra-methyl-diamido-triphenyl-carbinol oxalate. S. and J. 263.
5. Imperial Green cryst. Zinc double chloride of tetra-methyl-diamido-triphenyl-carbinol. S. and J. 263.
6. Solid Green GG. Tetra-methyl-diamido-triphenyl-carbinol sulphate. S. and J. 263.
9. Solid Green YVO cryst. Zinc double chloride of tetra-ethyl-diamido-triphenyl-carbinol. S. and J. 264.
10. Ethyl Green cryst. Tetra-ethyl-diamido-triphenyl-carbinol sulphate. S. and J. 264.

Mordant Colour :—

2. Chrome Green (Cr). Tetra-methyl-diamido-triphenyl-carbinol-carboxylic acid.

Safranine and Induline Colours.

Wool Book XI.

Basic Colour :—

17. Azine Green TO. Dimethyl-amido-phenyl-amido-phenyl-pbeno-naphthazonium chloride. S. and J. 363.

Azo Colours.

Wool Book XI.

Direct Cotton Colour :—

2. Columbia Green. Constitution not published.

CLASS III.—MODERATELY FAST COLOURS. (WOOL.)

Triphenylmethane Colours.

Wool Book IX.

Acid Colours :—

6. Alkali Green. Sodium salt of diphenyl-diamido-triphenyl-carbinol-mono-sulphonic acid. S. and J. 271.
7. Wool Green S. Sodium salt of tetra-methyl-diamido-β-oxy-naphthyl-carbinol-disulphonic acid.
8. Milling Green. Sodium salt of tetra-methyl-dibenzyl-pseudo-rosaniline-disulphonic acid.

Wool Book X.

*Azo Colours.**Direct Cotton Colour* :—

1. Diamine Green B. From benzidine, p-nitro-benzene-azo-amido-naphthol-disulphonic acid, and pbenol.

Mordant Colour :—

1. Azo Green (Cr). From m-amido-tetra-methyl-p-diamido-triphenyl-methane, and salicylic acid S. and J. 273.

CLASS IV.—FAST COLOURS. (WOOL.)

Wool Book X.

Direct Cotton Colour :—

3. Benzo Olive. Constitution not published.

Mordant Colour :—

4. Diamond Green (Cr). Constitution not published.

CLASS V.—VERY FAST COLOURS. (WOOL.)

Triphenylmethane Colours.

Wool Book X.

Mordant Colour :—

3. Cærulein (Cr). Product of the action of sulphuric acid on Gallen. S. and J. 336.

*Oryketone Colours.**Mordant Colour* :—

5. Alizarin Green SW. (Cr). Sodium bisulphite compounds of tri- and tetra-oxyanthraquinone-quinoline-sulphonic acids. S. and J. 258.

*Quinone-oxime Colours.**Mordant Colours* :—

6. Dark Green (Fe). Di-quinol-dioxime. S. and J. 232.
7. Gambine Y. (Fe). β -naphtho-quinone- α -oxime. S. and J. 231.
8. Gambine B (Fe). Constitution not published.
9. Naphthol Green B (Fe). Ferrous sodium salt of nitroso- β -naphthol- β -mono-sulphonic acid. S. and J. 236.
10. Dioxime (Fe). β -oxy-naphtho-quinone-oxime. S. and J. 235.
11. Gambine R (Fe). Naphtho-quinone-oxime. S. and J. 233.

NOTES.—The great fastness of the quinone-oxime colours when fixed with iron mordant is worthy of special notice. The fastness of Cærulein green as a Triphenylmethane Colour is also remarkable, but although Cærulein is usually classed as a Triphenylmethane Colour, its constitution when fully determined may cause it to be more properly placed in some other class.

SILK PATTERNS.

Most of the foregoing colours were also dyed on silk, and the patterns were exposed to light along with those on wool. The relative fastness of the various colours was, for the most part, the same as on wool, the differences observed being too unimportant to necessitate a special classification for silk.

The Chinese natural dyestuff Lo-kay fixed on silk with alum mordant is much faster than the same colour fixed on cotton from a soap bath. It was not found possible to apply it satisfactorily to wool.

Vat Indigo Blue is apparently less fast on silk than on wool, and on this fibre some of the Alizarin Blues, and notably the Brilliant Alizarin Blues, are much faster than Indigo Blue. As on wool, so on silk, Prussian Blue is faster to light than all other blues.

Indigo, Cultivation of, in Mexico. J. Soc. Arts, 1896, 44, 713.

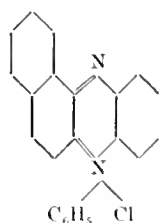
THREE varieties of indigo are cultivated in Mexico, namely, *I. tinctoria*, *I. disperma*, and *I. anil*. Details are given as to methods of extraction and preparation for market, and it is finally stated that the actual cost of indigo-raising amounts, after the first year, to about 53 dols. per hectare.

Dye [Blue] for Wool and Silk. G. Ulrich. Färber Zeit. 7, [25], 396.

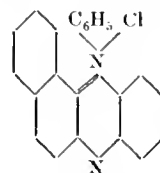
THIS new acid colouring matter, which is sold under the name of "Biebrich Acid Blue," is said to dye, at a temperature of 50°–70° C., in a mixed fabric of silk and wool, the silk only, leaving the wool woven with the former almost of its natural colour; whilst at boiling temperature both silk and wool may be dyed full "level" shades. This new dyestuff is said to go on very evenly, and is recommended for the dyeing of shot effects on goods composed of silk and wool.—I. S.

Phenosafranin and Rosinduline, Conversion of, into Parent Azonium Compounds. F. Kehrman. Ber. 29, 2316–2322.

THE author has succeeded in converting phenosafranin into phenylphenazonium by the following method. Aposafrafin chloride or sulphate is dissolved in a small quantity of water, and sufficient sulphuric acid is added to produce a pure green colour. Sodium nitrite solution is then quickly added until the whole is a dark orange-red, when it is treated with three times its volume of absolute alcohol. A violent evolution of nitrogen takes place, and after standing six hours the conversion into phenazonium sulphate is complete. The liquid is then treated with 10 grms. of ferric chloride for each 1 gm. of aposafrafin taken, and hydrochloric acid of 20 percent. strength, is added as long as a brownish-yellow precipitate of the ferric chloride double salt is formed. After filtering off and washing with cold glacial acetic acid, it can be recrystallised from boiling acetic acid, when it separates in reddish-brown shining prisms. For analysis, the salt is dissolved in lukewarm water, and the iron precipitated as hydroxide by the careful addition of ammonium carbonate. The azonium compound remains as a carbonate in solution, and can be obtained as hydrochloride by filtering into dilute hydrochloric acid. The addition of ammonia to the carbonate solution produces a deep magenta coloration and formation of aposafrafin, since, on adding acid, the solution does not turn yellow, as it would do were unchanged azonium base present. With soda lye, aposafrafinone is obtained, whilst dimethylamine produces violet dimethylaposafranin. Concentrated sulphuric acid dissolves the chloride with a red colour, almost of the same shade as that given by acetylaposafranin chloride, and from the great similarity in the physical properties of the phenazonium salts with those of acetylaposafranin, it follows that both substances have an analogous constitution, and that the salts of acetylaposafranin have an azonium formula. In a similar manner rosinduline chloride can be converted into phenyl-naphthophenazonium, which in solution is of the same shade and shows the same fluorescence as solutions of acetylrosinduline salts. The solutions also in concentrated sulphuric acid have the same shade, which also points to the fact that the salts of acetylrosinduline are azonium compounds. The phenyl-naphthophenazonium from rosinduline chloride is not identical, but is isomeric with that from β -naphthoquinone and phenyl-*o*-phenylene diamine, which can also be obtained by removing the amido group from the blue chloride isomeric with rosinduline chloride previously described (Annalen, 290, 275; this Journal, 1896, 536). The following formulae represent the constitutions of the two isomers :—

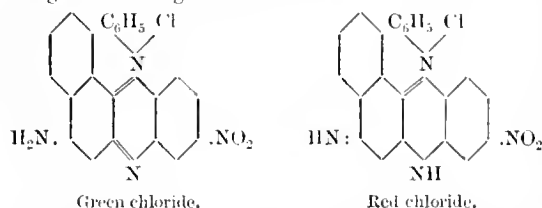


From Rosinduline.

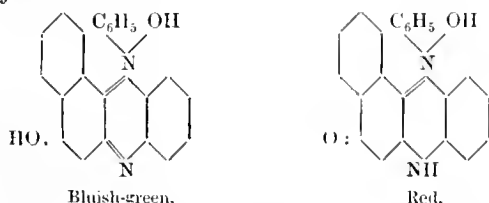
From β -naphthoquinone.

The author considers that the evidence for the constitution of the safranines and rosindulines definitely points to the azonium formula. He reserves for a future paper a detailed criticism of the *p*-quinonoid theory, but makes reference to the principal points in dispute (O. Fischer, Ber. 29 1873; this Journal, 1896, 646). 1. It has been shown that aposafrafin and rosinduline can be diazotised in a strongly acid solution. 2. The basicity of the azonium compounds is a function of the substituents attached to the azonium nitrogen, and the more negative these are the easier does the transformation into the *p*-quinonoid and hence anhydride form take place. The fact that rosindone and aposafrafinone are weak bases does not preclude the possibility of their salts being azonium compounds. That acetyl aposafrafin carbonate is only partially hydrolysed

by water is easily intelligible, since acetylrosinduline, which is somewhat less basic, does not form a carbonate. 3. Fischer (*loc. cit.*) admits that the precipitation by carbonates or ammonia is no argument against the azonium theory, since he quotes instances of undoubted azonium compounds, which are precipitated by these reagents. 4. The azonium formula affords an explanation as to why the very faintly basic azines and erubodines, which do not yield carbonates are converted into stronger bases by the addition of the negative radicle phenyl, and then yield carbonates and salts with stronger acids, which, with few exceptions, are soluble in water without dissociation. 5. The formation of the acetyl derivatives by boiling phenosafranine, aposafranine and rosinduline chloride with acetic anhydride accords better with the azonium formula. 6. The azonium theory obtains especial support from the analogy existing between the non-amidated azonium salts and those safranine or rosinduline salts the amido groups of which are acetylated. 7. The quinonoid nature of the non-substituted azonium compounds, which from their formation and reactions must be *o*- and not *p*-quinonoid, is, like β -naphthoquinone, apparent from their behaviour to amines and alkalis, and thus the quinonoid character of the safranines, &c., cannot be used as an argument in favour of the *p*-quinone formula. 8. That the safranine and induline salts have the azonium formula, and that the rosindones and oxygen-free rosinduline bases are formed by a liberation of water accompanied by a molecular transformation affords the only explanation of existing facts. Even in cases where the liberation of water is impossible, instances of molecular transformation are known, and it has been found that nitro-isorosinduline gives two isomeric series of salts having the following formulae:—



Both these compounds can be converted into one another, give different sulphuric acid reactions, and correspond entirely to the two forms of *Orysonaphthophenazonium hydrochloride*—



The question as to the conjugation of the yellow diazo solution of phenosafranine and aposafranine (Nietzki, Ber. 29, 1445; this Journal, 1896, 537) must still remain an open one. At any rate, an alkaline β -naphthol solution is scarcely suitable for the purpose, since these diazo compounds, which at the same time have a quinonoid structure, are easily attacked by alkalis.—T. A. L.

PATENTS.

Triphenylmethane Series [Violet-Blue Dyestuffs], Manufacture of Derivatives of the. C. D. Abel, London. From "The Actien Gesellschaft für Anilin Fabrikation," Berlin, Germany. Eng. Pat. 23,051, Dec. 2, 1895.

This is an extension of Eng. Pat. 7550 of 1889 (this Journal, 1890, 386), and has reference to the preparation of triphenylmethane colouring matters from *o*-chlorodimethyl-*p*-amidobenzaldehyde, which is readily soluble in alcohol and ether, sparingly volatile with steam, and separates from an aqueous solution in small crystalline needles melting at 82° C. By combining one molecular proportion of this substance with two molecular proportions of an amine in

presence of or without a condensing agent, a leuco compound is formed, which on oxidation yields a basic colouring matter. For instance, 9 kilos. of *o*-chlorodimethyl-*p*-amidobenzaldehyde and 15 kilos. of dimethylaniline are dissolved in dilute sulphuric acid and heated for 24 hours. After neutralising with caustic soda, the excess of dimethylaniline is driven off with steam. The resulting leuco compound, after filtering off, is oxidised with lead dioxide, and yields the corresponding colouring matter, which dyes cotton mordanted with tannin a violet-blue shade, and gives a similar shade on wool from an acid or neutral bath. Acid colouring matters may be obtained in a similar way by substituting for the dimethylaniline above employed, either two molecular proportions of an amine sulphonic acid, or one molecular proportion of an amine and one molecular proportion of an amine sulphonic acid, the leuco compound produced in either case being subsequently oxidised. Thus by condensing in dilute sulphuric acid 9 kilos. of *o*-chlorodimethyl-*p*-amidobenzaldehyde with a mixture of 15 kilos. of ethyl-benzylaniline sulphonic acid and 6.1 kilos. of dimethylaniline, a leuco compound is obtained, which after oxidation yields a colouring matter dyeing wool bluish-violet shades from an acid bath.—T. A. L.

Sulphuretted Colouring Matters [Direct Dyes] Dyeing Non-Mordanted Fibres, Manufacture of. J. Murray, London. From "La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis," Paris, France. Eng. Pat. 23,312, Dec. 5, 1895.

In Eng. Pats. 23,578 of 1893 and 3411 of 1895 (this Journal, 1894, 94, and 1896, 29) processes are described for obtaining colouring matters by the action of sulphur, with or without the presence of alkalis, on substituted aromatic amines or acetylated aromatic diamines. According to the present specification the *p*-diamines of the first-mentioned patent may be replaced by *m*-diamines, such as *m*-cresylene diamine or *m*-xylene diamine, or by substances which produce them on reduction with sodium sulphide, such as *p*-nitro-*o*-toluidine, *o*-nitro-*p*-toluidine, dinitrotoluene, or nitro-*m*-xylidine. A mixture of 100 kilos. of *m*-cresylene diamine, 200 kilos. of sulphur, and 400 kilos. of sodium sulphide is heated for five hours to 200°–250° C. The resulting black mass is soluble in water, alkalis, and alkaline sulphides with a brownish-red colour, but is insoluble in acids. It dyes unmordanted cotton yellowish-brown, fast to washing and the action of air and light. A colouring matter dyeing similar shades is also obtained by heating together for the same time to 225°–250° C., 100 kilos. of *m*-cresylene diamine and 250 kilos. of sulphur. This product is insoluble in water, but dissolves in sulphides.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Silk, Causes of Damage to. G. Giauoli. Chem. Zeit. 1896, 20, 821.

The diminution in strength of silk fabrics after dyeing is attributed mainly to the colours used and to faulty manufacture. Iron and stannous salts weaken the silk fibres, as does also an excessive quantity of mineral acid. Unnecessary stretching during the processes of dressing and weaving reduces the thickness of the threads. It is hoped that the use of injurious dyes will be abandoned. Further study of the process of dyeing will doubtless lead to the discovery of colours and methods of dressing by which the strength of the silk fabrics can be maintained unimpaired.—W. P. S.

Cotton Velvet, A New Method for the Production of Figured [Embossed]. M. Knoop. Bull. Soc. Ind. Mulhouse, 1896, 347–349.

WHEN caustic soda at 30°–40° B. is printed on a cotton fabric and the fabric dried without washing, the printed portions are considerably tendered. This fact can be made use of to produce embossed effects on pile fabrics and is particularly suitable for velveteens. Caustic soda of the above strength, thickened with baked starch or dextrin, is printed on the fabric, which is then dried, preferably on heated cylinders, and at once thoroughly brushed, when the

fibres weakened by the action of the caustic soda are broken off and removed; the fabric is finally washed and the pile re-dressed. The chief precaution to be observed is to brush out the disintegrated fibres immediately after drying, and since caustic soda is extremely hygroscopic, this cannot well be effected by hand in the case of large pieces, and brushing machinery should be employed. The author states that embossed patterns can be thus produced superior to any obtained by processes previously employed.

In a report which follows the description of the process, C. Sehoen confirms the author's statements, and declares that after thorough research he is unable to find any other substance which acts in this respect in a similar manner to caustic soda.—R. B. B.

PATENT.

Mercerising Cotton Fibres [Increasing Affinity for Dye-stuffs] without Shrinking. R. Thomas and E. Prevost, Crefeld, Germany. Eng. Pat. 18,040, Sept. 26, 1895.

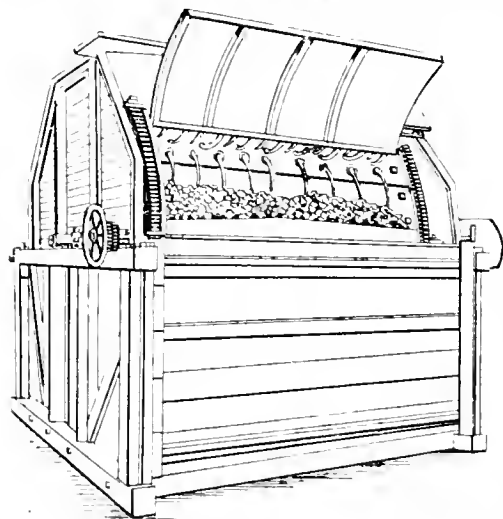
THE object of this patent is to mercerise cotton in the yarn or woven piece without causing it to shrink. It is claimed that inasmuch as the mercerised cotton fibre has a much greater affinity for colouring matters than untreated cotton or silk, various colour effects may be produced on cloth consisting of cotton and silk, by subjecting the same, "whilst tightly stretched, to the action of suitable acids and bases," and washing the same, "whilst still under tension, until the strong internal tension present in the fibre has ceased." As an alkaline lye, the patentees employ "a concentrated solution of caustic potash or soda of, say, 15°–32° B., which has not any injurious action in a cold state upon the strength of the silk and cotton fibres, but which rather increases their strength." As acid, sulphuric acid of 49.5°–55.5° B. is recommended; "but when this is used, the process must be effected with more care, and the acid must be washed out thoroughly at once after a short period of action." The completion of the reaction is indicated by the parchment-like appearance of the fibre or fabric.—I. S.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Cotton and Wool, Apparatus for Dyeing Loose.

Leipziger Färber Zeit. 45, [10], 415.

THE illustration shows an apparatus used in America for the dyeing of loose cotton and wool with substantive



colouring matters. It consists of a cylinder, radially divided into compartments and internally provided with bent hooks, which revolves in a semi-circular trough.—I. S.

Tannins, The Knowledge and Classification of. K. Krause. Chem. Zeit. 1896, 20, 794.

See under XXIII., page 831.

PATENTS.

Feathers, An Improved Method of Dyeing [Spraying]. H. N. Bour, Paris, France. Eng. Pat. 23,035, Dec. 2, 1895.

THE dye or other liquid to be applied to the feathers, is discharged in the form of a fine spray by means of an "atomiser." The feather may thus be dyed in one or different colours without taking the curl out of it, if it has already been curled in the ordinary way.—I. S.

Zinc Lactate as Mordant for Cotton. C. H. Boehringer Sohn, Nieder-Ingelheim-on-the-Rhine, Germany. Eng. Pat. 372, Jan. 6, 1896.

ZINC lactate is proposed in place of antimony compounds for mordanting cotton and other vegetable fibres. It is claimed that this salt is cheaper, and is fixed quantitatively by the tannin; hence a saving in cost is effected. The dye with basic colouring matters on zinc-tannin mordants is not so fast to washing as that on antimony; but this defect may be remedied by passing the zinc-mordanted goods through a second tannin bath.—I. S.

Printing Compositions for Printing [Bronze and Aluminium] upon Textile and other Materials, Impts. in. S. H. Sharp, Leeds. Eng. Pat. 16,274, July 22, 1896.

16.6 PARTS by weight of gum arabic, 50 parts of linseed oil, 16.7 parts of oil of resin, and 16.7 parts of dextrin are "boiled together to a syrup-like consistency." This mixture is called A.

Another mixture, called B, is made "by first boiling together, say for about three-quarters of an hour," 20 galls. of linseed oil and 40 lb. of red lead; then incorporating with this mixture 40 lb. of litharge and 80 galls. of turpentine, and boiling the whole "for, say, about an hour," and, when cold, filtering the mass through a woollen bag.

The mixtures A and B are incorporated together when cold in the proportion of about four parts by weight of mixture A to one part of mixture B, thereby forming a liquid, with which is incorporated "any desired aniline or other bronze powder," or aluminium powder, in the proportion of about three parts of the composition to one part of the powder.

Claims:—1. The herein-described manufacture of a bronze- or aluminium-coloured composition suitable for use in stencil printing machines for printing designs on textile and other fabrics, consisting of bronze or aluminium powder and a mixture of gum arabic, linseed oil, oil of resin, dextrin, red lead, litharge, and turpentine, substantially as described.

2. The manufacture, in the manner herein-before described, of the printing composition referred to in the preceding claim.—I. S.

Waterproof Fabrics, Impts. in. 1. Frankenburg, Salford. Eng. Pat. 650, Jan. 9, 1896.

THE waterproof surface of the material, either before or after vulcanisation, is printed with a composition of aluminium powder suspended in rubber solution, &c., in order to give it "the appearance of woven silk patterns, silk damasks, and all the varied styles of silk and half-silk fabrics." It is claimed that aluminium, as distinguished from other metallic dusts and bronzes, has no deleterious effect on the india-rubber.—F. H. L.

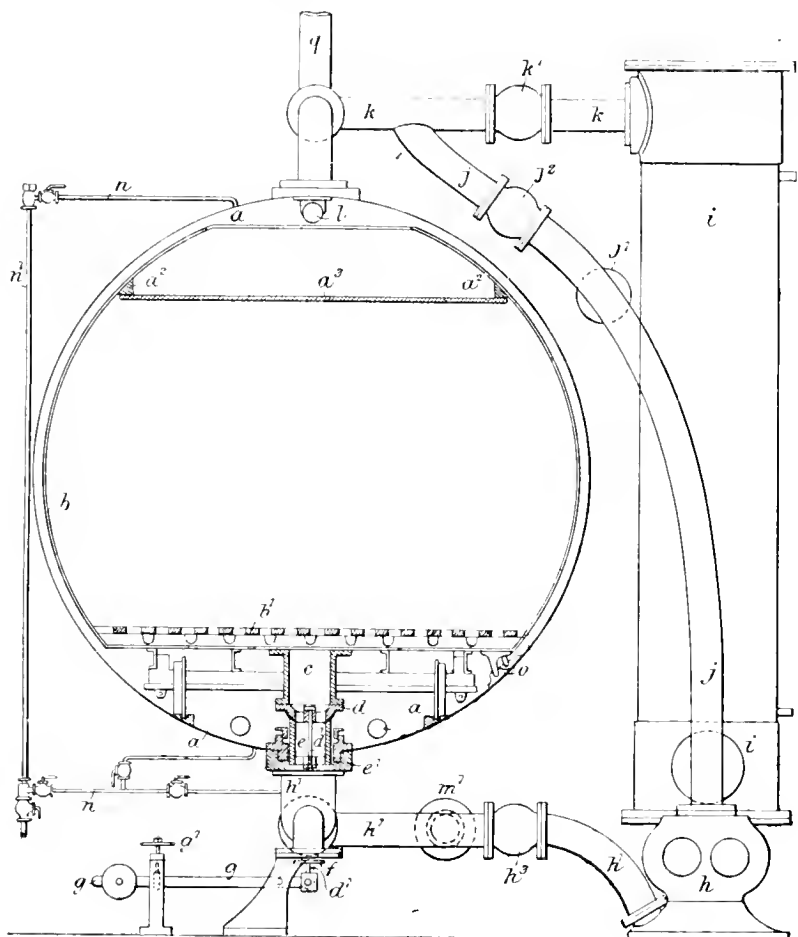
Waterproof Fabrics, Impts. in. 1. Frankenburg, Salford. Eng. Pat. 651, Jan. 9, 1896.

THIS is a modified form of the previous process. The aluminium, with or without other powdered material, is spread uniformly all over the fabric, which may afterwards, if desired, be printed upon in any suitable colours or patterns.—F. H. L.

Bleaching Kiers, Impts. in. M. Walton, Fratte di Salerno, Italy. Eng. Pat. 21,393, Nov. 12, 1895.

This invention relates to improvements in what are known as Mather kiers, and consists in means for making a more

perfect joint between the waggon in the kier and the pipe leading to the pump, the object being to improve the circulation of liquor, and to effect a saving in time and materials.



To the false bottom b^1 of the waggon is fixed a short flanged pipe c , the lower flange of which is faced to make a tight joint with the upper surface of a flanged collar d . The lower face of this collar is turned to fit into a cup or socket formed in the end of a short cylinder e , which is fitted and free to slide in a stuffing-box fitted into a casting, e^1 , secured to the kier. The collar d is connected to the cylinder e by a bolt d^1 , which retains it in position, but permits it sufficient freedom of movement in any direction for adjustment. The lower end of the bolt d^1 passes out of the cylinder e , through a stuffing-box f , and its lower end is connected to a weighted lever g , so that by moving the said lever, the sliding cylinder e and collar d can be raised and lowered as required. The lever g is worked by means of a hand-wheel and screwed spindle g^1 , or by any other suitable device. A pipe h^1 connects the cylinders e to a circulating pump h , which is connected by a pipe j to the upper part of the kier a . The pump h is also connected by a pipe to a superheater i , communication between the two being controlled by a valve. A valve j^1 on the pipe j opens or closes a communication between this pipe and a reservoir (not shown), and a valve j^2 opens or closes the connection between the pump and the pipe j with the top of the kier.

The operation is as follows:—Previous to running the waggons into the kier, the levers g are raised to lower the bolts d^1 , the sliding cylinders e , and collars d , so that

the flanged pipes c can come over the collars d . The waggons are then run into the kier up to the fixed stops (not shown), and the levers g are now lowered to raise the cylinder e and collars d against the pipes c . If desired, an india-rubber or other suitable flexible washer may be placed on each collar d to assist in forming a perfectly tight joint between the cylinders e and the waggons.

After the waggons have been filled with liquor, the door of the kier can be closed, and the valve m^1 and another valve (not shown) are closed, valves h^1 and another (not shown), opened, valve k^1 opened, and valve j^2 closed, and the pump set to work to draw the liquors from the bottoms of the waggons through the pipes c , sliding cylinders e , pipes h^1 , and pump, &c., into the bottom of the superheater i , which heats the liquor as it is forced through it up to the top, from which it flows through the pipe k and valve k^1 to the spreaders (not shown), by which it is distributed upon the goods in each waggon.—I. S.

Cups Dyeing, Scouring, Bleaching, &c.: Improved Machinery and Process for. W. Hepworth-Collins, Bradford. Eng. Pat. 3058, Feb. 11, 1896.

The apparatus consists of a metal cylinder a with a movable piston b , and piston-rod d , which passes through the bottom cover f of the cylinder. The piston consists

of four arms, a rim, and a boss to which the piston-rod is attached. (See Fig. 2.) The piston-plate *c*, or cop-carrier, is securely fixed by means of a water-tight joint to the

Fig. 1.

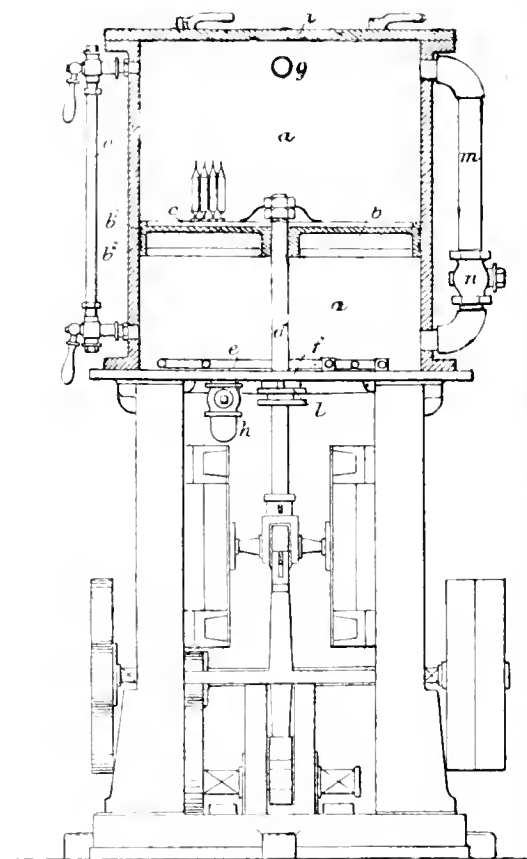
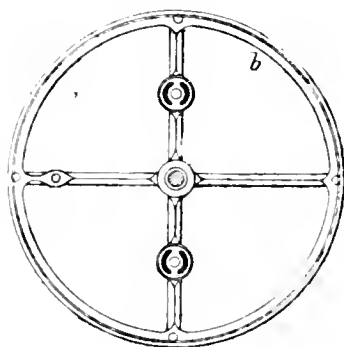


Fig. 2.



piston *b*, and is perforated to receive the hollow spindles of the cops. The piston charged with cops is pressed up and down by any mechanical means, whereby the liquor is forced through the cops, yarn, &c. in alternate directions.

—I. S.

Leather, Chrome-dressed, for Dyeing Purposes, and Improved Process for Preparing. E. Avellis and L. Koster, Berlin. Eng. Pat. 16,600, July 27, 1896.

See under XIV., page 818.

VII.—ACIDS, ALKALIS, AND SALTS.

Solvay Process in the United States. Eng. and Mining J., Oct. 17, 1896, 367—368.

THE Solvay Process Company was established at Syracuse, N.Y., in 1884, for the manufacture of alkali by the Solvay ammonia process. At the present time the ammonia used in the process is obtained as a by-product in the manufacture of coke in ovens of the Semet-Solvay type.

The range of the Company's products, as at present made, is shown by the following list:—(1.) Soda ash, including 58 per cent. for easy dissolving; dense, 58 per cent. for melting purposes; 48 per cent. for general commercial use; special 48 per cent. for glass-makers; 36 per cent. for special chemical operation. (2.) Caustic soda, including high test 76 per cent. nearly chemically pure NaOH; 74 per cent., 70 per cent., and 60 per cent., the three customary commercial grades; special 70 per cent. and 60 per cent., made softer than the ordinary grades. (3.) Soda crystals, including monohydrate crystals containing 49.8 per cent. actual alkali; and snow-flake crystals, with 40.9 per cent. actual alkali. (4.) Bicarbonate of soda, including pure bicarbonate, 99 per cent. NaHCO₃ for baking soda, and anchor dust, an inferior grade for making carbonic acid. (5.) Crown filler, a pure hydrated sulphate of lime for surfacing papers. (6.) Chloride of calcium for use in refrigerating machines. (7.) Muriatic acid.

The growth and extent of the business is shown by the accompanying table, which gives the raw materials consumed and the products of the works from 1884 up to the close of 1895. The original capital of the company was 300,000 dols., and the output 30 tons of soda ash a day; the capital is now 4,000,000 dols., and the capacity of the works 600 tons a day. (For Table, see next page.)

Aluminium Acetate Solution. Vulpius. Chem. Zeit. 1896, 20, 795.

THE specific gravity of the basic aluminium acetate prepared according to the German Pharmacopoeia is 1.064—1.066, and not 1.044—1.046, as it is there given. A solution could not be prepared by any of the numerous suggested methods which did not give a precipitate on keeping. In determinations of aluminium in the acetate the method by evaporation of the liquid and ignition of the residue gives too high numbers.—A. C. W.

Bromides, The Double. R. Varet. Comptes rend. 1896, 123, 497.

See under XXIV., page 831.

[*Potassium Percarbonate*] *Oxidising Substances, Electrolytic Preparation of a New Class of.* E. J. Constan and A. von Hansen. Zeits. f. Elektrochem. 3, (1896), 137.

See under XI. A., page 815.

Nitrites, Detection of, in Presence of Sulphites, Some Colour Reactions of Brucine. P. Pichard. Comptes rend. 123, [16], 590.

See under XXIII., page 829.

Nitrates in Vegetable Products, Rapid Estimation of. P. Pichard. Comptes rend. 121, [22], 758.

See under XXIII., page 829.

Coal and Saltpetre in South Africa. Imp. Inst. J., Nov. 1896, 402.

See under Trade Rep., page 836.

Carriage of Liquid Ammonia on board Ship.

See under Trade Rep., page 838.

Shipment of Sulphide of Sodium and Sulphide of Potassium.

See under Trade Rep., page 838.

Materials consumed by and Products of the Solvay Process Works, Syracuse, N. Y. (In Metric Tons.)

	1884.		1885.		1886.		1887.		1888.		1889.	
	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.
Materials used:—		Dols.		Dols.		Dols.		Dols.		Dols.		Dols.
Salt, as brine	20,000	1'25	28,000	1'25	45,000	1'25	58,000	1'25	90,000	1'12	39,000	1'00
Limestone	21,000	1'25	29,000	1'25	47,000	1'25	60,000	1'25	100,000	1'25	124,350	1'00
Coal consumed	22,000	2'00	30,000	2'00	48,000	2'00	62,000	2'15	90,000	2'15	101,395	2'25
Coke .....	..	..	..	..	..	..	8,000	3'75	11,000	3'75	12,000	..
Ammonia, as sulphate	440	68'00	520	70'00	615	68'00	680	66'00	920	66'00	990	66'00
Sulphuric acid .....	..	..	..	..	..	..	..	..	..	..	..	..
Bauxite .....	..	..	..	..	..	..	..	..	..	..	..	..
Products:—												
Ammonium sulphate .....	..	..	..	..	..	..	..	..	..	..	..	..
Tar produced .....	..	..	..	..	..	..	..	..	..	..	..	..
Soda ash, 58 per cent.	11,000	40'00	15,000	35'00	24,000	32'00	31,700	28'50	50,700	26'25	54,500	26'55
Caustic .....	..	..	..	..	..	..	..	..	4,120	55'00	9,100	53'25
Bicarbonate .....	..	..	..	..	..	..	..	..	3,145	42'00	3,400	40'00
Crystals .....	..	..	..	..	..	..	..	..	..	..	..	..
Sulphate of soda .....	..	..	..	..	..	..	..	..	..	..	..	..
Crown filler (CaSO ₄) .....	..	..	..	..	..	..	..	..	..	..	..	..
Oxide of alumina hydrate .....	..	..	..	..	..	..	..	..	..	..	..	..
	1890.		1891.		1892.		1893.		1894.		1895.	
	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.	Price.
Materials used:—		Dols.		Dols.		Dols.		Dols.		Dols.		Dols.
Salt, as brine	115,000	1'00	125,000	1'00	150,000	1'00	160,000	1'00	197,000	1'00	215,000	1'00
Limestone	153,110	1'00	189,800	1'00	209,810	1'00	199,070	1'00	240,000	1'00	270,000	1'00
Coal consumed	122,690	2'25	142,910	2'25	173,180	2'25	162,485	2'25	170,000	2'25	200,000	2'25
Coke	11,680	3'50	17,310	3'50	18,785	3'50	17,220	3'50	20,000	3'50	25,000	3'50
Ammonia, as sulphate	1,250	64'00	1,400	70'00	1,670	70'00	1,690	65'00	1,790	64'00	1,800	65'00
Sulphuric acid .....	..	..	..	..	..	..	..	..	700	..	700	7'00
Bauxite .....	..	..	..	..	..	..	..	..	160	..	..	..
Products:—												
Ammonium sulphate .....	..	..	..	..	75	65'00	130	65'00	135	65'00	135	65'00
Tar produced .....	..	..	..	..	275	8'00	420	8'00	415	8'00	420	8'00
Soda ash, 58 per cent.	65,870	27'54	70,990	30'50	82,000	33'60	85,000	32'00	104,300	23'50	120,000	23'00
Caustic	11,120	60'00	14,950	63'00	23,800	60'00	22,700	64'00	30,000	53'00	36,000	41'00
Bicarbonate	4,090	40'00	6,520	39'00	8,100	39'00	8,940	37'00	9,900	36'00	9,900	36'00
Crystals .....	..	..	..	..	..	..	..	..	430	10'00	430	40'00
Sulphate of soda .....	..	..	..	..	..	..	100	..	530	11'00	350	11'00
Crown filler (CaSO ₄) .....	..	..	..	..	..	..	..	..	700	25'00	700	25'00
Oxide of alumina hydrate .....	..	..	..	..	..	..	70	66'00	100	66'00	..	..

—J. T. C.

PATENTS.

Salt, An Improved Apparatus for the Manufacture of. A. R. Davis, Manchester. Eng. Pat. 19,692, Oct. 19, 1895.

The apparatus includes a furnace and combustion chamber, adapted to secure a smokeless flame; an evaporating chamber, in which a fixed depth of brine is maintained, the brine being sprayed by the rapid rotation of two shafts carrying fanners, which dip about half an inch into the brine; and a mechanical conveyor of the salt deposited in the trough-shaped bottom of the evaporating chamber. Pans are placed on the top of the furnace and evaporating chamber, fed with brine, to utilise waste heat. The products of combustion pass directly from the combustion chamber into the evaporating compartment, which opens into a chimney at the opposite end. The salt that deposits is withdrawn continuously, and is mechanically lifted by another conveyor on to a draining receptacle, whence the drainage returns to the evaporator. Other arrangements are shown in which the salt collects in a trough or troughs placed along the outside of the chamber, the conveyors being dispensed with, and the salt removed by hand. The process may be worked with gaseous fuel.—E. S.

Alkali Furnaces and the like, Impts. relating to Feed Hoppers for. F. H. Bowman, J. J. Howitt, J. Knowles, and T. A. Reid, Lostock Gralam, Chester. Eng. Pat. 21,267, Nov. 9, 1895.

The invention relates particularly to feeding bicarbonate into furnaces for the manufacture of sodium carbonate by the ammonia-soda process, and is intended to prevent loss of ammonia or influx of air during the charging. An iron box, circular in vertical section, is placed over the opening

to the furnace. The box has a hood or cover, with a sliding valve in the side for the introduction of the charge. A horizontal shaft, fitted to rotate, and carrying six radial blades which just clear touch with the periphery, passes axially through the box. As the bicarbonate is passed through the opening at the side and near the top, it falls upon the blade next below, and is carried by rotation downwards until it reaches and falls through the opening to the furnace, from what is then practically a closed chamber. The shaft may be rotated by hand, or by the weight of the material on the blades, or by power.—E. S.

Cyanides and Ferrocyanides, Impts. in the Manufacture of, from Sulphocyanides, and in the Recovery of By-Products. J. Raschen and J. Brock, Liverpool. Eng. Pat. 21,678, Nov. 14, 1895.

REFERENCE is made to Eng. Pats. 10,476 and 10,956, 1895 (this Journal, 1896, 543), on which the present invention is an improvement. Sodium or calcium sulphocyanide (preferably), with 4 to 5 parts of water, is allowed to fall gradually into a still containing water or mother-liquor from a previous operation, simultaneously with a separate stream of nitric acid, or of sodium nitrate solution mixed with sulphuric acid. The liquor in the still is kept near to its boiling point, and an agitator is used. An excess of acid is added. Air is excluded during the operation. The gases disengaged, consisting of hydrocyanic acid, nitric oxide, aqueous vapour, some higher nitrogen oxides, and carbonic acid gas, are passed through a scrubber containing water heated to about 80° C. to retain the nitrous fumes, and the dilute acid solution formed, may be used in the next operation. The unabsorbed gases are brought into contact with cold water, which absorbs most of the hydrocyanic acid, and are then passed through lime water, which takes up the

remainder, forming calcium cyanide, which may be decomposed to obtain an alkaline cyanide. The nitric oxide escaping from the lime scrubber, is mixed with steam and air to recover nitric acid. The solution of hydrocyanic acid obtained, is neutralised by an alkali to obtain sodium or potassium cyanide, the solution being preferably evaporated in a vacuum. A ferrocyanide may be obtained from the cyanide by known processes.—E. S.

Nitrogen Compounds [Ammonia as Final Product], Impts. in the Production of, and in Apparatus employed therein. (Under Intern. Convention.) T. L. Willson, New York, U.S.A. Eng. Pat. 21,755, Nov. 15, 1895.

A COMPOUND of a metal or metalloid is subjected to the intense heat of an electric furnace together with carbon in a current of nitrogen, to obtain a nitride, or in some cases a cyanide, from which ammonia may be produced. The apparatus consists of a pump by which air is forced into the bottom of a converter in which fuel is burned; a dust-separating chamber into which the nitrogen and carbon oxides from the converter are passed, and then conducted, either into the bottom or side of an electric furnace, or through the carbon electrode of the furnace, hollowed for the purpose. As an example of the process, a mixture of magnesia with granulated coke or coal-dust is heated in the manner described, to obtain magnesium nitride, which, when treated with water, yields ammonia. Nitrides of silicon, boron, aluminium, calcium, titanium, barium, &c. may be similarly produced. When a barium compound is used, however, "a large proportion of barium cyanide mixed with the carbide" occurs.—E. S.

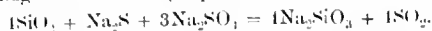
Metallic Cyanides and other Nitrogen Compounds [Ammonia from Cyanides; the Cyanides from Carbides], Impts. in the Production of. (Under Intern. Convention.) T. L. Willson, New York, U.S.A. Eng. Pat. 21,997, Nov. 19, 1895.

NITROGEN is brought into contact with a carbide of a metal or metalloid, either simultaneously with the formation of the carbide from an oxide of the metal and carbon by electric smelting or otherwise; or when the carbide has been tapped off and is still in a molten state. Or a carbide, after cooling, may be fused and subjected to the action of nitrogen. The apparatus described, consisting of an electric furnace and accessories, is similar to that shown in Eng. Pat. 21,755, 1895 (see preceding abstract), except that provision is made for running off the molten carbide from the furnace into an adjacent receptacle into which a branch pipe conducts the mixture of nitrogen and carbon monoxide gases derived from the combustion of fuel. The pipe has also another continuation into the electric furnace, so that the conversion of the carbide into cyanide may, if desired, be effected before the carbide is run off. Examples are given of the formation of calcium and barium cyanides from oxygen compounds of those metals, fused with carbon and treated with nitrogen, and the process is stated to be applicable to the metals of the alkalis, as well as to silicon.

Cyanides obtained as described may be decomposed by superheated steam to obtain ammonia; or the cyanides of calcium and barium, for instance, may be decomposed by an alkali chloride to obtain an alkali cyanide.—E. S.

Alkaline Silicates, or Silicates of the Alkaline Earths, and of Chlorine or Hydrochloric Acid; Impts. in the Manufacture or Production of. D. A. Péniaikoff, Huy, Belgium. Eng. Pat. 22,037, Nov. 19, 1895.

A MIXTURE of silica with a sulphide and sulphate of an alkali or alkaline earth is heated to obtain the corresponding silicate and sulphurous acid. The proportions are taken according to the following equation:—



The sulphide may be replaced by an increased proportion of the sulphate with a suitable proportion of carbon, in which case carbonic acid is evolved with sulphurous acid. Or the sulphide may be replaced by pyrites in excess. The sulphurous acid obtained, may be utilised "for transforming alkaline chlorides, or chlorides of the alkaline

earths, into the corresponding sulphates and chlorine, or hydrochloric acid," by the processes described in Eng. Pat. 20,604, 1893 (this Journal, 1894, 947).—E. S.

Alkaline Aluminates, or Aluminates of the Alkaline Earths, and of Sulphurous Acid; Impts. in the Manufacture or Production of. D. A. Péniaikoff, Huy, Belgium. Eng. Pat. 22,038, Nov. 19, 1895.

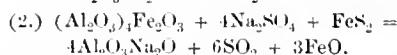
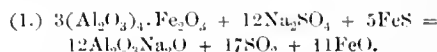
ALUMINA and sodium sulphate are heated with one-fourth the quantity of carbon required for complete reduction. Under these conditions, instead of formation of a sulphide, sulphurous and carbonic acids are evolved, according to the equation—



Instead of alumina, red bauxite, consisting practically of alumina and ferric oxide, is preferably taken, and so much additional carbon as may be required for reduction of the ferric to ferrous oxide. The mixture is highly heated, with exclusion of air, and the effluent gases are conducted, either into a Hargreaves apparatus for recovery of alkaline sulphate, or into apparatus for obtaining sulphuric acid. The alkali aluminate produced may be extracted by washing.—E. S.

Aluminates and Sulphurous Acid, Impts. in the Manufacture or Production of. D. A. Péniaikoff, Huy, Belgium. Eng. Pat. 22,039, Nov. 19, 1895.

AN ALUMINOUS ore containing ferric oxide, such as red bauxite, is mixed with an alkali sulphate and either ferrous or ferric sulphide, and the mixture is calcined to obtain a mixture of alkali aluminate with ferrous oxide and sulphurous acid. The proportions used, according to the iron sulphide employed, are indicated by the following equations:—



The sulphurous acid disengaged is conveniently utilised as described in Eng. Pat. 20,604, 1893 (this Journal, 1894, 947), for transforming alkali chlorides or chlorides of the alkali earths into the corresponding sulphates and chlorine or hydrochloric acid. "The production of chlorine is rendered much easier by using, instead of atmospheric air, the well-known oxygen-yielding compounds."—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Composition of American Kaolins. C. F. Mabery and O. T. Klooz. J. Amer. Chem. Soc. 18, 10, 909.

THE authors give analyses of the kaolin used in the Royal Berlin factory at Charlottenburg, and point out they are characterised by a high percentage of silica and a low percentage of lime, iron, and alkalis. Analyses of a number of American kaolins are also given, from which the authors conclude that abundance of material exists in the United States for the manufacture of ware equal to the best European productions, but that the wide variation in the composition of American kaolins renders it necessary for the manufacturer to take careful note of analytical results before choosing his material.—V. C.

PATENT.

Enamelled Metallic Ware [Steel], Impts. in the Manufacture of. A. Niedringhaus, St. Louis, U.S. Eng. Pat. 16,107, July 21, 1896.

HERETOFORE iron has generally been used in preference to steel for the base of enamelled metallic ware, on account of the "pin-holes," "flicks," and "chips," which generally appear if steel be employed, although steel has been occasionally used with a double coating of enamel.

In the present invention, the "pin-holes" and other imperfections are got rid of by placing sulphur (with or without a chloride) in the annealing pot, either before or

after the shaping of the ware. The proportions required are about 2 lb. of sulphur to 100 lb. of steel, and the time of exposure to the sulphur vapour is from three to six hours.

—V. C.

IX.—BUILDING MATERIALS. CLAYS, MORTARS, AND CEMENTS.

Cement exposed to Low Temperature during Setting: Influence of Magnesia upon the Strength of. F. Haas and J. A. McGraw. *Thonind. Zeit.* 1896, 20, 535.

EXPERIMENTS were tried with five brands of natural cement, and with five of Portland cement, with the object of ascertaining the causes of the varying diminution in strength produced by freezing, even when the same proportions are used in mixing. The following conclusions may be drawn from the results:—1. The reduction in the strength is due to different causes in these two kinds of cement. 2. In Portland cement it is due to physical causes; and the effect of the magnesia present is insignificant as compared with these. 3. In natural cements, the percentage loss of strength varies directly with the increase in the proportion of magnesia, and physical differences play no appreciable part. 4. A Portland cement having a suitable chemical composition and a relatively low strength suffers a greater percentage loss through freezing than one of greater strength. Hence a heavy reduction in the strength of Portland cement points to want of care in its manufacture.—W. G. M.

Portland Cement: the Effect of Admixtures of Kentish Ragstone, &c. D. B. Butler. Abstract, separate copy. *Proc. Soc. of Engineers*, Nov. 2, 1896.

KENTISH rag is a sandy limestone of the lower greensand formation which is extensively quarried for building and road-making purposes. Some of the cement manufacturers uphold the view that a judicious mixture of this material improves the quality of Portland cement.

The author finds that, although it increases the cohesive strength of the sample, it invariably diminishes its adhesive power or cementing value when used in combination with sand or mortar or in concrete.—V. C.

Portland Cement, Methods of Testing at the Imperial Testing Station at Berlin. M. Gary. *Mitt. königl. tech. Versuchsanst. zu Berlin*, 1896, 155—191.

DETAILS of the mode, manipulation and methods employed for testing Portland cement at the testing station at Berlin are given.

Setting Time.—Seeing that the time of setting of cement is largely influenced by the percentage of water used to gauge it, it is important to determine the precise quantity strictly requisite for each sample. This end is attained by making a preliminary experiment on the quantity of water necessary to bring a weight of 300 grms. of cement into a syrupy consistency, so that it flows freely from a palette knife. Between 32 and 38 per cent. is usually requisite. Calling this quantity n , the percentage of water needed for gauging briquettes neat and with sand of quick-setting and slow-setting cements can be calculated according to the following empirical formulæ:—

Slow-setting cements:

$$\text{Neat tests, per cent. of water} \dots = \frac{n+1}{2}$$

$$1+3 \text{ cement, per cent. of water} \dots = \frac{n+3}{4}$$

Quick-setting cements:

$$\text{Neat tests, per cent. of water} \dots = \frac{n+2}{2}$$

$$1+3 \text{ cement, per cent. of water} \dots = \frac{n+6}{4}$$

These formulæ are found to apply with fair accuracy to normal Portland cements. They lead to a result of such a character that the neat tests are generally gauged with from

16 to 19 per cent. of water. In determining the setting time when the cement has been gauged with the quantity of water arrived at by the circuitous process described above, the Vicat apparatus is used.

Owing to the fact that a loose scum commonly accumulates on the surface of the test block, it is the practice at Berlin, when once initial setting has occurred, to reverse the block and take the true setting time on the bottom surface. It is also customary not only to take the temperature of the air at the time of setting, but also to observe its percentage of moisture by means of a hair hygrometer.

Fineness.—Great difficulty is experienced in the accurate determination of fineness, on account of the imperfection of most commercial sieves. Thus it is prescribed in the standard rules for cement testing, approved by the Association of German Cement Makers, that the 900-mesh sieve shall be made of wire, 0.111 mm. in diameter, and have a mesh opening of 0.222 mm.; the sieve actually in use at the testing station is made of wire 0.094 mm. in diameter, and is 0.230 mm. clear in the mesh.

Standard Sand.—One of the difficulties of obtaining reliable standard sand arises from the same cause as that mentioned under the previous head, *viz.*, the irregularity of the sieves commercially procurable. That this is sensible is apparent from the following figures:—

	No. of Meshes.	Width of Mesh.	Diameter of Wire.
1	120-mesh sieve.	mm.	mm.
2	120	0.60	0.30
2	121	0.654	0.255
Prescribed figures	120	0.589	0.32
1	60-mesh sieve.		
2	52.5	0.88	0.458
Prescribed figures	60	0.87	0.38

The considerable effect of the errors of construction may be realised when it is stated that with the sieves quoted above, No. 1 allowed 4.6 per cent. of standard sand to pass through it, and No. 2 as much as 35.4 per cent. The errors may be greatly enhanced by wear, the wires becoming more or less displaced. Similarly the irregular stretching of a piece of wire gauze on a round frame to form a sieve, will impair the accuracy of the width of the meshes, and square-framed sieves are generally preferable. Photographs of actual sieves are given on an enlarged scale demonstrating the exceeding irregularity of the best commercial sieves in width of mesh.—B. B.

Portland Cement, Manufacture of, in Belgium.

U.S. Consular Reports, Sept. 1896, 52, [192], 184—191.

NATURAL and artificial Portland cements are made in the district of Tournay, in Belgium. The calcareous stone of this region also yields common lime and hydraulic lime. The following products are of importance:—(1.) "Natural Portland cement." The stone used for this has the composition: silica, 15.75 per cent.; alumina, 3.95 per cent.; ferric oxide, 1 per cent.; lime, 43.1 per cent.; magnesia, 0.49 per cent.; sulphuric anhydride, 0.5 per cent.; carbon dioxide and water, 35.21 per cent. After burning, the clinker is cooled under sheds, ground, and the resulting cement stored in pits for two months. The annual output of this material is about 1,200,000 barrels of cement. (2.) Roman cement is also made in the same district from such stone as is inferior in quality to that yielding "natural Portland cement." The normal light yellow colour of the Roman cement is often masked by the addition of cinders, the mixture being fraudulently sold as Portland cement. (3.) Portland cement proper. The processes for making differ in no essential respect from those commonly adopted. "Some manufacturers rectify the composition of these cements after burning, by adding, as required, limestone, slag, &c. Cements are thus produced resembling in chemical constitution Portland cement, but which do not possess its properties on account of the constituent elements not having been forced into combination by calcination and semi-fusion of the mass. These cements are sold under the name of artificial Portland cements, though in reality

they are really mixed cements composed of limestone or slag possessing none of the qualities or properties belonging to real Portland cement."

Details are given of the methods of testing used by a Belgian cement company. Results are also quoted of certain commercial cements of Belgian origin, from which the following may be excerpted:—

(1.) "Natural Portland cement." One sample quoted had the composition: silica, 22.17 per cent.; alumina, 4.6 per cent.; ferric oxide, 1.23 per cent.; lime, 60.86 per cent.; magnesia, 0.73 per cent.; carbonic anhydride, 1.16 per cent.; water, 0.48 per cent. This material had a tensile strength at 7 days of 38 kilos. per sq. cm., and at 28 days of 44 kilos.; with sand (3:1) at 28 days the strength was 16.8 kilos. per sq. cm. Another sample of natural cement had the composition: insoluble siliceous matter, 4 per cent.; combined silica, 24 per cent.; alumina, 3 per cent.; ferric oxide, 2 per cent.; lime, 62 per cent.; magnesia, 0.6 per cent.; sulphuric anhydride, 1.2 per cent.; carbonic anhydride, 1.2 per cent. This gave a tensile strength at 7 days neat of 42.7 kilos., and at 27 days of 52.4 kilos., while sand tests (3:1) gave at 27 days 17.3 kilos. per sq. cm.

(2.) Portland cement proper. Typical figures are afforded by the following example:—The cement had the composition: insoluble siliceous matter, 1.6 per cent.; combined silica, 21.2 per cent.; alumina, 7.79 per cent.; ferric oxide, 1.27 per cent.; lime, 64.5 per cent.; magnesia, 0.59 per cent.; sulphuric anhydride, 0.6 per cent.; carbonic anhydride, 1.36 per cent. This cement had tensile strength at 7 days of 41 kilos. per sq. cm., and at 28 days of 68 kilos. when tested neat; sand tests (3:1) at 28 days gave a tensile strength of 39 kilos. per sq. cm.—B. B.

Normal Sands, Prussian, from Freudenwalde [for testing Cements and Mortars]; Comparative Investigations on. M. Gary. Mitt. königl. tech. Versuchsanst. zu Berlin, 14, 1896, [2], 103—112.

THE results of investigations as to the character of the material adopted in Prussia as normal sand, for use in cements, mortars, &c., are stated, with regard to physical condition and character and chemical composition. Also the resistance to strain and pressure of mortars made with this normal and sundry other sands with which it is compared, are given. The paper is illustrated with photographs and tables.

PATENTS.

Cement, An Improved [Admixture of Dextrin], and Means and Methods for Producing the same, and Architectural and other Works thereof. E. Robbins, Battersea. Eng. Pat. 18,331, Oct. 1, 1895.

THIS cement, which may be composed of lime, silica, magnesia, and zinc salts, with the addition of dextrin or other binding material, is said to possess adhesive, cementing, and strengthening properties, and to be very generally applicable to constructive and decorative work.—V. C.

Kilns, Impts. in Continuous-burning [Utilising Waste Heat], for Burning Bricks and other Clay Goods, and also for Limes and Cements. H. R. Vaughan, Belfast. Eng. Pat. 20,540, Oct. 31, 1895.

IN these kilns the flues are arranged so as to withdraw the waste heat from the goods in the burnt chambers and to convey it through the chambers which contain the "green" goods, which are thereby wholly or partially dried. This not only economises fuel, but improves the colour of the goods by drying them before they are brought in contact with injurious gases.—V. C.

X.—METALLURGY.

Metals, The Structure of: its Origin and Changes. F. Osmond and W. C. Roberts-Austen. Proc. Roy. Soc. 60, 148—152.

AS it is possible to distinguish in metals and alloys both the visible and molecular structure, it was thought of interest to ascertain to what extent the mechanical properties of a given sample of metal are due to each of these kinds of

structure and how far to their mutual relations. The samples of gold containing 0.2 per cent. of foreign elements which were used by Roberts-Austen in establishing the relation between tenacity and atomic volume were subjected to microscopical examination. The methods of preparing, polishing, and etching the micro-sections of these gold specimens, and photographs of the sections, are fully described. From the results, the authors conclude that there is no relation between the structure, the appearance of the fractures, the melting points of the alloyed elements, and the mechanical properties of the masses of the alloyed gold. They observe that the micro-section of the gold with potassium would indicate a highly favourable metal in respect to mechanical properties, viewed in the light of similar indications in steels, whereas it is itself the worst alloy of the series. On the other hand, the micro-section of the gold alloyed with zirconium would indicate great structural weakness, whilst, as a matter of fact, it might equally well represent alloys which vary in tenacity from less than half a ton to 7½ tons per sq. in., and which might be either incapable of extension, or be capable of elongation as much as 30 per cent.

The authors conclude the first part of the paper by saying that they do not contest in any way the importance of the part which may be played in the mechanical properties of the alloys by the residues which remain liquid after the main mass of the alloy has solidified, which residues constitute the *eutectic* alloy, and to which the name of "cements" has been given. However, in order that it may be possible for such cements to affect the mechanical properties of alloys, they must have a real existence, and nothing indicates that they do exist in 10 out of the 12 alloys examined in the present instance. It is possible, at the same time, that some new method of etching may reveal new facts on the point. Small secondary crystals at present show themselves, and might readily be taken for cements if they were found only in certain specimens, and in such proportions as could be accepted. But they occur everywhere, and in all cases with identical appearances, forms, and dimensions, and, moreover, are collected into crystallites which pervade the whole mass. These are, therefore due to the crystallisation of the gold itself, although the alloying substances sometimes join up the crystals in question. The dark lines of the joints traced as furrows by the etching are very rarely the empty tracks of cement which has been dissolved away by *aqua regia*, but are connected with the secondary crystallisation. It is believed that in 10 of these alloys the solidification of the mass has been directly accomplished at a single time, and that the foreign bodies have remained as solidified solutions in the same manner that they were fluid solutions when the alloys were liquid. The cement question in respect to explaining the mechanical properties of these alloys is hypothetical.

IN the second part of the paper it is pointed out that gold alloyed with bismuth, thallium, antimony, and aluminium has its structure entirely changed by annealing in sulphuric acid at about 250°. Nothing remains of the original structure, and the effect resembles that obtained by annealing steel castings at a bright red heat. The transformation of the structure of a metal at a temperature far below its melting point, and, in the case of the gold-antimony and gold-aluminium series, below the melting point of the *eutectic* alloys, in the presence of only two tenths per cent. of a foreign body, is probably not an isolated fact, and appears to open a new field for research.—A. W.

Binary Alloys containing Silver or Copper with another Metal, Complete Freezing-Point Curves of. C. T. Heycock and F. H. Neville. Proc. Royal Soc. 60, 160—161.

AN account is here given in abstract, of some experiments on the freezing points of alloys of two metals, one being in each case either silver or copper. The curve representing the freezing point in terms of percentage composition of the alloy, might either consist of two branches, each starting from the freezing point of the pure metal, and descending to the eutectic point, or, if a stable compound be produced, then the curve will be divided into two systems, with two eutectic points and an intermediate summit. An example of

the first case is illustrated by the silver-copper curve, and of the second case by that of copper-antimony, as proved by the investigations of Le Chatelier.

Of the alloys examined, the curve for that of silver-copper shows no indication of chemical combination except for an alloy of composition Ag_3Cu ; while in the case of silver-lead and silver-tin the eutectic alloy contains so little silver that the curve consists almost wholly of the branch starting from silver. The lead-copper alloy furnishes an illustration of the solidification of a system consisting of two conjugate liquids, namely, a saturated solution of lead in copper and copper in lead. The copper-tin curve presents features of interest: the rapid increase in the steepness of the curve as the tin is added, suggests the formation of complex molecules, possibly of the composition SnCu or Sn_2Cu , existing in solution; an abrupt change takes place when 15.2 atomic proportions of tin have been added—a fact in accordance with the observations of Behrens upon the great changes in the physical and microscopical character of the alloy. The curve between this point and that corresponding to 20 atomic proportions of tin is a straight line, indicating the existence of an isomorphous mixture of SnCu_4 and another compound, while the flat curve between 20 and 25 atomic proportions, may be due either to another case of isomorphism or the separation of conjugate liquids. Double freezing points occur between 15 and 20 atomic proportions.

A few experiments have been made on alloys of gold, nickel, and iron in copper; the latter two cause a rise, but the first a depression of the freezing point. Other investigations upon this subject are in progress.—V. H. V.

Blast Furnace, Obstructions in the. E. Barnard. Eng. and Mining J. 1896, 393—394.

"SCAFFOLDS" must be distinguished from obstructions in the crucible, which latter always arise from too low a temperature, while scaffolds occur when the furnace is hot and working regularly. Van Vloten's view—that scaffolds result from reduced carbon mingling with the charge and caking it—can hardly be maintained, for it postulates such a large quantity of carbon. More probably they are due to a refractory slag. A very basic slag may be looked upon, when melted, as a solution of the excess of base in a neutral or less basic slag of lower melting point. When the solid slag is heated it begins to soften and cake at or slightly above the melting point of the neutral slag, and is only completely fluid at a very high temperature. In the furnace the temperature rises from the throat to the crucible, and when working cold the temperature at which such a basic slag becomes pasty or cakes is only reached at the crucible, and no signs of fusion occur above; but when working hot, the temperature at the crucible is sufficient to melt the slag completely, and at some higher point, the temperature is such that the slag may cake, and thus block the furnace.

—J. T. D.

Iron and Steel, Note on Copper in. R. W. Raymond. Eng. and Mining J. 62, 293.

IN connection with the old idea that copper in small quantity acts detrimentally on steel, the author states the fact that the absence of any mention of copper and sulphur in some recent specifications would seem to indicate that the present process of steel manufacture guarantees the amount of copper present to be too small to be injurious. The actual limit is said to be still in doubt, and a few figures of early experiments are quoted in relation to the mechanical effect of copper on steels. It was formerly assumed that about 0.4 per cent. of copper would produce red-shortness in wrought iron, but instances are quoted of low-carbon steels containing 0.452, 0.849, and 0.862 per cent. of copper giving good welding results, and Howe quotes an instance mentioned by Choubley of a steel containing as much as 0.96 per cent. without serious red-shortness. In referring to the Holtzer copper-steels, shown at the Paris Exhibition of 1889, containing 3 to 4 per cent. of copper and possessing a high tensile strength and elastic limit with a considerable elongation, the author considers the data furnished to be incomplete, but that the conclusions seem to indicate that there was nothing to be gained in quality by the addition of copper to steel.—A. W.

Iron Alloys, Production of. Schrey. Berg. u. Hütten-Zeit. 1896, 55, 223.

ALLOYS of iron with nickel are made in Germany by adding pure nickel to the melted bath of iron in the Siemens furnace, or in the casting ladle, so that the nickel may not be carried into the slag. In France ferro-nickel is added in place of the pure metal, and in North America nickel oxide is used, mixed with lime for introduction into the open hearth or with carbon for crucible steel. For alloys, however, which are to contain more than 27 per cent. of nickel the pure metal must be added. The alloys cannot well be made in the blast furnace, because the crude product is not readily converted into a low-carbon, and therefore malleable material; as, on refining, it yields a brittle alloy, containing nickel oxide, which, however, may be made malleable by the addition of manganese, aluminium, or magnesium. Nickel steel is more fluid on pouring than is ordinary steel, and gives clean ingots, free from indications of liquation. Alloys containing up to 25 per cent. of nickel behave like ingot iron under the hammer or in the rolls; those containing as little as 5 per cent., are not easily machined, and the difficulty increases with the proportion of nickel. The ability to harden, depends upon the composition; it is absent in those samples which contain but little carbon, even though they are high in nickel; whilst those which contain more than 0.2 per cent. of carbon may be hardened, but this property is not affected by silicon. With higher proportions than 25—30 per cent. of nickel, the power of hardening is diminished, and carbon separates in the graphitic state.—W. G. M.

Cementation-Crucible Steel, Conversion of Siemens or Bessemer Steel into. S. Kern. Berg. u. Hüttenmänn. Zeit. 1896, 54, 235.

SOFT open-hearth steel, with less than 0.25 per cent. Mn. and 0.03 per cent. P and S, was cemented in chests, with the aid of the waste heat from reheating and puddling furnaces. The resulting steel, containing 0.85—1.15 per cent. C, was melted in crucibles with some wrought iron and a little ferro-silicon and chrome-iron ore, yielding a product with 0.95 per cent. C, 0.3 per cent. Mn, 0.04 per cent. P and S, 0.12 per cent. Cr, and 0.27 per cent. Si, which could be hardened well, and was adapted to the manufacture of tools, projectiles, and gun components.

—W. G. M.

Steel for Tram Rails, Composition of. Engineer, Oct. 30, 1896.

THE following is the specification, as regards chemical composition, of the street rails used in Syracuse, U.S.A.:—Carbon, from 0.53 to 0.63; phosphorus, not to exceed 0.095; sulphur, not to exceed 0.07; manganese, 0.80 to 1.00; silicon, 0.10 to 0.12.—A. S.

Copper Smelting: the "Direct" Method considered as the Future Metallurgical Treatment of Copper Ores, Argentiferous or Otherwise. C. James. Inst. of Mining and Metall. 1896 (39 pages).

AFTER a description of the ordinary Welsh process of smelting, reference is made to the use of the Baboon furnace, in which the roof of the melting furnace serves as the bed of a calciner, and it is pointed out that although there is an economy of heat in thus combining the two furnaces, the difficulty of preventing the bellying of the furnace in the middle, even when strong clamps are employed in its construction, and the greater frequency and extra cost of repairs, have led to its abandonment in most cases. Among the modifications of the Welsh process that are to be recommended, is the use of the blast furnace for making coarse metal and cleaning slags, and the employment of regenerative gas furnaces in place of ordinary reverberatory furnaces. In the latter case, not only is there an economy in labour and in fuel (the saving in the actual consumption amounts to 40 per cent., and the fuel itself may be of an inferior character), but there is a real saving of copper, which, as dust in charging or as splashes from the fused material, passes over into the grate and ordinarily is lost in the ashes of the solid fuel. An account

is given of the Continental and American methods of smelting, with a short description of the author's form of fore-hearth for the (copper) blast furnace. This consists of a reverberatory furnace, in which the metal and slag from the blast furnace are allowed to accumulate; these enter at one end, and the copper is tapped at one side, whilst the slag flows through the whole length of the furnace, and being thus kept hot and very fluid, passes off through a notch at the other end entirely free from shots of metal. The cost of calcining in automatic calciners of the O'Hara, Pearce, or Brown type is found to be one-third of that in the older furnaces, and at the same time the sulphur may be reduced to 5 per cent., as against 9 per cent., which is the minimum in the ordinary calciners. In bessemerising, the weak points are the destruction of the silicious converter lining, which is inevitable, and the mass of slag so produced, which contains too much copper to justify its rejection. Again there is a great loss both of copper and silver by volatilisation during the blow. These losses are acknowledged at 3 and 5 per cent. of the quantities of these metals respectively in the charge; but careful experiments in England point to an even greater loss than is admitted in the United States. But these losses occur only when metallic copper is present; hence some smelters have used the bessemerising process for the production of white metal, which is then finished in the ordinary roasting furnace.

In the direct method, a regulus containing from 70 to 80 per cent. of copper is first crushed, so as to pass a sieve with $\frac{1}{8}$ -in. holes; two-thirds of this is then roasted to oxide at a temperature below the fusing point of the sulphide, and is mixed with the remaining one-third portion, and the mixture is charged into a refinery furnace. The exact proportion between the two constituents of the charge depends upon the degree of calcination of the first portion. This is determined by a preliminary fusion of a sample of the mixture in a Cornish crucible; if the button of copper poured from the mixture be solid and flat, and covered more or less with regulus, it indicates that too much uncalcined regulus has been added; if, on the other hand, it be covered with an oxide of copper slag, it shows that too little was present. The extent of the oxidation during calcining depends upon economic considerations; the removal of the last portion of the sulphur in a charge is relatively the most expensive, inasmuch as a much longer time is needed for the purpose; hence the calcination of about two-thirds of the total weight of regulus without removing all the sulphur, is generally the most satisfactory. As soon as the mixture is charged into the refinery, the temperature is raised as quickly as possible. Reaction occurs on the surface first, and the reduced copper helps to conduct the heat downward to the remainder of the charge. The reaction is strongly exothermic, so that no extra fuel is required during this part of the process, and the sulphur dioxide in an especially pure condition (nearly free even from atmospheric nitrogen) may be utilised in vitriol chambers. The reaction over, the copper is brought to complete fusion, and is skimmed, but should be almost free from slag; it is then refined just as in the ordinary treatment of blister copper. The time required to work off the complete charge is about the same as that for refining; but the furnace used must be a little larger than those ordinarily employed for the same quantity of refined copper, although no greater weight of fuel is needed. Practice has shown that from 68 to 71 tons of copper may be obtained from 100 tons of white metal, as against about 50 tons by the old method; and in the cost of production, there is a difference of 13s. 9d. per ton of white metal in favour of the direct treatment. The cost of the preliminary treatment, being distributed over a larger ultimate output in the new process, becomes also reduced by about 24 per cent.

The special advantage of this process is that the oxidation is effected at a temperature below that at which the regulus fuses, instead of above it. But when matte or regulus is "roasted" (in the copper refiner's sense of the word) to copper, from 2 to 3 per cent. of the copper and from 5 to 8 per cent. of the silver present are lost by volatilisation. The author is certain that neither metal is lost during

calcination, and that no loss, therefore, occurs during concentration until metallic copper is produced. It is usually asserted that calcination causes a loss of silver, especially when the material contains arsenic, antimony, and zinc as impurities; but the author has found that in laboratory calcinations the calcining dish retains microscopic scales upon its surface which, on assay, make up the deficit of silver; and where calcination and sinterification are conducted in the same dish, no appreciable loss occurs. Hence the roasting process in the Welsh method involves a loss of copper and silver, which may be demonstrated by the use of condensing arrangements in the door of the furnace; in the direct process no such fumes can be detected, and there is no loss whatever of copper or silver. The reduction, in fact, is effected so rapidly by the reaction of the sulphide and oxide, that, although volatilisable compounds would tend to form at the temperature employed, there is no time for any serious loss to be incurred.

Under a recent patent (June 1896) the author now sometimes substitutes sulphide ores for white metal in the charge of the refinery, and with the Cape ore used at the Briton Ferry works a good result is obtained with a charge consisting of two of ore and three of calcined white metal. More refinery slag is produced, but this is no practical disadvantage, as it raises the pitch of the metal during smelting. Lumpy mattes may be satisfactorily treated without loss if silica be added to the charge; no silver or copper is lost, and the lead forms a silicate slag, from which the lead may be recovered in the blast furnace.

In starting new works for this process, the following course is recommended as embracing all the latest improvements and the results of the best experience:—Calcine and melt the bulk of the ore in reverberatory or blast furnaces, making coarse metal. Reserve sufficient of the ore, uncalcined, for cleaning all the rich slags of the works, and smelt this reserved portion with the slags in a water-jacketed cupola, again producing coarse metal. The coarse metal derived from both sources is crushed and calcined in automatic calciners, and the calcined product is melted in reverberatory furnaces to make white metal, which is then treated by the "direct" method.—W. G. M.

Gold Extraction. The Cyanide Process in the United States. Eng. and Mining J. 1896, 386—387.

THE cyanide process was introduced into America in 1889, and is yet in an experimental stage. Attempts to work the process with extemporised and insufficient plant are responsible for many failures. The chief requisite for success is fine comminution of the ore to pass at least a 40-mesh sieve (50 per cent. could then pass a 100-mesh), and that the metal be in a very fine state of division, as gold fragments of any considerable size are very slowly acted on by the cyanide. Neutral or slightly basic ores are best suited for the process, whilst those containing copper, ferrous sulphate, or other substances which consume the cyanide, are, of course, unsuitable. Many telluride ores give very poor results, and where the ore before lixiviation has been roasted to separate the gold and tellurium, the gold is often left in the form of compact globules which resist the cyanide. Any ore should be submitted to physical and microscopic as well as to chemical examination before its suitability for cyanide treatment is finally decided on.

Comparison between the cyanide and the chlorine processes, in the matter of cost, can hardly be profitably made, save in each individual case, as the circumstances of mechanical condition as well as composition of the ore, influence so greatly the applicability of the methods.—J.T.D.

Gold Recovery (Cyanide Process). The Siemens and Halske Process of. Eng. and Mining J. 62, 292.

BUTTERS states that the Siemens-Halske process is still successfully practised in the Worcester, Robinson, and other mines in the Transvaal, for the treatment of slimes and tailings, and a recent statement that it had been discarded is not true. Liquors containing 4 dwt. of gold per ton are reduced to 8 or 9 grs., and others containing 18 grs. are reduced to about 3 grs. per ton.—A. W.

Cyanide Process in the United States. G. A. Packard. Eng. and Mining J. 1896, 62, 341.

CHLORINATION is the only process which the cyanide method is seriously superseding. For mines located at a considerable distance from a railroad, the cyanide is said to be the better process—at least until the use of liquid chlorine becomes a practical success, as the cost of transportation of the chemicals used in chlorination has been hitherto high.

At the "Golden Reward" plant in South Dakota early in 1895, 35 lb. of chemicals per ton of ore were used for chlorination, while only $2\frac{1}{2}$ lb. were necessary for treating one ton with cyanide. If silver be present, the gold extraction is usually higher by chlorination than by cyanide, but by using the latter process, part of the silver is recovered. With amalgamation, cyanide enters into competition only in the case of very finely divided gold, which is saved more or less successfully in pans. The cost of cyaniding varies largely with the character of the ore. The lowest cost reported is 85 cents a ton. The cost of treating tailings has been reduced, at one plant operating under exceptionally favourable conditions, to 69 cents a ton. The tailings plants do not generally obtain a high extraction. Altogether, 200,000 tons of ore and tailings were treated by cyanide in 1895, producing over 1,000,000 dols. in bullion value.

—A. S.

Gold, Extraction from Slimes by the Bettel Process. Chem. Zeit. Rep. 1896, 251.

Among the various methods of treating tailings from the amalgamation mill, the McArthur-Forrest process has been very successful; but the whole of the tailings cannot be treated by it, owing to the impermeability of the slimes. Heating the slimes in order to render them porous, gives irregular results; and all dressing methods have failed, owing to the contained gold being so exceedingly finely divided. Bettel finds that the whole of this gold can be extracted by means of very dilute cyanide solutions. This special process consists solely in the manner of separating the solutions quickly from the slimes, and of washing the residue; it has been found capable of extracting 96–98 per cent. of the gold from slimes assaying 6 dwt. per ton, and 97 per cent. of that in concentrates; but it is only applicable to rich slimes with about $4\frac{1}{2}$ dwt. of gold per ton. Although a large number of operations have to be performed in conducting this process, they are simple and involve but little cost, as the material is circulated by means of a current of water or a steam jet.—W. G. M.

Gold. The Engelhardt Bromine Extraction Process in Operation. D. C. Pret and H. Trachsler. Eng. and Mining J., 62, 295.

THE so-called refractory ores of the La Plata Mountains, Colorado, which yield a low extraction of gold by amalgamation, have recently been subjected to experiment to ascertain which wet process could be commercially employed. The gold in the ore is chiefly combined with tellurium, whilst a small quantity exists in the free state. Cyanide of potassium was first tried, but was abandoned owing to the waste of cyanide by the copper present. In addition, also, to this metal, some of the ores contain arsenical iron pyrites, zinc blende, galena, and small quantities of chromic and titaniferous iron, so that the use of cyanide was out of the question. Consequently the process to be chosen was either that of chlorination or bromination, and the preference was given to the latter, owing, *firstly*, to the solvent power of the bromine solution being greater than that of the chlorine; *secondly*, to the quantity of chemicals required per ton of ore being less, and consequent saving in freight; and, *thirdly*, to the time required in applying the bromine solution in the barrel being less.

An analysis of an average sample from 100 tons of ore gave the following results:—Silica, 80.5; iron sesquioxide, 10.0; lime, 1.05; magnesia, nil; alumina, 3.7; and sulphur, 2.8; total, 98.05 per cent. The remainder, 1.95 per cent., is covered by small quantities of copper, arsenic, chromium, titanium, and tellurium, which are detected in solution after treatment. The gold contents vary from 1.25 to 2 oz., and the silver from 0.5 to 1 oz. per ton.

The latter is considered as scarcely sufficient to be noticed. The ore is roasted and charged into a lead-lined barrel containing bromine solution of an average strength of 0.25 per cent., although 0.15 per cent. may sometimes be employed with equal advantage.

After two or three hours' contact, the charge is lixiviated, and the excess of bromine got rid of by sulphurous acid. The gold is then precipitated as sulphide by sulphuretted hydrogen, and is refined in a manner similar to that used in the chlorination process. The average extraction varies from 93 to 96 per cent. of the total gold present.—A. W.

Sulphides [Silver, Gold, Copper], The Sulphuric Acid Process of Treating Lixivation. F. P. Dewey. Eng. and Mining J., 62, 293–294.

THIS is a description of the process as carried out at the Marsac Mill, Park City, Utah. It consists of six main operations, *viz.*:—(1) Boiling the sulphides with strong sulphuric acid in an iron pot; (2) Dissolving out the sulphate of copper and silver in a lead-lined tank, leaving a residue containing the gold and lead of the sulphides, and also rich in silver; (3) Precipitating the silver from the filtered solution by means of copper plates; (4) Sweetening, drying, pressing, and melting the cement silver; (5) Treatment of the solutions after the removal of the silver to crystallise the sulphate of copper and recover the excess of acid for re-use; and (6) Treatment of the gold-bearing residues. The silver contained in 116,519 lb. of sulphides amounted to 572,544 oz., and the amount obtained as fine bullion was 93.29 per cent. The remainder of the metal was divided as follows:—2.76 per cent. in the residue, 0.93 per cent. in the "cleanings," and 0.38 per cent. on hand, showing a "plus clean up" of 0.36 per cent.

The figures in respect to the gold recovery are not satisfactory, and this is attributed to the difficulty of determining the small quantities of gold in the presence of the large proportion of silver.—A. W.

Blende, Metallurgical Treatment, Reactions occurring in. E. Prost. Bull. Assoc. Belge des Chimistes, 10, [6], 246–263. (Second paper. See this Journal, 1896, 723.)

THE examination of the reducing action of carbon on the zinc in roasted blende was divided into the following series.

A. On zinc oxide alone, and in combination with the other free metallic oxides present.

Results.—In the first case the whole of the zinc is volatilised at about 1,075° C. When the zinc oxide is mixed in equal molecular proportions with ferric oxide, alumina, or lead oxide, the zinc is also volatilised at temperatures of 1,075° and 1,200°–1,250° C. respectively, so that the presence of these oxides does not increase the refractory properties of the zinc oxide.

B. On zinc oxide in presence of sulphur compounds.

For these experiments a chemically pure specular blende was employed, and the most favourable furnace temperature for the operation—in order to allow of the detection of any zinc sulphide formed—was determined by preliminary tests to be between 1,200° and 1,250° C., it having been found by such preliminary experiments that whilst within this range of temperature, zinc sulphide is not appreciably reduced, any zinc existing as oxide is completely volatilised.

The action of iron and lime on the liberation of zinc from combination with sulphur was first studied. In the case of iron, the action at any given temperature depends on the relative proportions of the iron and blende. The former should always be in excess of the theoretical quantity requisite for combination with the sulphur, the influence of temperature being demonstrated by the results of two tests with the same mixture (containing 150 per cent. excess of iron) at 1,200°–1,250° C. and 1,075° C. respectively. In the first test all the zinc was volatilised, whereas in the other a large quantity remained in the residue.

Lime has a much more energetic liberating action than iron, an excess of 75 per cent. over the theoretical quantity enabling all the zinc to volatilise at about 1,250° C.; and if a large enough proportion of lime be used, the same result may be attained at the fusing point of gold.

At the temperature of the tests (1,200—1,250° C.) no retarding influence on the reduction of zinc oxide appears to be exerted by calcium sulphate, even in presence of such bodies as silicate of lead and iron, which might convert the reduced calcium sulphide into silicate, and facilitate the formation of zinc sulphide.

On the other hand, magnesium sulphate, by reason of its different behaviour in presence of carbon at high temperatures, *viz.*, decomposition into magnesia and sulphur dioxide, favours the production of zinc sulphide, and it is fortunate that this sulphate is generally present in but small proportion in blends.

C. On the compounds of silica and zinc.

The result of experiments made with a mixture of zinc oxide, lead oxide, and silica heated together at 1,000° and afterwards reduced in presence of carbon at 1,200—1,250° C., seems to indicate that at these temperatures a certain proportion of an irreducible double silicate is formed, but when the temperature of the working furnace was employed, all the zinc was driven off. The simple silicate of zinc formed at 1,450—1,500° was totally reduced at the practical working temperature, and to within less than 1 per cent. at 1,200—1,250°, but when prepared at 1,550°, although completely driven off at 1,500°, was less readily so at 1,200—1,250° than in the former case.

The conclusions drawn from the results are: that no combinations are formed, during the reduction by carbon, which cannot be decomposed at the ordinary working temperature (1,450—1,500°) of the furnace. Furthermore, that it is highly probable that, by a judicious admixture of lime with the mineral, the loss (sometimes attaining to more than 4 or 5 per cent.) of zinc in the plumbaceous residues could be avoided. The intimacy of the mixture has an appreciable effect on the result of the reducing process, and the trouble of preparing the mixture with more than the ordinary care would be more than compensated if the yield were thereby increased by a few tenths of 1 per cent.

—C. S.

Lead and Bismuth, Solubility of Zinc in. Spring and Romanoff. *Zeits. Anorg. Chem.* **13**, 29—35.

A CRUCIBLE with a plug in the side was heated to regulated temperatures, varying from 250° to 900° C., as determined either by a mercury thermometer containing compressed nitrogen, or by calorimetric methods. Before being placed in the furnace, the crucible was filled above the plug with lead or bismuth, and a quantity of zinc placed on the top of the other metal, a layer of salt serving as a protection from the air. After long heating, with occasional stirring, a sample of the upper layer was taken, the melted metal run out by opening the plug, and a sample of the lower layer, remaining in the crucible, then taken. The analysis of these two samples gave figures representing the solubilities at different temperatures of bismuth or lead in zinc, and of zinc in bismuth or lead. Curves plotted from these figures show that the values of the reciprocal solubilities approach one another as the temperature rises, so that at a temperature of about 850° for bismuth and zinc, or 950° for lead and zinc, the values would be the same, or the metals would be miscible with one another in all proportions. The curves are analogous with those obtained by Alexejoff in the case of partially miscible liquids.—J. T. D.

Pyrometer, Le Chatelier-Heraeus, Use of, in Iron Works. H. Wedding. *Stahl u. Eisen*, 1896, **16**, 663.

See under XXIII., page 823.

Diamonds in Steel. L. Frank. *Stahl u. Eisen*, 1896, **16**, 585.

See under XXIV., page 835.

Aluminium and its Alloys, Analysis of. H. Gouthière. *Ann. de Chimie Analyt.* i. [14], 265. *Analyst*, **21**, 270.

See under XXIII., page 830.

Tin-Plate Industry in Pennsylvania. J. Franklin Inst. 1896, **142**, 315.

See under Trade Rep., page 836.

Government Metallurgical Works in New South Wales.

See under Trade Rep., page 836.

PATENTS.

Gold, Impts. in Apparatus for Extracting, by Means of Mercury. [Use of Hydrogen.] J. W. Butler, London. Eng. Pat. 15,356, Aug. 15, 1895.

This is an appliance for forcing hydrogen gas on to the surface of mercury used in a revolving pan for extracting gold from ores by amalgamation, to prevent the surface of the said mercury from sickening or becoming oxidised.

—A. W.

Slimes or Tailings, Impts. in the Treatment of, for the Extraction of Gold or Silver therefrom by Means of Solvents, and Apparatus for that Purpose. John Cobeldick, London. Eng. Pat. 16,303, Aug. 30, 1895.

The various solvents, gases, and cleansing solutions are caused to circulate continuously through the mass of slimes by a forcing process, through the agency of the apparatus described.—J. H. C.

Copper, Zinc, Lead, Silver, Gold, and other Metals: Impts. relating to the Separation or Extraction of [Treatment with Chlorides and Chlorine, &c.], from Ores or Compounds containing the same, and to the Recovery of Chlorine used in the Treatment of such Ores or Compounds. H. R. Lewis, London, and C. Gelstharp, Manchester. Eng. Pat. 17,190, Sept. 14, 1895.

THE ore is roasted, if necessary, and then mixed, either in or out of the furnace, with a quantity of solid or liquid chloride of iron, or with hydrochloric acid, or some chloride. A quantity of water is added to the mixture in suitable vats, and chlorine gas passed into it, the whole being kept hot by steam or hot air. The mixture is then leached with water, containing acid if convenient, and washed with water until free from copper, zinc, or tin. The residue, if it contain lead, silver, or gold, is smelted or treated by any well-known process. The clear solution, after passing through a further quantity of ore, is run into covered vessels having one or more compartments, each containing anodes and cathodes. A current of electricity deposits the metal on the cathodes and liberates the chlorine at the anodes, ready for further use. The gold and silver which enter into solution are precipitated with metallic copper or zinc. The solution is then treated with a small quantity of oxide of copper or oxide of zinc to precipitate the iron, after which it is electrolysed to obtain the copper, zinc, lead, or tin.—A. W.

Aluminium Compounds [Carburized Aluminium and Alloys], Impts. in, and Means for Producing the Same. R. I. Roman, London. Eng. Pat. 17,250, Sept. 16, 1895.

To carburize aluminium, 99 per cent. of that metal is melted with 1 per cent. of calcium carbide, which latter is introduced in an aluminium cartridge into the molten metal. In order to remove the calcium, 16 parts of another alloy, consisting of 3½ per cent. of nickel, 3½ per cent. of tungsten, and 93½ per cent. of aluminium, are added to 84 parts of this mixture. When properly melted, the alloy is poured, and the calcium, together with any silicon and iron, remains at the bottom of the crucible in the form of a "slack." The metal so produced has considerable hardness, great elasticity, and a melting point lower than that of aluminium. Analysis shows the percentage of carbon to be about 0·1 per cent., but it is said that it may be as high as 1·5 per cent.—A. W.

Metallic Fumes, Impts. in Apparatus for Collecting. [Mingling in Suction Fan with Water.] J. Woolford, London. Eng. Pat. 17,320, Sept. 17, 1895.

To collect the metallic particles suspended in fumes after passing the ordinary cooling conduits and collecting chambers, a fan is introduced into the flue, provided with a nozzle through which water or a mixture of water and steam is injected. The water is broken up by the fan blades into a

finely divided condition, and, mixing with the fumes, washes out of them any metallic matter, which matter is afterwards collected by subsidence, filter-pressing, or otherwise.—A. W.

Gold and Silver, An Improved Process for the Extraction of, from their Ores. [Weak Alkali Hydrate and Carbonate.] F. C. May, London. Eng. Pat. 18,116, Sept. 28, 1895.

THE crushed ores are boiled in a mixed solution of alkaline hydrates and alkaline carbonates for at least one hour, and subsequently digested therein for at least 24 hours before amalgamation, so as to prevent the flouing or sickening of the mercury.—J. H. C.

Aluminium Alloy [Al, Ni, and W]. The Manufacture of a New. R. I. Roman, London. Eng. Pat. 21,186, Nov. 8, 1895.

THE alloy consists of 98 per cent. of commercial aluminium, 1 per cent. of nickel, and 1 per cent. of tungsten. Two methods of preparing this alloy are mentioned. The nickel and tungsten are first alloyed by adding the latter in the amorphous state, in a receptacle of aluminium, to the molten nickel, and then adding the aluminium. Or, an alloy of tungsten and aluminium is prepared by melting the latter metal with a mixture of tungstic acid and eryolite, so as to produce a metal containing 10 per cent. of tungsten. More aluminium is added in sufficient quantity for the final alloy, and the whole is added to the necessary amount of molten nickel. The alloy so produced possesses all the qualities of aluminium, as regards low specific gravity, ductility, colour, and resistance to corrosion, and has, in addition, a greater tensile strength and elasticity, a finer polish, and can be more easily machined.—A. W.

Sulphide Ores and Mattes. Impts. in the Roasting of. [Air or Air and Steam in Different Zones, &c.] C. F. Claus, London. Eng. Pat. 21,380, Nov. 11, 1895.

THE object of this patent is to bring, during the roasting process, the whole or most of the hot sulphurous acid gas produced by the oxidation of the sulphur contained in that portion of the ore charge which was last introduced into the furnace, together with air and some steam, into intimate contact with the other parts of the charge, which have already been partly or wholly roasted, in order to convert the oxides or remaining sulphides into sulphates. The furnace may be a vertical one, closed at the top with the exception of the charging door. The air enters through openings placed at different heights in the walls, and the sulphurous acid gas is withdrawn through an opening at the base. The ore in the lower portion of the furnace is first roasted, and the zone of combustion is then raised towards the top by introducing the air and steam through the higher openings. The products of combustion of the new ore at the top are then drawn downwards through the roasted ore at the bottom. In the case of horizontal furnaces, the same object may be attained by dividing them by partition walls into a number of chambers or compartments, connected together by means of valved passages, so that the gases may be supplied to and directed through any series of compartments according to the nature of the charge.

—A. W.

Soldering or Brazing of Metals, Impts. in, particularly applicable to Aluminium Alloys. F. A. Ellis, London. Eng. Pat. 22,041, Nov. 19, 1895.

THE bodies to be united (or one of them) are (or is) heated nearly, but not quite, to the melting point. The braze or solder employed, is composed of Al, 1 oz.; Sn, 1·3 oz.; Cu, $\frac{1}{2}$ oz.; Zn, $\frac{1}{4}$ oz. The copper is first melted, the zinc is added, then the aluminium, and finally the tin, the whole being stirred with a copper rod. For the process the claim is: "The preparation of one surface to be united with an aluminium braze, carefully amalgamating the same with said surface, and the completion of the brazed joint with another part by the casting of the latter part upon the former prepared part, to fuse the braze and make a homogeneous joint between them."—J. H. C.

Malleable Iron or Steel, An Improved Process and Means for Converting Pig Iron into. P. Sherk, J. L. Rutter, and S. Weiss, Lebanon, Penn., U.S.A. Eng. Pat. 18,981, Aug. 14, 1896.

A BLAST of air is variously applied to the molten metal in the manner and by means of the apparatus described, for converting pig iron into malleable iron or steel.—J. H. C.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A).—ELECTRO-CHEMISTRY.

[Potassium Percarbonate], Oxidising Substances, Electrolytic Preparation of a New Class of. E. J. Constan and A. von Hansen. Zeits. f. Elektrochemie, 3, 1896, 137—144.

WHEN carbonates of alkalis or of ammonium are dissolved

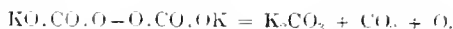
in water, they are dissociated into ions \bar{M}_2 and \bar{CO}_3 ; and when they are electrolysed we get at the cathode, hydrogen, and the hydroxyl compound of the alkali (or ammonium), and at the anode, oxygen and a bicarbonate. It might be expected that if water were added gradually to the solid carbonate, the dissociation would take place in stages, —

ions \bar{M} and \bar{MCO}_3 being first formed, and complete dissociation into three ions occurring on further dilution.

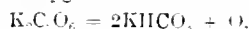
Under suitable conditions the ions \bar{MCO}_3 might unite into new molecules $\bar{MCO}_3 - \bar{MCO}_3$, just as persulphuric acid is obtained from sulphuric acid.

The authors find that this is the case. When a saturated solution of potassium carbonate is electrolysed, the evolution of oxygen at the anode diminishes as the temperature is reduced and ceases at -10° . In place of the crystalline precipitate of potassium bicarbonate, there is formed a bluish amorphous powder; this is potassium percarbonate, $K_2C_2O_6$. In order to obtain a good yield, the potash solution must be kept saturated. It is electrolysed between platinum electrodes in a beaker with a porous diaphragm, the beaker standing in a freezing mixture. 3—6 accumulators are used. Platinum wire is used as the anode and platinum foil as the cathode. The temperature must not rise above $9^\circ C$; the yield is best when it is kept below -15° . The percarbonate is quickly decomposed by water at the ordinary temperature. The suspended salt must therefore be quickly transferred to a filter, and then (without washing) placed on a porous plate in a desiccator over phosphorus pentoxide. On drying, it loses its bluish colour and becomes nearly white. The amorphous highly hygroscopic powder thus prepared always contains more or less bicarbonate and carbonate of potassium.

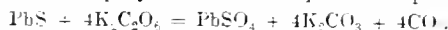
When slightly warmed, potassium percarbonate decomposes into potassium carbonate, carbonic acid, and oxygen—



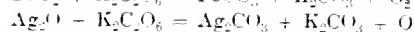
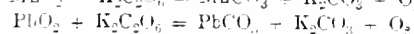
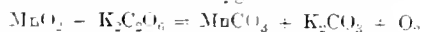
In ice-cold water it dissolves almost without decomposition; when dissolved in water at the ordinary temperature it evolves oxygen and forms bicarbonate—



In presence of oxidisable substances it acts as an oxidising agent. It bleaches indigo solution, cotton, silk, and wool. It rapidly oxidises lead sulphide to sulphate—

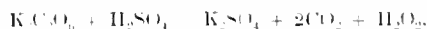


Under certain circumstances potassium percarbonate also acts as a reducing agent. Thus the following reductions take place with evolution of oxygen—



This behaviour indicates that the percarbonate is really the carbonate of a holoide (Traube, Ber. 19, 1115), viz., potassium peroxide. Like the holoide of the alkalis, it is a reducing as well as an oxidising agent; and like the

hydroxides of the alkalis and alkaline earths, it produces hydrogen peroxide when acted on by acids (e.g., dilute sulphuric acid)—



Under similar conditions, rubidium percarbonate is obtained from rubidium carbonate as a white, exceedingly lygroscopic powder. The carbonates of sodium and ammonium are only very slightly soluble at low temperatures, and their percarbonates have not yet been isolated.

—D. E. J.

PATENTS.

Electrolytic or Galvanic Processes or Cells, Impts. in or relating to. H. H. Lake, London. From C. Hoepfner, Giessen, Germany. Eng. Pat. 17,745, Sept. 23, 1895.

In this process the bath is divided by means of diaphragms into anode and cathode compartments so that the latter are above the former, and anode cells communicate with anode cells, and cathode with cathode, as described in Eng. Pat. 13,733, 1890 (this Journal, 1891, 839, and 1892, 1015). To allow of the use of as low an electro-motive force as possible, soluble anodes are employed, which are formed of some metal or metallic substance which differs from the metal of the final product obtained at the cathode, and is readily precipitated from its solutions like lead, but is insoluble in diluted acid (especially in diluted sulphuric acid), so as to exclude the employment of zinc or iron for the anodes. These may consist of lead or plumbiferous substances, compounds, or alloys in a compact, pulverulent, or spongy condition; or of other metals, such as mercury or copper, or their compounds or alloys. The metals dissolved from the anodes are rendered insoluble by chemical or physical means, and their precipitation takes place preferably outside the anode compartment. The precipitates are collected and utilised preferably by regenerating the metal by the action of some reducing agent, such as coal-water-gas.

One or both of the electrodes may be removable, and that next the anode should preferably consist of a chloride, nitrate, or acetate—say the acetate of zinc, or of acids or salts capable of forming soluble lead compounds. The lye is circulated past the lead anodes, so that it never contains more than from 50 to 100 grms. of lead per litre, and this lead is precipitated by means of the salt or oxide to be indirectly decomposed (such as sulphate of zinc), thereby regenerating the electrolysed intermediate substance, such as acetate of zinc. Other precipitates may be employed, and the process can be applied to the method of depositing copper and zinc described in Eng. Pats. 18,080, 1890, and 11,724, 1894 (this Journal, 1895, 581), and to the production of many bodies by electrolysis.—G. H. R.

Plates for Electric Accumulators or Secondary Batteries, Impts. in and in the Manufacture of. [Potassium Sulphate Coating.] J. Korner, Mannheim, Germany. Eng. Pat. 19,745, Oct. 21, 1895.

To lengthen the life of the plates, the supports are subjected to the action of the current in a bath composed of a solution of potassium sulphate in sulphuric acid, when they receive a protective crystalline coating of the acid sulphate. When sufficiently coated, the supports are removed from the bath, and the paste of active material is applied to them, after which they are formed in a bath of the same composition, whereby each particle of the paste is also enclosed in a crystalline coating. When the cells are in use, the electrolyte must always contain potassium sulphate in excess.

—G. H. R.

Primary Electric Batteries, Impts. in or relating to. [Circulation.] W. Rowbotham, Birmingham. Eng. Pat. 20,828, Nov. 4, 1895.

This invention relates to that class of primary batteries in which the main body of the exciting and depolarising liquids is contained in reservoirs separated from the portion contained in the cells by perforated partitions which allow of the circulation of the exciting and depolarising fluid during the working of the battery, as described in Eng. Pats. 197,760 and 13,730 of 1895 (this Journal, 1896, 38).

In this improvement the battery consists of an outer case divided longitudinally into three main compartments, each of which is divided into four subsidiary compartments by means of three transverse partitions. The centre longitudinal compartments are each provided with a porous partition, between which the metal elements, preferably iron, are placed, while the carbon elements are in the outer spaces. Provision is made for the circulation of the electrolyte by means of tubes passing through the various portions, and an exhaust tap; or the various compartments may be thrown into communication as desired, by means of taps worked from the outside of the vessel by means of a rod. The carbon elements are immersed in a solution composed as follows:—

	Oz.
Bichromate of soda	32
Nitric acid	55
Sulphuric acid	150
Water	320
Potassium chlorate	4

The exciting fluid within the porous cell, consists of a solution of about 1 oz. of potassium chlorate to about 60 oz. of a saturated or diluted solution of ammonium chloride or potassium chloride.—G. H. R.

Electrodes, Impts. in, suitable for Electrolytic Apparatus. [Platinum.] C. Kellner, Vienna, Austria. Eng. Pat. 22,207, Nov. 21, 1895.

In order to give rigidity to the electrodes and to reduce the weight of platinum employed, they are constructed of thin-walled platinum tubes, in which are inserted or cast, accurately fitting metallic conductors. The platinum tubes may be provided with lateral rib-like projections, preferably serrated at their edges. These electrodes may be made bipolar by arranging them so that they extend through a wall of non-conducting material, as described in Eng. Pat. 9285, 1894.—G. H. R.

(B).—ELECTRO-METALLURGY.

Peroxide of Lead, Improved Method of Manufacture of. H. N. Warren. Chem. News, 1896, 74, 141.

LEAD ORE or sulphate of lead from vitriol tanks, &c., is introduced into canvas bags, through each of which is inserted a lead sheet. These bags are now immersed in dilute vitriol, and connected respectively to sheets of iron; the sulphate or other lead compound contained therein is thus speedily and completely reduced to the spongy metal, the bags being afterwards connected alternately by their lead plates and exposed to the action of an electric current, the positives being thus completely converted into peroxide, whilst the temporary accumulator thus produced is again emptied of its current into further quantities of spongy metal, thus producing a further quantity of peroxide. The author states that the process, when rightly conducted, yields an absolutely pure and cheaply formed oxide.—A. S.

PATENTS.

Metallic Zinc and Metallic Copper, Impts. in a Process and Apparatus for the Electrolytic Production of, from Zinc Ores containing Copper, and Oxygen Gas as a By-Product. C. A. Burghardt, Manchester, and G. Rigg, Eccles. Eng. Pat. 19,934, Oct. 23, 1895.

THE roasted and ground ores are treated in a suitable tank, provided with a mechanical stirrer, with a concentrated solution of ammonium carbonate, sesquicarbonate, or bicarbonate, or mixtures of these, or with a solution of ammonia gas. On stirring, the oxides of zinc and copper are rapidly dissolved out of the ore, and may be removed in solution after settlement or by filtration. The separated solution is heated to 40° C., and the iron is removed by means of hydrated oxide of tin and prolonged agitation. The copper is then precipitated by metallic zinc; finally the zinc is removed by electrolysis at a temperature of 40° to 50° C., oxygen gas being at the same time liberated from the positive pole. The tanks used may be of wood; they must not be of iron. The oxide of tin is recovered by dissolving the accompanying oxides of iron with sulphuric acid.

The ammonium salts accompanying the insoluble residues are recovered by washing with water.

The various solutions are covered with a layer of paraffin oil or other mineral oil of high flashing point and low viscosity, to prevent loss of ammonia by volatilisation.

—J. H. C.

Metals, Impts. in the Electro-Depositing of. [*Rapid Circulation.*] A. S. Elmore, Leeds. From J. O. Elmore, Kapurthala, India. Eng. Pat. 21,283, Nov. 9, 1895.

The object of this invention is to allow of much higher current densities being employed in the electro-deposition of metals than has heretofore been possible. This is effected by placing the anode close to the mandrel on which deposition takes place, and forcing a large volume of electrolyte through the interspace by means of a centrifugal pump or other suitable agency. The electrolyte may be admitted between the anode and cathode from the ends of the tank, or preferably through a perforated pipe or chamber running along the bottom of the tank under the anodes, which are so arranged as to allow a free space between the mandrel and the supply pipe.—G. H. R.

Impure Bismuth, Impts. in the Treatment of, for Refining the same. B. Zakorski, F. Hurter, and J. Brock, Liverpool. Eng. Pat. 22,251, Nov. 21, 1895.

THE impure bismuth is employed as an anode in an electrolytic tank with a solution containing nitric acid as an electrolyte. Carbon, pure bismuth, platinum, or other suitable material may be employed as the cathode. A current density of 15 amperes per sq. ft. of active bismuth surface is recommended, and the density must not exceed 30 amperes. Pure bismuth is deposited on the cathodes, from whence it falls, or may be easily removed. It is then washed with dilute HNO_3 , dried and fused. When the electrolyte has become too rich in lead, it may be freed from it by electrolysis, or the contained bismuth may be precipitated by metallic lead, and the resulting solution of lead nitrate utilised in any desired way.—J. H. C.

Metals, Improved Apparatus for the Electro-Deposition of. [*Polishing.*] A. S. Smith, T. A. Smith, R. J. Smith, S. Smith, and T. Deakin, Walsall. Eng. Pat. 5274, March 9, 1896.

THE polishing is effected by the rotation of a hollow barrel or drum, within which the work to be plated is placed. The drum, which is perforated to admit of the circulation of the electrolyte, is made of wood or earthenware, and is preferably octagonal in shape. It is mounted horizontally on a long sleeve or hollow hub provided with equidistant copper contact pieces, which are separated by wood or earthenware rings, which protect the metal from the action of the liquid. The hub and the barrel are mounted so as to rotate freely on a metallic bar supported on insulated brackets, and the apparatus is immersed in the bath, which contains the usual anodes. Suitable means are provided for rotating the barrel at any desired speed, and connection is made with the work contained in it by means of the contact pieces and the metal axis, which latter is connected to the negative pole of the source of electric supply.

—G. H. R.

XII.—FATS, OILS, AND SOAP.

Beef-Fat in Lard, Note on the Microscopic Detection of T. S. Gladding. Analyst, 1896, 21, 254.

See under XXIII., page 831.

Wool-Fat, The Iodine Absorption of. W. Herbig. Dingler's Polyt. J. 302, [1], 17.

See under XXIII., page 831.

PATENTS.

Soap, A New or Improved Process of Manufacture of Petroleum. S. E. von Graeve, Düsseldorf, Germany. Eng. Pat. 18,760, Oct. 7, 1895.

FAT (with or without the addition of wax) is heated to 100°C ., and nitric acid at a temperature of 100°C . gradually

added to it, with constant agitation, until the evolution of nitrous acid and volatile organic acids ceases. The product is dissolved in petroleum, and saponified with caustic or carbonated alkali.—J. J. K.

Soap, Impts. in the Manufacture of. J. W. Barclay, Eltham. Eng. Pat. 19,021, Oct. 10, 1895.

THE object of this invention is the incorporation in soap of solidified or thickened unsaponifiable oils, and thereby of disinfectants or insecticides dissolved therein. The unsaponifiable oil is solidified or rendered pasty (e.g., by treating with resin or alkali), and then incorporated with the soap at any stage in the course of its manufacture. In this way a better and more homogeneous soap is said to be obtained than if ordinary liquid oil be used.—V. C.

Filtering Apparatus [Wash Oil, &c.], Impts. in. C. Whitefield, Kettering. Eng. Pat. 19,968, Oct. 23, 1895.

See under I., page 792.

Detergent or Tanning Substance, New or Improved. [*Extract of Soap-Berry.*] P. C. D. Castle, Liverpool. Eng. Pat. 21,557, Nov. 13, 1895.

THE husks of the soap-berry (*Sapindus trifoliatus* L.) are macerated in water at 180° to 190°F . for seven hours, in the proportion of 1 lb. per gallon. The liquid is passed through strong, coarse silk and evaporated at a temperature not exceeding 190°F ., with the result, that a sticky resinous substance is formed which, at 60°F ., is as hard as beeswax. It "melts" readily in hot or cold water, and forms a lather which has more powerful cleansing properties than soap. It may be used in tanning.—W. G. M.

Soaps, Impts. in Liquid Disinfectant. J. B. McArthur, Newferry, Chester. Eng. Pat. 22,332, Nov. 22, 1895.

86 PARTS of 77 per cent. caustic potash are mixed with 250 parts of carbolic acid, tar oil, naphthol, or similar disinfectants, at 200°F .; 355 parts of oleic acid or other fatty material are then stirred in, and sufficient water added to produce a liquid soap containing 12 per cent. Another method is to saponify the fat first with alkali, and then dissolve the soap in the disinfectant.—J. J. K.

Separating Oil from its Volatile Solvent [Steaming]. Impts. in or appertaining to. G. F. Metzger, Cleveland, Ohio, U.S. Eng. Pat. 15,050, July 7, 1896.

THE ordinary process of removing naphtha by live steam leaves the oil with an objectionable smell, and a glutinous matter known as "foots" separates from the oil. These bad effects, which are due to the live steam being too hot and too dry, are avoided by the present invention, which consists in heating the solvent and its contained oil to the vaporising temperature of the former, and then injecting water heated to about the same temperature. The mixture is kept agitated, and the vapours are conducted away as they are formed.—V. C.

Separating Naphtha or other Volatile Solvent from Oil, A New or Improved Process of and Apparatus for. [*Vatdissolving by Steam from Large Surface.*] G. F. Metzger, Cleveland, Ohio, U.S. Eng. Pat. 15,597, July 14, 1896.

AFTER the extraction from crushed seed, the volatile solvent with its contained oil is heated in one receptacle, and a small body of water in another receptacle. A large proportion of the solvent is removed by the action of the steam upon the large surface exposed in a shallow trough, and the action is carried to an end by the further extension of surface caused by the subdivision of the oil into drops, which fall through the perforated bottom of the trough into the remaining water. Air is blown through the liquid, which, with a constant suction kept up by fans, accelerates the action and promotes the mixing of oil and water. During this part of the process, not only is the last of the solvent removed, but the oil is thoroughly washed and partially bleached.—V. C.

Soap, Impts. in Process and Apparatus to be used in the Manufacture of. W. F. Haywood, Austin, Ill., U.S.A. Eng. Pat. 16,746, July 28, 1896.

Soap is rapidly manufactured under pressure, the apparatus consisting of a horizontal jacketed cylinder, provided with an agitator, and valves for the reception of raw material and ejection of the finished soap. The charge of field fat and lye (the alkali in which is sufficient for complete saponification) is run into the cylinder and agitated, steam at 40 lb. to 60 lb. pressure being admitted at the same time to the jacket. When the temperature of the mass in the cylinder has risen to that of the steam supply, the air in the cylinder is expelled through a valve. The temperature will now be about 260° C., perfect saponification resulting in a few minutes; the soap is then ejected from the cylinder into the crutching pan.—J. J. K.

Fats, Oils, Resins, Sulphur, Colours, Tanning Materials, and the like; Impts. in or relating to the Extraction of, by Means of Volatile Solvents, and Apparatus therefor. J. Merz, Brünn, Austria. Eng. Pat. 16,766, July 28, 1896.

See under I., page 792.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

Chrome Yellow and Chrome Red [Lead Chromes], Analysis of. R. Amsel. Zeits. angew. Chem. 1896, 613.

See under XXIII., page 830.

PATENT.

Colour Wash or Distemper Paints, Impts. in the Preparation of. A. T. Hall, Hull. Eng. Pat. 23,155, Dec. 3, 1895.

"The preparation of colour wash or distemper paints" is to be "by mixing pigment, glue, or the like, linseed oil and oak varnish, with or without glycerin, and then oxidising them." "A disinfectant is added to this mixture." —F. H. L.

(B).—RESINS, VARNISHES.

PATENTS.

Cleansing Varnished and Polished Wood Surfaces, Compound for [Hydrochloric Acid and Glycerin], A New or Improved. C. E. Postlethwaite, Forest Gate, Essex. Eng. Pat. 12,930, July 4, 1895.

This compound is composed of a mixture of 70 oz. of hydrochloric acid and glycerin (in the proportion of 3 parts of hydrochloric acid to one part of glycerin), and 30 oz. of flour. The addition of 5 per cent. of albumin to the hydrochloric acid is said to impart an extra gloss to the cleansed surface of wood.—J. J. K.

Artificial Veneers, Improved Composition for the Manufacture of. C. Köster, Cologne. Eng. Pat. 16,999, July 31, 1896.

The claim is for "A composition for producing artificial veneers, consisting of a mixture of wood dust, zinc white, flour paste, resin size, linseed oil, and grape sugar or other similar saccharine matter." The composition on drying is said to be soft, elastic, and tough, and also to be waterproof.—A. S.

(C).—INDIA-RUBBER, &c.

PATENT.

Pneumatic Tyres, Impts. in Compositions [Glycerin with Gelatinous Silica or Alumina] for repairing Leaks in. C. S. Howe and J. W. Langley, Cleveland, U.S.A. Eng. Pat. 16,365, July 23, 1896.

A small quantity of the proposed liquid composition, within a pneumatic tyre, will act automatically, it is said, in repairing punctures in the india-rubber of pneumatic

tyres. Glycerin holding gelatinous silica or aluminium hydrate in suspension may be used. Three volumes of glycerin are mixed with one volume of liquid water-glass, an acid is stirred in, and the resulting jelly is incorporated with three additional volumes of glycerin. Four to six ozs. of such a liquid are sufficient for a tyre. To make the aluminous fluid, a salt of alumina, or an alkali aluminate solution, is incorporated with glycerin and neutralised by addition of an alkali or of an acid, according to the aluminium compound used, and the thick jelly formed is ground up with more glycerin to the consistency of a syrup. Instead of glycerin, water thickened with mucilage or dextrin, and in which an equal weight of calcium chloride is dissolved, to prevent evaporation, may be used.—E. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

PATENTS.

Tanning Hides and Skins, Impts. in Apparatus employed for. [Agitation.] L. A. Groth, Stuttgart. Eng. Pat. 18,879, Oct. 8, 1895.

In order to impart a reciprocating motion to the hides in the vats, they are suspended from laths attached to a series of independent frames, of which there is one to each vat. Above these frames are other larger frames worked by a crank and connecting rod. These upper frames are kept constantly in motion to and fro over rollers placed on the rims of the vats, and the smaller frames may be instantaneously connected to or disconnected from them by means of a simple clutch thrown into or out of gear by a lever. In this way each vat-frame with the hides may be kept oscillating as long as may be necessary, and may then be kept stationary without interfering with the motion of the hides in other vats. Electrical connections may be made, if desired.—W. G. M.

Detergent or Tanning Substance, New or Improved. [Extract of Soap-Berry.] P. C. D. Castle, Liverpool. Eng. Pat. 21,557, Nov. 13, 1895.

See under XII., page 817.

Lime, Process for the Removal of, from Hides and Skins, after Treatment in the Lime Bath. A. Brogard, Mörchingen, Lothringen. Eng. Pat. 23,310, Dec. 5, 1895.

The hides, after the removal of hair and flesh, are placed in a solution containing from 1.5 to 2 per cent. of sulphuric acid for about 1 or 2 minutes to extract the lime remaining from the effect of the lime bath. Dilute potash may be substituted for the acid.—W. G. M.

Whalbone, Artificial; Process for Manufacturing. W. Hunkemöller, Amsterdam. Eng. Pat. 13,242, June 16, 1896.

BONES are stripped of fat, the calcareous constituents are extracted with hydrochloric acid, and the residual cartilaginous substance is steeped in 15 to 30 per cent. chrome alum solution until saturated. It is then dried and cut into strips for use.—W. G. M.

Leather, Chrome-dressed, for Dyeing Purposes, Improved Process for Preparing. E. Avellis and E. Köster, Berlin. Eng. Pat. 16,600, July 27, 1896.

THE leather is first freed from acid by washing in water containing 3 per cent. of whitening and 2 per cent. of common salt. It is then immersed for about half an hour in a tannin liquor of 1° to 2° B. (for divi divi), or weaker for light tints. The leather may then be dyed at once, or to obtain clearer tints, it may be re-tanned with tartar emetic in the manner described in the specification.—W. G. M.

Glue, Liquid [from Leather Parings]; New or Improved Process for the Preparation of, for Joiners, Upholsterers, and the like. E. E. E. Martens, Neustadt-Holstein, Germany. Eng. Pat. 17,370, Aug. 6, 1896.

100 PARTS of the best glue, made from leather parings, are softened in 150 parts of water; 10 parts of salicylate of

soda are then added, and the mixture is heated until the solid has dissolved. 1 grm. of oil of cloves is finally added to each kilo. of glue. The whole remains liquid, and may be used, after dilution, as a substitute for gum.—W. G. M.

Tannin Extract, Improved Manufacture from Sulphite Cellulose [Waste Liquors] Lyes. M. Honig, Brünn. Eng. Pat. 18,265, Aug. 13, 1896.

THE ordinary lyes obtained by treating wood with calcium bisulphite cannot satisfactorily be used, it is stated, after the mere separation of the lime by sulphuric acid, by reason of the existence of free acids in the solution, and as only the tannin of oak is precipitable by lime from these liquors, the alternative method is restricted in its use. In this process, the sulphite lyes are first neutralised with calcium carbonate or with lime, so that they may be safely concentrated, after clarification by deposition, to 15° – 18° B. They are then heated in lead-lined boilers with sufficient sulphuric acid to combine with the lime contained in the lye; or other acids capable of forming lime salts soluble with difficulty, may be used instead of sulphuric acid. The heating is here continued until all volatile acids are expelled. The precipitated calcium sulphate is filtered off, and the filtrate is brought up to 28° – 30° B. in a vacuum pan. After clarification by deposition, the solution may be used as a tannin extract.—W. G. M.

XV.—MANURES, Etc.

Fertilisers and Anti-Fertilisers. Imp. Inst. J., November, 1896, 409.

RESEARCHES* have shown that a calcareous soil is advantageous for the growth of pine trees, the most conspicuous effect produced by a deficiency of lime being the production of short needles. If, however, magnesia is present with the lime, it acts injuriously, unless the relative proportion is very small. This last fact has been amplified by other experiments;† these show that it is only the chloride of magnesium which is injurious, the other and less soluble salts being probably innocuous in the presence of lime.

The latter is also of great use as a manure for tobacco, when grown on soils poor in this ingredient. The combustibility is thereby considerably increased, potash not being so useful for this purpose as was supposed.‡

The disappearance of nitrates from soils is a matter of considerable importance, and has met with some attention. It has been found that certain kinds of manure, if used together, caused a great loss of nitrogen,§ and this was attributed to denitrification by ferments. In 1890 the presence of such denitrifying agents in straw and other vegetable substance was demonstrated, and it is now experimentally proved that soil when watered with a preparation of these germs rapidly loses nitrogen. A similar result can be produced by consolidating the ground so as to check aeration.¶

The influence of various chemical reagents on germination has been studied. An elaborate paper on this subject has been published, containing the results of 275 experiments, arranged in 17 series.** The more important conclusions may be summarised as follows:—Mineral and organic acids are injurious to germination, and strongly acid salts are more injurious than neutral salts. Free bases and strongly basic salts are poisonous. Salts, generally, are either injurious or without effect. Fats and ethereal oils prevent the germination of corn, and much retard peas and rape. Anaesthetics and hydrocarbons, generally, retard germination, while their vapours kill the seeds. Organic antiseptics are all injurious in solutions of more than 0.1 per cent., and coal-tar dyes also in solutions of 0.05 per cent. The influence of the various constituents of artificial manures in solutions of 0.05 to 0.5 per cent. has been examined.†† It is found that they are injurious

to germination, but grains are more resistant than other seeds to their action. Lime water and basic phosphates, however, are very beneficial, especially to leguminous seeds. Sulphuric acid, even in very dilute solutions, is highly injurious, and as a considerable quantity (0.108 to 1.612 per cent. by weight) is produced in the germination of seeds, it seems evident that it is the power which lime possesses of combining with, and neutralising, this acid that is the secret of its value.

New Phosphate Discoveries in Tennessee. Eng. and Mining J., Oct. 31, 1896, 418.

See under Trade Rep., page 837.

PATENT.

Phosphates of Ammonia and Potash, Process for the Manufacture of, in an Alkaline Mixture suitable for Manure. T. Jamieson, Glasterberry, N.B. Eng. Pat. 18,635, Oct. 5, 1895.

DRY superphosphate is stirred up with about an equal quantity of ammonium sulphate or potassium sulphate, or a mixture of the two salts, to which has been added a proportion of water insufficient to dissolve the salts. Just before the mixture thickens, some dry organic substance, such as bran, sawdust, &c., is mixed in, and, after solidification, a further proportion of the drier is added, which has been previously caused to absorb sufficient potassium carbonate solution to give a slight alkaline reaction to the finished product, to which bone-dust or the like may be added, if desired.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Progress in, for the Second Quarter of 1896. Dingl. Polyt. J. 1896, 302, 40–46.

Aqueous Digestion.—Since the publication of Pellet's method (this Journal, 1896, 716) for the determination of sugar in beetroot by aqueous digestion, many investigations have been made to decide whether this method gives results in agreement with the alcoholic method in use. From E. Becker's results (Die Deutsche Zuckerind. 1896, 21, 1057) it appears that the aqueous digestion cannot replace the alcoholic, and that there are conditions under which the aqueous method may give results as much as 1 per cent. over the alcoholic digestion, the chief cause being due to the fact that, from the abnormal conditions of growth during the dry summer of 1895, a quantity of optically active non-sugar was produced in the beet, which is not precipitable by acetate of lead alone in aqueous solution.

Action of Acetic Acid on Sugar Solutions.—Xhonneux (Zeits. Ver. Rübenzuckerind. 1896, 46, 469) draws attention to the preservative action of 1 per cent. solutions of acetic acid. The solution is said to keep much longer if lead acetate is also present.

Magnesia in Limestone.—The method of Prinsen-Geerlig for the determination of small quantities of magnesia in limestone has been improved by A. Herzfeld and A. Förster (Zeits. Ver. Rübenzuckerind. 1896, 46, 284). After separating silica in the usual manner by evaporating to dryness with strong hydrochloric acid, the chlorides are redissolved in water and a few drops of hydrochloric acid. A few drops of nitric acid are added and the solution boiled, and then precipitated chalk added until a small quantity remains undissolved. The mixture is boiled and filtered. The test-tube containing the filtrate is now almost filled up with clear lime water, closed with an india-rubber stopper, and shaken. If much magnesia be present a precipitate forms at once, with smaller quantities after a few minutes. In the quantitative estimation this precipitate is dissolved in hydrochloric acid, neutralised, the traces of lime removed as oxalate, and the magnesia precipitated as phosphate.

Instantaneous Saturation.—The all but instantaneous saturation is, according to W. Guerrero (La Suc. Ind. 1896, 31, 161), preferably employed in the saturation of sugar juices with carbonic or sulphurous acid. In this arrangement the distributing pipes for the gas are placed one above the other in a spiral, so that the gas issues, not in one plane,

* Loew and Honda, Bull. Coll. Agric. Imp. Univ. Tokyo, 1896, 2.

† Larbalétrier and Malpicaux, Ann. Agron. 1896, 22.

‡ Cserháti, J. Landw. 1895, 43.

§ Wagner, Journ. Agric. Prakt. 1895.

¶ Béal, Ann. Agron. 1892.

** Béal, Ann. Agron. 1896, 22.

†† Sigmund, Landw. Versuchs. Stat. 1896, 47.

†† Claudel and Crochetelle, Ann. Agron. 1895, 22.

but in several. The advantages are:—1st. Saturation of a larger quantity of juice with a smaller number of saturators. 2nd. Possibility of the saturation of very dense juice, otherwise difficult. 3rd. A more thorough purification by the calcium carbonate, and a greater decolorisation of the juice. These distributors are in use in the Spanish sugar works of Atarfe and Aleolea, where two saturators are now doing the work of three.

Purification of Juice by Electricity.—A Bandy (Oester. ungar. Zeits. Zuckerind. und Landwirth. 1896, 35, 238) makes an interesting communication on the working of the electrolytic method of Schollmeyer and Huber in the Russian sugar works, Stepanowka and Waronowitza.

After the diffusion juice leaves the measuring tank, $\frac{1}{4}$ per cent. of lime is added, and it is passed through a heater to be heated to 80° C. It is then electrolysed in a rectangular reservoir with zinc electrodes. A gradually thickening mud forms and a sticky deposit on the cathodes, which would cause great resistance to the current unless removed from time to time by reversing the current, when it falls off. In 15 to 20 minutes, the juice, now of a fine yellow colour, is passed to the saturators. From this point onwards, the action of the electrolysis is seen in a saving of 40 to 50 per cent. of lime, less foaming and consequent saving in grease of 60 to 70 per cent. The filter presses work better and give 20 to 25 per cent. less cake, so that there is a saving in cloths, in wash water, and in labour. The evaporation is easier, the massecuite freer and more easily centrifuged. For a daily work of 409.5 tons of beet, a current of 850 amperes at 5.5 volts suffices, requiring a motor of a little over 7 h.p. The author calculates that on working up 32,800,000 kilos. of beetroots there is an actual saving by electrolysis of 14,470 roubles. The tests have plainly shown that the use of electrolysis alone as a method of purifying raw juice is impossible, as it is irrational to place the more expensive electricity in opposition to cheap lime. Schollmeyer conceived the happy idea of employing them in conjunction, and herein lies the secret of the results of his process.

Electricity, instead of opposing, now completes the action of the lime, and acts, moreover, on certain parts of the non-sugar which lime, even used in large quantities, could not affect. Electrolysis precipitates almost three times the nitrogenous matters that are removed in the ordinary separation.

The Ranson Process.—This process, which has for its object the obtaining direct of the whole of the sugar contained in the beet juice as a white product, and thus seems called upon to render the further existence of refineries impossible, has given occasion in France for various communications, which, however, do not clear up the matter. The process was tried in the Beaumont Sugar Works in February 1896, with such success that according to Renard it is now to be introduced on the large scale. The process, as given in the French Pat. 284,831, is as follows:—The characteristic agent is barium peroxide (BaO_2), by which colouring matters rich in oxygen are reduced, and those poor in oxygen oxidised, in so far as the reduction of the former has not become superfluous by the employment of sulphurous acid. To beet and cane juices and liquors, 2 to 5 per cent. of barium peroxide are added in the form of a milk of 20° to 25° B., and allowed to stand until the escape of gas ceases. The barium peroxide decomposes, yielding oxygen in an intensely oxidising form, and barium oxide (BaO), which combines with sugar to form barium saccharate. The saccharate remains dissolved in the excess of sugar juice. The solution is sprayed under pressure into a closed vessel filled with carbonic acid, barium carbonate and sugar solution being obtained, the latter of such purity that it may be at once worked up into refined without the loss of more than $\frac{1}{2}$ per cent. of sugar. It is merely necessary, as some barium always remains in solution, to determine the quantity, and then to precipitate it quantitatively by sulphuric acid of known strength and afterwards with soda. The barium carbonate, by the action of nitric acid, gives carbonic acid, which is used for precipitation of further juice containing barium, and a solution of nitrate. The latter is evaporated to dryness and ignited in special

furnaces, yielding nitric acid, which is used again, and baryta, which is used, as before, to treat fresh quantities of the juice to be purified.

Du Beaufret (J. Fabr. de Sucre, 1896, 37, No. 18) attributes the action to the baryta, and not to the peroxide, whilst Verbière (*loc. cit.* No. 19) denies this, and remarks that Ranson aims, not at purification, but at decolorisation. Von Lippmann (Die Deutsche Zuckerind. 1896, 21, 1058) remarks that the most difficult and costly part of the regeneration, *viz.*, the conversion of barium oxide into peroxide, is not explained in the patent.—L. J. de W.

Sugar House Products, Determination of Viscosity of. Jaglenczky. Bull. de l'Assoc. des Chimistes de Sucre, et de Dist. 1896, 14, 239–240.

The analytical figures of the laboratory afford only incomplete information of the yield of sugar and molasses from a massecuite; for two massecuites apparently of the same composition, when centrifuged, give different results. Such differences depend not only on the chemical composition of the syrups, but also on their physical properties, notably their viscosity. The author recommends the Reischauer-Aulby viscosimeter; the determination is carried out by observing the length of time taken by 100 or 200 c.c. of the syrup to flow from the tube of the apparatus. The fluidity of water is taken as 100, Z and Z' the time of flow of water and the liquid under observation, the viscosity of the latter being expressed by the proportion $X = 100 \frac{Z'}{Z}$. —J. L. B.

Juice and Syrups, Relations between Evaporation and Viscosity of. Claassen. Centralbl. für die Zuckerind. der Welt, 1896.

It is well known that dilute solutions of sugar are more readily evaporated than concentrated solutions, other conditions being similar; but no commonly accepted explanation has yet been deduced from experimental data. The author has conducted his experiments in the laboratory, for the problem cannot be satisfactorily solved by working on a large scale, weak and strong juices being evaporated under different pressures and temperatures.

In the transmission of heat through a liquid, it is of great importance that the solid and liquid particles on the surface should change position rapidly. Steam bubbles must also be removed from the sides and bottom of the heater, for so long as they cover the heated surfaces, no transmission of heat can take place. The movement of a liquid and of its particles is dependent on the viscosity, and as it is known that a relation exists between this property and the rate of evaporation, the author conducted his experiments for the elucidation of this point. The apparatus used by him consisted of a Fischer's viscosimeter and of an evaporator. The weight of water evaporated, the temperature both of the heating steam and of the boiling liquid, and the duration of the experiment, were determined. The viscosity tests were made at 100° C., water being taken as unity. Solutions of molasses, massecuites, and sodium chloride were examined; the data obtained from the first two of these show that the coefficients of calorific transmission of the denser solutions diminish proportionately as the specific heat is lowered and as the viscosity coefficients are raised.

It then, obviously, became necessary to establish which of these factors, viscosity or specific heat, influenced the transmission of heat; and to this end experiments were made with solutions of sodium chloride. A series of tabulated results shows that in concentrated solutions the coefficients of calorific transmission, unlike those of massecuites and molasses, increase with the viscosity; that the specific heat of concentrated solutions is lower than that of dilute solutions or of water; whence it is concluded that the specific heat of boiling liquids has a very slight influence on the transmission of heat. From these results the author considers that it is no longer possible to ignore the influence of the viscosity of solutions upon the transmission of heat.

—J. L. B.

Low Products, Process for Boiling and Crystallisation of. F. Sachs. Bull. de l'Assoc. des Chim. de Sucre et de Dist. 1896, 14, 183—187.

THE author describes a process invented by R. Sachs, which has been successfully employed in a Russian factory. The syrups from first runnings are quickly worked into grained massecuites. On cooling, these massecuites yield a quantity of sugar, so that the syrups from the centrifugal machines have the composition of molasses. The green syrup from first runnings is boiled *in vacuo* until the sugar completely separates in crystals of medium size. About one-half of the product at this stage is allowed to flow into a mixer, and boiled with fresh syrups. If, at first, crystals are not deposited in sufficient quantity, they are certain to separate on the addition of new syrup. The process is equally suitable for the working of refinery products.—J. L. B.

Sugar, Methods of Manufacturing directly-consumable. J. de Gröbert. Bull. de l'Assoc. des Chim. de Sucre et de Dist. 1896, 14, 166—171.

THE methods in use to obtain a directly-consumable sugar, may be divided into two categories, namely, to treat the syrups resulting from the working of beetroot or cane as refinery clairess, or to transform raw into refined sugar by more simple and economical means than those employed by refiners. The chief obstacle to the direct manufacture of refined sugar is the coloration of the initial products. Many patents have been taken out for decoloration, and sugars of good appearance have been prepared. But the economy realised in avoiding boiling to grain, and centrifugalising, is more than counterbalanced by the cost of decolorising agents and the indifferent yield and quality of the products.

Agglomerated sugars, prepared by powdering a raw product of sufficient purity, mixing with a little water or clairess, and running into moulds, are condemned by the author, such products being dull in colour, and not homogeneous in structure.

Wulff has shown that if a mutilated sugar crystal is placed in a saturated solution of sugar, it exerts a selective action on the molecules of sugar in solution, and before any increase of size occurs the crystal assumes its typical form. This circumstance led Prangey to devise the following process:—A grained white sugar of good quality is powdered, and the sifted product mixed with sufficient saturated clairess for the mixture to have the same composition as a refinery massecuite. It is then led into a double-jacketed apparatus furnished with an agitator, and heated from 95°—100° C. by slack steam. When this point is reached the temperature is allowed to drop slowly to about 90°, and the mass then satisfies all conditions which characterise the ordinary refinery massecuite: that is, it consists of uniformly developed crystals of the same size, separated by a saturated syrup, which, in the course of working, behaves like the mother-liquor of a refinery massecuite. The mixture, after being run into moulds, is centrifugalised and treated in the manner commonly applied to refined products.—J. L. B.

Sugars, Production of Carbon Dioxide during the Decomposition of. [Bearing on Fermentation, &c.] Berthelot and André. Comptes rend. 123, [16], 567—580.

THE sugars subjected to examination were dextrose, levulose, galactose, and maltose; dilute hydrochloric, sulphuric, or phosphoric acid being the reagents employed—the latter being in some instances preferable, since it neither distils with water nor exerts any oxidising action.

Three methods were pursued: (1) Heating in sealed vacuum tubes at a temperature of 100° C.; (2) Distillation in flasks with inverted condensers; and (3) The same with ordinary condensers, the water distilled being replaced by an equal volume. The products examined were: unaltered glucose, carbon dioxide, carbon monoxide, humic acid, formic acid, levulinic acid, furfuraldehyde, and water.

In the experiments with sealed tubes a constant temperature of 100° C. was maintained for 644 hours, the products being analysed after 115 hours' and 168 hours' treatment, as well as at the end of the reaction. Phosphoric acid (16.78 grms. to 19.5 grms. of water) was employed as reagent.

Water.—At the first and second stages the loss of oxygen and hydrogen unrecovered, may be due to the formation of water or carbohydrates, but at the final stage must be regarded as water eliminated as a result of the formation of humic, levulinic, and formic acids, the proportions being O, 19.42; H, 2.35 per cent. of the total glucose taken.

Glucosan.—The results obtained point to the formation of glucosan by dehydration in the preliminary stage of the transformation of glucose.

Furfuraldehyde could not be detected among the products in this series.

Formic (11.90 per cent.) and *Levulinic* (39.88 per cent.) *Acids.*—In the theoretical decomposition of glucose into these acids and water, the ratio of the carbon in the first-named to that in levulinic acid is 1:5, so that the actual ratio (1:3.3) obtained in these experiments points to some other reaction as the source of about one-third of the formic acid found, corresponding, in fact, to the formation of *Humic Acid* (23.60 per cent.). In presence of phosphoric acid there appears, however, to be no connection between the formation of humic and levulinic acids, their ratio being irregular. Thus, at the end of 115 hours, some two-thirds of the final total of the former acid, against scarcely one-half of the latter, had been formed; and whilst after 168 hours the formation of humic acid had almost ceased, the production of levulinic acid still continued. On the other hand, when strong hydrochloric acid is used, nearly the whole of the glucose is converted into humic acid in 25 hours, levulinic acid having apparently not had time to develop under these circumstances. No definite relation could be detected between the amounts of humic and formic acids produced in 25 hours under the influence of hydrochloric, sulphuric, and phosphoric acids in different degrees of dilution.

Carbon Monoxide (1.19 per cent.) was shown by a separate test to be derived in part from formic acid, none being formed from levulinic acid.

Carbon Dioxide (2.07 per cent.)—The greater part (1.47 per cent.) formed during the first 115 hours; the increase during the remainder of the time is partly attributable to the gradual decomposition of humic acid. By heating glucose *in vacuo* with strong HCl to 120° C., the evolution of CO₂ and CO was found to increase progressively with the duration of the reaction.

In the distillation tests, which were performed by the aid of all three reagents, and in presence of air or hydrogen, the chief difference in comparison with the sealed tube experiments was the increased and more rapid formation of carbon dioxide, which, however, did not, as was proved by direct experiments, proceed either from oxidation or from the decomposition of levulinic acid. As regards the other products, the volatile acids were formed more extensively by sulphuric than by phosphoric acid, whereas the amount of humic acid was fairly constant under similar experimental conditions, the results, as a whole, pointing to the simultaneous occurrence of various congeneric reactions of such a nature as to be readily influenced by slight modifications in the conditions.

The other glucoses behaved in a similar manner, furnishing approximately equal quantities of carbon dioxide, small amounts of furfuraldehyde being also constantly produced in the distillation tests. The larger amount of humic acid yielded in a given time by levulose, as compared with the other glucoses (observed by Tollens and Grote), was found to be merely due to the more rapid rate of decomposition of this sugar, the total amount of the acid formed at the end of 24 hours' reaction with strong HCl being nearly the same for all.

The glucoses being formed by the synthetic accumulation of several simple molecules of methyl aldehyde, constitute systems of a low degree of stability, which accounts for their endothermic characteristics, and renders them liable to undergo various simultaneous reactions. For example, they may polymerise, disengaging heat from the union of several molecules, and the formation of stable compounds, such as water: glucosan and humic acid being produced in this manner. Again, by the action of dilute acids, the glucoses are converted into formic and levulinic acids and water, the first of which may be regarded as due to the separation of the carbon of the last molecule of methyl

aldehyde, and the concurrent deoxidation of the other five. Finally, this separation of oxygen may proceed further, the result being to convert the last molecule of aldehyde into carbon dioxide and hydrogen. This reaction always occurs, but is heightened by prolonged distillation and an increase in temperature above 100° C. Part of the hydrogen becomes fixed in the formation of humic acid, and it is probable that the tendency of the last molecule of aldehyde to separate may explain the formation of furfuraldehyde, which seems to indicate the production of traces of the pentoses during the decomposition of the glucoses.—C. S.

Molasses or other Sugar Solutions, Extraction of Sugar from. Langen. Monit. Scient. 1896, 47, 775—776.

The process consists in treating molasses or other syrups with barium hydroxysulphide, and recovering from the residues the whole of the sulphur as sulphurous or sulphuric acid, the latter being used to recover the barium from the saccharate and residues.

The sulphite and sulphate of barium thus obtained are then converted into barium hydroxysulphide by calcining with carbon. The solution from which the saccharate has been removed contains the barium which has not been precipitated as saccharate, as well as all the sulphur of the barium hydroxysulphide originally used. By treating the solution with concentrated carbonic acid, the barium is precipitated as carbonate, and sulphuretted hydrogen gas is disengaged. The sulphuretted hydrogen is converted into sulphurous or sulphuric acid by burning it, and the barium carbonate by these acids into sulphite or sulphate.

Magnesium sulphite or sulphate may also be used to decompose the barium saccharate, but as the magnesium hydroxide is difficult to filter, it is converted into carbonate. The magnesium may be easily separated from the barium salts after conversion into sulphite or sulphate.

—L. J. de W.

Saccharose, Purification of, and Recovery of Sugar from Solutions of. A. Wohl. Monit. Scient. 1896, 47, 766—775. (See also this Journal, 1896, 125, 287, 550, and 551.)

PRACTICALLY speaking, no process is known for the complete recovery of saccharose from its solutions by the formation of lead saccharate. Dubrunfaut (Dingl. Polyt. J. 1850, 138), in describing his baryta process, remarks that it is necessary "to maintain the oxide of lead for a long time in contact with the liquid, and even then it only fixes the sugar incompletely."

The fact that it is possible to convert more or less pure solutions of saccharose almost instantaneously and completely into lead saccharate, has hitherto escaped attention, from a number of conflicting causes.

The red litharge of commerce, finely pulverised and sifted, has scarcely any action, while the yellow combines at once, even at the ordinary temperature. By heating basic carbonate of lead to 200° or 300°, mostly red litharge is obtained, whilst by raising the heat to dull redness (about 600°) for a short time, and cooling quickly, it is obtained of a sulphur-yellow colour, soft and porous.

The combination of the oxide of lead with sugar to form di-saccharate of lead is assisted by heat in more concentrated solutions; with dilute solutions heat retards the reaction. A 50 per cent. solution heated for 15 minutes to 90° yields 95 per cent. of its sugar, while a 20 per cent. solution under the same conditions gives up only 35 per cent. This phenomenon is due to the fact that the solubility of the saccharate increases with the concentration of the solution of saccharose, and diminishes with rise of temperature.

The best temperatures are, for a 50 per cent. solution, from 80° to 50°, and for a 20 per cent. solution, 40° to 50°.

When impure solutions of saccharose are used, not only the sugar, but the non-sugars react, the lead oxide forming principally basic salts of lead, alkalis being liberated. This action is prevented by previous addition of potash or soda, and even dilute solutions may be desaccharified more quickly and completely if a small quantity of alkali be added and the temperature be not too high.

Ordinary beetroot molasses require 1 to 2 per cent. KOH and 75 per cent. of yellow oxide of lead calculated on the

molasses. Without heat the sugar is removed so completely in two hours that the liquor becomes levo-rotatory. The same result is reached in less than five minutes by employing 100 per cent. of PbO. Molasses containing 50 per cent. of sugar requires theoretically 66⅔ per cent. If the oxide of lead be not properly calcined—that is, if it is too hard, or if it be of a dark-yellow instead of a lemon-yellow colour—its efficiency may be reduced to 20 per cent., and the more so as it contains more of the red oxide.

To complete the reaction, it is merely necessary to stir until the mixture becomes homogeneous; as soon as it begins to thicken, its viscosity prevents further mixing. Methods of obtaining PbO in the wet way are also given.

The saccharate is next purified by filtration, after dilution with water at 10° to 50°. Above 60° the quantity of sugar dissolved, increases rapidly with the temperature. The washed lead saccharate is decomposed by saturation at 70° to 80° C. with carbonic acid gas, taking care to maintain the gas in intimate contact with the saccharate by suitable agitation. As the sugar passes into solution, the mixture becomes more fluid, and when saturation is complete, the volume of the deposit has diminished by a third. The final point of saturation is determined, not by titration, but by the polariscope, the current of gas being interrupted when the sugar content ceases to increase, the lead precipitate having still a strongly alkaline reaction. A further supply of gas would set at liberty non-sugars and reduce the quotient of purity.

The decomposition of the lead saccharate may be advantageously combined with other operations. It has been previously proposed to prepare lead saccharate from pure sugar, and to treat with the saccharate the juice to be separated, and to precipitate the excess of lead by sodium-calcium phosphate, but it is not necessary to have recourse to pure sugar.—L. J. de W.

Arabinose, Action of Water and Acids on, at an Elevated Temperature. Berthelot and G. André. Comptes rend. 1896, 123, 625—631.

The following observations were made:—

1. Dilute aqueous solutions of arabinose are not decomposed when cautiously boiled. If heated, however, to 200° C. in a sealed tube, furfural is produced in considerable amount (30 per cent.).

2. Arabinose, when heated to 100° C. in a sealed tube with hydrochloric or phosphoric acid, yields a large (15—55 per cent.) proportion of blackish humin substances (humine acid), and as by-products, variable quantities—depending somewhat on the concentration of the mineral acid employed—of carbon dioxide (1—2 per cent.), carbon monoxide ("traces" to 1.6 per cent.), formic acid (1—3 per cent.), and fixed acids. The humin substance formed, closely resembles in composition, &c., that obtained by the action of acids on glucoses, or by the polymerisation of furfural. Similar results, as regards products formed, were obtained by submitting gum arabic to the action of acids.

3. Pure furfural, when treated as under (2), yields 82—85 per cent. of humin substance, and traces of CO₂, CO, HCO₂H, &c.

4. Arabinose, on distillation with diluted phosphoric acid, yields, besides furfural (the authors have obtained up to 14 per cent.), carbon dioxide. The latter is continuously evolved during the whole time of distillation, and is formed in maximum amount (6 per cent.) when the operation is effected slowly and spread over a long period of time. In addition, a considerable percentage of humin substance is formed, and distinct proportions of volatile and fixed organic acids.—H. T. P.

Steffen's Sulphuration Process. Bauman. Centralbl. für die Zuckerind. der Welt, June, 1896.

The Steffen-Drucker process consists in passing a current of sulphurous acid gas through a saturated juice to the point of strongly acid reaction, and then filtering through powdered animal charcoal. In order to prevent inversion, the juices are kept, so long as they are acid, at a temperature of 30—40° C., and it is claimed that decoloration, boiling, and centrifugalising are alike favoured by the acidity of the juices. Experiments have been carried out on various

juices, and it is said that in general the use of sulphurous acid produces better coloured massecuites, but increases the ash, and does not alter the purity or non-sugar content of the juice. It is possible that the filtration of acid juices through charcoal eliminates a portion of the viscous matter, and so accounts for the easier boiling and slightly increased *rendement* as compared with the other processes. Any advantages, however, are counterbalanced by the cost, as the char, by reason of its acidity, cannot be revived or employed in the manufacture of manures. Amongst other drawbacks during evaporation, acid sulphite of calcium is deposited on the heating tubes, the calorific power being thereby diminished.—J. L. B.

Silica, On the Origin of, in Incrustations and Deposits in Beet-Sugar Works. The Solubility of Silicate of Lime and of Silica in Sugar Solutions. J. Weiβberg. Bull. Soc. Chim. de Paris, **15**, [18—19], 1097—1100.

THE incrustations in evaporating apparatus and deposits on filter-cloths of beet-sugar works show a greater quantity of silica than is accounted for by that contained in the diffusion juice, which showed on analysis only 10 mgrms. of SiO_2 per litre of juice at 7°B . The other possible sources are the limestone, the coke, and the masonry of the lime-kilns, which may introduce silica and silicate of lime into the juice from the milk of lime used in defecation.

The author finds that both calcium silicate and silica, prepared by precipitation and air-dried, are more soluble in solutions of sugar than in water, and that the solubility is increased by heating to boiling, by increasing the concentration, and by passing a current of carbonic acid gas. When the silica is previously calcined, somewhat less is dissolved.

A 10 per cent. solution of sugar, heated to boiling with an excess of calcium silicate, subjected to the action of carbonic acid gas for five minutes, and filtered hot, contained 0.0365 per cent. of CaSiO_3 .—L. J. de W.

Melzitose, Hydrolysis of, by Soluble Ferments. E. Bourquelot and H. Hérissey. J. de Pharm. et de Chim. 1896, **16**, 385.

See under XXIV., page 835.

Starch, A Study of Methods for the Determination of. H. C. Sherman. School of Mines Quart. 1896, **17**, [4], 356.

See under XXIII., page 832.

Aldazine, Ketazine, and the Benzozones of Aldoses and Ketoses. E. Davidis. Ber. 1896, **29**, 2308.

See under XXIV., page 835.

Defecated Liquors, Precipitation of Lead in. Zamaron. Bull. de l'Assoc. des Chim. de Suer. et de Dist. 1896, **14**, 181.

See under XXIII., page 832.

Beetroot Juice, Determination of Free Alkali in. J. Corraut. Bull. de l'Assoc. des Chim. de Suer. et de Dist. 1896, **14**, 182.

See under XXIII., page 832.

Basic and Neutral Lead Acetate, Influence of, upon the Polarisation of Sugars. H. Pellet. Bull. de l'Assoc. des Chim. de Suer. et de Dist. 1896, **14**, 131.

See under XXIII., page 831.

Raw Sugars, Determination of Water in. Herzfeld. Sugar Cane, 1896, [321].

See under XXIII., page 832.

Polarisation, Influence of Temperature on. [Sugar.] F. Sachs. Zeits. Ver. Rübenzuckerind. 1896, **46**, 264.

See under XXIII., page 831.

Hydrometer with Correction Scales. [Sugar Solutions.] Volquartz. Zeits. Ver. Rübenzuckerind. 1896, **46**, 392.

See under XXIII., page 829.

PATENT.

Molasses, Syrup, or other Solution of Sugar, an Improved Method of Purifying, by Means of Animal Charcoal. C. F. Kastengren, Stockholm. Eng. Pat. 18,138, Aug. 15, 1896.

It is claimed that, by means of pressure, the purification of sugar solution with the help of animal charcoal may be effected in a shorter space of time, and with the employment of less animal charcoal, than by the ordinary filtration process. The sugar solution is heated with animal charcoal in a closed vessel to from 105° — 130° , or even higher, until the desired degree of purity is obtained. The purification may also be effected below 100° , and even as low as 50° , and in this case compressed air is made use of.—A. K. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

Fermenting Yeast, Influence of Oxygen on. R. Rapp. Ber. 1896, 1893.

CHUDIAKOW (this Journal, 1895, 290) found that on passing a stream of oxygen through a fermenting sugar solution, the fermentation was gradually stopped, but that a stream of hydrogen did not affect the course of the fermentation. From these and other experiments Chudiakow deduces certain theoretical conclusions on the nature of fermentation.

The author has repeated these experiments, using pure yeasts, but with results contrary to those of Chudiakow; he, however, finds that a very vigorous stream of either hydrogen or oxygen will stop the fermentation, and this he considers to be a mechanical effect, as vigorous shaking has the same result.

The author concludes from his experiments that the presence of oxygen is necessary for the increase of the yeast, but not for the exercise of its fermenting power.

—A. L. S.

Sugars, Production of Carbon Dioxide during the Decomposition of. [Bearing on Fermentation, &c.] Berthelot and André. Comptes rend. **123**, [16], 567.

See under XVI., page 821.

Beer, Japanese. C. Makel. Wochenschr. für Brau. **13** [41], 1036.

THE following is an analysis of the first sample of Japanese beer that has been seen in Germany. The bottle bears a label carrying in Japanese and Roman characters the inscription "Yebisu." Japan Beer Brewery Co., Meguro-mura, Tokyo, Japan. The beer was brewed by a German brewer:—

Specific gravity, 3.12° Balling; alcohol, 4.56 per cent.; extract, 5.23; maltose, 1.29; dextrin, 2.41; total acidity (as lactic acid), 0.161; albuminoids (nitrogen $\times 6.25$), 0.491; ash, 0.222; phosphoric acid, 0.051; glycerin, 0.126; original gravity, 13.98° Balling; apparent attenuation, 77.7 per cent.; real attenuation, 62.6 per cent.

The beer was of a clear gold-yellow colour, bright, with a fair amount of a white, flocculent sediment, rich in carbonic gas, holding a good head, and, allowing for the pasteurised flavour, of a clean, vinous, and pleasant taste. Microscopic examination showed the presence of albuminous matter only.

—J. G. W.

Vinegar, White-Wine. A. H. Allen. Analyst, 1896, **21**, 253.

WHITE-WINE vinegar was originally understood to mean a vinegar made from wine derived from white grapes, but of late years, distilled malt vinegar or simply diluted acetic acid has been very commonly sold in its place. Genuine white-wine vinegar always contains a notable quantity of acid potassium tartrate, which is not present in vinegar from other sources. Fourteen samples purchased from pharmacists in Midland towns were found to consist of either dilute

acetic acid or distilled malt vinegar. White-wine vinegar has the colour of sherry. It has a vinous aroma and peculiar flavour.—A. S.

Salicylic Acid, Quantitative Determination of. F. Freyer. Chem. Zeit. **20**, 820.

See under XXIII., page 834.

PATENTS.

Waste Products [Spent Hops, Grains, &c.] from Breweries, Distilleries, Vineyards, &c.: Improved Methods of Utilising. J. Bradbury, Salford. Eng. Pat. 17,611, Sept. 21, 1895.

APPLIANCES are described for drying spent hops, grains, and other waste products, and thereby rendering them suitable for litter, and in some cases for cattle food, whilst in other cases the products are submitted to destructive distillation, the gas and acid distillate being collected, whilst the resulting vegetable charcoal is suitable for foundry use.—A. K. M.

Yeast, Impts. in the Manufacture of. [Peptonising Ground Grain with Spent Wash.] J. H. Folkerts, London. Eng. Pat. 18,296, Oct. 1, 1895.

A MASH is prepared from malted and unmalted grain, and, after saccharification of the starch, some spent distillers' slt is added, whereby the albuminoid matters are peptonised and rendered more suitable for yeast food. The rt is then separated, run into aerating vats, and fermentation started by the addition of yeast; the outcrop is separated in the ordinary way. The "grains" from the above operation are put into a vat with some yeast and moistened with sufficient spent wash or yeast washings to render fermentation possible. Afterwards the fermented wort (after removal of the yeast) is added, the whole distilled, and the residual spent wash is used for a future operation.—A. K. M.

Beer, Impts. in the Preparation or Treatment of. [Priming.] R. Free, Mistley, Essex. Eng. Pat. 20,130, Oct. 25, 1895.

A CONCENTRATED diastatic malt extract is prepared, diluted for use to a gravity of about 1.145 to 1.50, and added to the finished beer, generally in the proportion of about one to four pints to the barrel, according to the gravity of the beer and the purpose it is intended to serve. The malt extract may be used either alone or in conjunction with other priming materials; it imparts an improved flavour to the beer, and also brings the latter more rapidly into condition.—A. K. M.

Wort, A Process for the Aëration, Oxidation, and Oxygenation of. J. B. Grisez, Lachapelle-sous-Rougemont, France. Eng. Pat. 22,035, Nov. 19, 1895.

THE process consists in injecting filtered air into the hot wort as the latter enters the closed refrigerator, the wort being thus protected from atmospheric germs, whilst the aëration is more thorough than in the ordinary process.

—A. K. M.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Cocoanut Butter and Cows' Butter, Comparative Digestibility of. Benrat and Jean. Comptes rend. **123**, [16], 587—590. (See also this Journal, 1896, 747.)

THE experiments were made on the human subject, each series lasting 5½ days, during which time 175.482 grms. of fat were supplied in the food, the remainder of the nutrient materials being arranged according to the albuminoid ratio most approved by physiologists. The total alimentary matter amounted to 15.770 kilos., representing 3.743 kilos. of dry matter, containing 80.233 grms. of nitrogen and 1534.293 grms. of carbon.

The actual amounts of fat digested were found to be: cocoanut butter, 463.03 grms.; cows' butter, 455.65 grms., or respectively 98 per cent. and 95.8 per cent. of the total fat supplied, thus demonstrating the superior digestibility of the former, and as the cocoanut butter employed had been pressed, and deprived of the greater portion of its soluble volatile glycerides, it is evident that the high ratio of digestibility of cows' butter is not due to its content of these, as formerly supposed.—C. S.

Zinc, Determination of, in Foods. Janke. Chem. Zeit. 1896, **20**, 800.

See under XXIII., page 832.

Boric Acid, Estimation of. [Foods, &c.] Schneider. Chem. Zeit. 1896, **20**, 822.

See under XXIII., page 830.

Casine in Milk, A Rapid Volumetric Method of Determining. Denigès. Bull. Soc. Chim. **15**, [18—19], 1116.

See under XXIII., page 832.

PATENT.

Protection of Sterilised Liquids. F. T. Bond, M.D., Gloucester. Eng. Pat. 20,328, Oct. 29, 1895.

THE liquid is sterilised by heat in the vessel in which it is to be stored, round the neck of which is a rim.

Whilst still hot a tightly fitting india-rubber capsule is slipped on over the rim. On cooling, the unsupported part of the capsule is forced inwards by atmospheric pressure, and will remain in this position so long as the contents of the vessel are sterile.

Should fermentation take place the gases given off will force the capsule outwards.—R. B. P.

(B.)—SANITATION; WATER PURIFICATION.

Dangerous Gases [Chemical Works], Rules suggested by the Chemical Trade Journal for dealing with. Chem. Trade J. 1896, **19**, 250.

General Regulations.—No person must enter any boiler or tank which has been recently used for the storage of any poisonous liquid or gas, or enter any dangerous workings, drain, sewer, culvert, gas purifier, flue, vitriol chamber, or tower (whether closed or open), except under the following conditions:—(1.) A respirator, properly charged and in good condition, must be worn. If the atmosphere is wholly irrespirable, a safety-pipe and face-piece supplied with air or oxygen must be substituted. (2.) The person entering must be efficiently secured round the waist by a rope, the opposite end of which must be securely fastened to the ground at the surface, or at the top of the tower or flue, &c. (3.) A man must be in attendance and ready to render assistance if necessary. For underground work and in difficult positions, two men must be in attendance.

When a man is gassed, remove as quickly as possible into the open air, and place in a well-ventilated position and keep as warm as possible. In bad cases use the oxygen bottle and lung exercise simultaneously, from the outset.

Use of Oxygen Bottle.—If conscious, let the oxygen flow in a gentle stream through the glass tube which is placed in the mouth, and let it be breathed until relief is obtained. If unconscious, place the oxygen delivery tube in one corner of the mouth, and close the lips round it. Keep the oxygen flowing in a gentle, continuous stream, alternately closing and opening the nostrils to inflate and deflate the lungs. (Gently pressing the chest when the nostrils are open assists the deflation.) If the teeth are set, close the lips, insert the oxygen tube in one nostril, and alternately close and open the other in the manner just described. Complete inflation of the lungs is indicated by the blowing out of the cheeks. Carefully avoid too great a pressure in the lungs.

Artificial Respiration.—This is not often necessary, but if the oxygen does not act within a reasonable time, use the following additional help to respiration:—Lay the body at full length, face upwards, slightly raising the shoulders, and

letting the head fall well back. Loosen the clothing round the neck and chest. Grasp the arms above the wrist and steadily draw them straight out above the head, holding them there for two seconds. Then turn the arms down, bending the elbows, and at the same time pressing them firmly against the sides of the chest, and hold them in that position for two seconds. Continue this treatment about 15 times a minute for 20 minutes without cessation, or until consciousness is restored.

The following gases, according to the frequency of their occurrence, are roughly arranged in order of danger:—

Nitrous and Nitric Acid Fumes.—Very insidious in their action. Can be inhaled at first without great inconvenience, but sooner or later (sometimes after several hours), they react acutely, producing symptoms that need very prompt treatment. When there is any suspicion of gassing, remedial measures should always be adopted, whether there is any distress or not, and careful watching is advisable during the ensuing 12 hours. The gases are met with in Gay-Lussac towers and vitriol chambers during repacking or cleaning, and also in the manufacture of nitrate of iron and nitric acid, and all breakages of vessels containing this acid. In the case of Gay-Lussac towers, the bottom or top of the tower should be temporarily connected to the flue, to create and maintain a steady draught away from those engaged in unpacking. Vitriol chambers should be worked weak for some time, and well steamed and ventilated before opening.

Sulphuretted Hydrogen and Chlorine.—Sulphuretted hydrogen is one of the most dangerous gases, insensibility resulting very suddenly with even small quantities. Oxygen is the best restorative. The gas occurs in gas liquor-storage wells, gas purifiers, sulphate stills and saturators, and in sewers (in conjunction with carbon dioxide). In the case of an unexpectedly copious outburst, "the absorbing respirator" acts well. Owing to the smell and colour of chlorine, bad cases with this gas can only be due to gross carelessness. The instantaneous and continued use of all possible remedies is recommended. The "gas mixture" should be administered at once, and can be followed with oxygen whiffs, whiskey, or hot tea, with a view of inducing free perspiration. Chlorine occurs about bleaching powder chambers, manganese stills, and Deacon and other chlorine plant.

Carbonic Oxide and Carbon Dioxide (after damp and choke damp).—The former is the more dangerous, being a direct poison. It occurs in colliery workings after explosions, gas producers, blast furnace gases, and in the manufacture of calcium carbide. In cases of gassing with this, and also with carbon dioxide, longer treatment is necessary, as the lungs have to be cleared by displacement, and the use of oxygen may be supplemented by the lung exercise. Carbon dioxide occurs in the same places as sulphuretted hydrogen and also in the fermentation rooms in breweries, in coal pits, old workings, disused wells, &c.

Hydrocyanic Acid Gas and Arseniuretted Hydrogen; Hydrochloric Acid Gas and Sulphur Dioxide.—The first two are not of very frequent occurrence. Oxygen should always be kept handy, where their formation and escape are possible. With hydrochloric acid and sulphur dioxide, virtually no accidents have been recorded.—A. S.

Accidents and Dangers in Dye, Print, and Bleach Works.
Albrecht. *Leipziger Färber Zeit.* 45, [10], 439.

A discussion of the hygienic conditions of dye, print, and bleach works, and the dangers as to accidents and poisoning to which the workpeople are exposed, with suggestions for their prevention.—I. S.

(C.)—DISINFECTANTS.

PATENT.

Disinfectants and Antiseptic Compounds, Impts. in the Manufacture of. C. C. Whitaker, East Dulwich, London.
Eng. Pat. 22364, Nov. 23, 1895.

The patentee mixes pyridine bases or their salts with sodium carbolate or cresylate in aqueous solution, saturates the mixture with carbolic or cresylic acid, and adds to the aqueous portion, which he separates, from 0.5 to 1 per cent. of β -naphthol. This disinfectant, which is to be employed

as an insecticide or a sheep dip, can be obtained in a solid form by mixing from 5—20 per cent. of the solution with powdered chalk, gypsum, or other suitable material. The name "Deodo" is to be applied both to the solid and liquid material.—T. A. L.

XIX.—PAPER, PASTEBOARD, Etc.

Wood Pulp in Paper, Some Methods for the Detection and Estimation of. Wood Pulp, 1, [3], 1896, 61.

See under XXIII., page 833.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Hydrogen Peroxide [Keeping Powers]. Vulpinus. *Chem. Zeit.* 1896, 20, 795.

Portions of hydrogen peroxide solution of 3.27 per cent. strength, containing a little free sulphuric acid, were kept for 120 days under different conditions. In all cases the strength was reduced. The percentage in the sample kept in the dark in a full bottle was reduced to 2.71; in a half-filled bottle in the dark to 2.62; and in the light to 2.54; all these bottles having the inner surface covered with a layer of paraffin to obviate the effect of the glass surface. In bottles not paraffined, but filled with broken glass, the percentage had become, in a full bottle in the dark, 2.67; in the light, 2.5; in a half-filled bottle in the dark, 2.5; and in the light, 2.45. By no precautions could the decomposition of these solutions be prevented, but in no case did the percentage fall so low as the minimum of 2.15 allowed by the German Pharmacopœia.—A. C. W.

Mercury, Action of Ferric Chloride upon. P. Süß.
Pharm. Central-Bl. 1896, 17, 547.

LAURENZ had proposed to prepare mercury for use in mercurial ointment by shaking the metal with ferric chloride solution; but as this gives rise to a production of calomel, the method does not work satisfactorily. It is, however, suggested as very possible to utilise the reaction for the production of pure calomel, with the aid of a centrifugal machine and a gauze sieve.—W. G. M.

Alkaloids of Corydalis Cava. H. Ziegenbein. *Chem. Central-Blatt.* 1896, 2, 792.

FROM 10 kilos. of tubers were obtained, by the method of Freund and Josephi, 57 grms. of corydaline, 41 grms. of bulbocapnine, 6 grms. corycavine, and 4 grms. corybullbine. Corytuberine and corydine (Dobbie and Laufer) were not found. On account of the different statements made as to the properties of these alkaloids, very pure preparations were studied.

Corydaline, $C_{22}H_{27}NO_4$, easily soluble in warm alcohol and chloroform, when crystallised from alcohol, forms large transparent prismatic crystals of melting point 134° — 135° . The alcoholic solution on heating, acquires a yellow colour; nevertheless, from the yellow solution colorless crystals of the base separate. Both the crystals and alcoholic solution are coloured yellow by light. Alkalis and alkaline carbonates precipitate the alkaloid from aqueous solution of its salts, and the precipitate is not soluble in excess of either. The hydrochloride could not be obtained crystalline, the hydrobromide $C_{22}H_{27}NO_4 \cdot HBr$ and hydriodide crystallise from water in strongly refractive rhombic crystals, the latter turning yellow in the air. The nitrate, $C_{22}H_{27}NO_4 \cdot HNO_3$, crystallises from alcohol in shining tables of melting point 198° , soluble with difficulty in hot water.

Iodine only reacts completely with corydaline in alcoholic solution, on heating in a closed vessel on the water-bath. After removal of iodine in excess and that combined as periodide, by addition of potassium iodide, sodium bicarbonate, and finally thiosulphate, dehydrocorydaline hydriodide, $C_{20}H_{23}NO_4 \cdot HI + 2H_2O$, crystallises out of the solution. This salt recrystallised from alcohol, forms small yellow needles unaffected by light, very soluble in hot

alcohol, slightly so in cold alcohol, and very little in hot water. Dehydrocorydaline hydriodide boiled with acetone and water, on addition of excess of caustic soda, gives an acetone compound, which, by the action of hydrochloric acid, forms the hydrochloride. Chloroformdehydrocorydaline, $C_{22}H_{23}NO_4 \cdot CHCl_3$, obtained by warming the foregoing hydriodide with water, chloroform and caustic soda, does not lose weight at 100°.

Bulbocapnine, $C_{22}H_{23}NO_4$, by treatment with iodine, forms a black periodide, which does not decompose as does the corresponding corydaline compound. Heated with methyl-iodide under pressure, the compound $C_{22}H_{23}NO_4 \cdot CHI_3$ was formed, of melting point 235–240° (Frennd gives 257°).

Corycavine, $C_{22}H_{23}NO_4$, rhombic tables, very sensitive to the action of light, melting point 215°–216°, precipitated by alkalis and alkaline carbonates, and insoluble in excess of the reagent, much less soluble in alcohol than corydaline. $C_{22}H_{23}NO_4 \cdot HCl$ crystallises from hot water in thick colourless needles uniting to rosettes.

Corybulbine, $C_{22}H_{23}NO_4$, had the properties described by Dobbie and Lauder, but the melting point 238°–239° C., $C_{22}H_{23}NO_4 \cdot HCl$, yellow prismatic needles, soluble with difficulty in hot water, more readily in presence of hydrochloric acid. The base reacts with iodine to produce $C_{22}H_{23}NO_4 \cdot HI$, lemon-yellow needles.

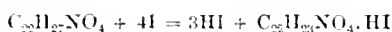
Behaviour of the bases towards different reagents:—

	Corydaline.	Dehydrocorydaline.	Bulbocapnine.	Corycavine.	Corybulbine.
Conc. H_2SO_4	After long time red and violet.	..	Orange, after 10 minutes violet.	Dirty green, brown, violet.	..
Conc. H_2SO_4 at 100	Yellow	Yellow	Violet	Dark green	..
Conc. HNO_3	Yellow	Yellow	Reddish-brown	Red	Yellow
Erhmann's reagent	Yellow, green, violet.	Yellow, green, violet.	Blue, bluish-violet	Dirty green	Yellow
Froehde's reagent.....	Yellow, pale green, fine blue.	Yellow, blue	Dark blue	Dark green	Red, brown, green
Sulpho-vanadic acid.....	Yellow, green, blue.	Yellow, green, blue.	Bright blue, blue	Dark green	Brown, green

— A. C. W.

Corydalis Alkaloids. E. Schmidt. Chem. Centralblatt. 1896, 2, 792.

DEHYDROCORYDALINE is obtained by the action of iodine on corydaline—



the same reaction is given by canadine and hydroberberine, and by corybulbine $C_{22}H_{23}NO_4$ only, of the remaining corydalis alkaloids. Dehydrocorydaline, $C_{22}H_{23}NO_3$, like berberine, forms compounds with acetone, chloroform, and hydrogen polysulphide, is reduced by nascent hydrogen to a colourless base of the same composition and melting point as corydaline, but forms a different double salt with gold chloride. Bulbocapnine and corycavine were also isolated from corydalis tubers.—A. C. W.

Arginine. M. Quiroga. J. Pharm. Chim. 1896, 16, 293.

This alkaloid is contained in the different parts of a species of laurel, called by the natives *vivaró-mi*, growing in the country to the east of the Argentine, and the west of Brazil. Arginine is extracted from the dried and powdered material by ordinary methods. It forms prismatic crystals, unaltered in the air, with a bitter taste, soluble in chloroform and benzene, and slightly soluble in ether, petroleum spirit, and water. The aqueous solution slightly acidified with hydrochloric acid, gave the following reactions:—With bromine vapour, a white precipitate, soluble in water; with ammonia, caustic soda or potash, sodium carbonate, and bicarbonate, a white precipitate, soluble in excess (the precipitate produced by caustic potash is turned a reddish-brown by hydrochloric acid); with fuming nitric acid, a carmine red coloration; with ferric chloride, a blood-red coloration; with gold chloride, a yellow precipitate, which is then reduced, giving violet, carmine, blue, and black colorations; with platinum chloride, a crystalline precipitate; with solid potassium bichromate, an intense carmine is produced, destroyed by sulphuric acid; with potassium ferrocyanide, a light blue colour, destroyed by excess of the reagent; with Millon's reagent, a red coloration, changing to carmine violet. With Fehling's solution no change occurs.

The bark and cambium contain 1.5 to 1.6, the wood and leaves 0.042–0.05 per cent. of the alkaloid. It may be determined by Meyer's reagent, 1 c.c. of which corresponds to 0.0135 grm. of arginine.

Arginine is used successfully to "combat certain diseases of microbial origin." It has given satisfactory results as a tonic.—A. C. W.

Taxine, Extraction and Purification of. Vreven. Pharm. J. 1896, 4, 215. Bull. Gén. de Thérap. Sect. Pharm. 1, 261. Pharm. J. 4, 1896, 215.

THE author extracted this alkaloid from yew leaves as follows:—Fresh yew leaves, cut up small, are extracted with water acidulated with tartaric acid, the extract evaporated on a water bath to a small bulk, mixed with sufficient sand to form a paste, and then exhausted with a mixture of equal volumes of water and alcohol in successive portions. This extract is filtered, evaporated, rendered alkaline with ammonia, and shaken out with benzene. The solvent separates fairly well from the emulsion formed by the ammonia, on the addition of a little alcohol. The benzene extract is partially distilled, and on cooling, throws down a trace of precipitate, apparently alkaloidal, but not taxine. This is filtered off, and the taxine shaken out from the residual benzene with dilute hydrochloric acid. The acid solution gives with ammonia a plentiful precipitate, which is taken up with ether. The ethereal solution on evaporation leaves the impure taxine as a hard yellowish amorphous mass, giving a red coloration with sulphuric acid, and a slight blue tint with nitric acid, passing on to blue on contact with fuming hydrochloric acid. The alkaloid is further purified by redissolving in hydrochloric acid and precipitating with an excess of ammonia, being allowed to stand in contact with the latter for 12 hours. The taxine subsides, leaving a greenish liquid, which is decanted and filtered. The alkaloid remaining behind, does not give a green coloration on again macerating with ammonia; it still gives the characteristic reaction with sulphuric acid, but no longer with nitric or hydrochloric acid.

So far as colour and alkaloidal reactions would indicate, it would seem that the yew leaves contain more than one alkaloid.—A. S.

Essential Oils. Dnyk. J. Pharm. Chim. 1896, 4, 359.

THIS is a continuation of the article abstracted in this Journal, 1896, 739–740.

Lemon-grass Oil is composed almost entirely of citral. To separate this constituent, shake with concentrated bisulphite of soda solution, press the crystalline mass, and wash with ether to remove geraniol; decompose with dilute sulphuric acid, separate the citral, wash and dry.

Artificial Essence of Violets (Ionone).—The odour of the violet is very similar to that of iris root, the odoriferous principle of which Haarmann and Reimer have shown to be the ketone, $C_{15}H_{26}O$, which, by the action of dehydrating agents, is converted into the hydrocarbon $C_{15}H_{24}$. Tiemann

and Krüger have obtained an isomer of irone, ionone, which has the odour of the violet. (See this Journal, 1894, 272, and 1895, 827.)

Geranium Oil is the name by which essences derived from very different sources, characterised by the presence of geraniol, are known. True geranium oil has a density of 0.894, and a rotation of -8.12 to 9.55 . Palmarosa oil has the same density and a rotation of -1.55 . Geraniol is non-rotatory, and of density 0.8835. After acetylation its index of saponification is 2.872 (Schimmel). It may be extracted from these essential oils by mixing them with powdered anhydrous calcium chloride, crushing the resulting solid compound, washing with ether, and decomposing by water. Réniol is another alcohol always found together with geraniol in geranium oils, and the mixture of the two alcohols constitutes the rhodinol of Barbier and Bouveault (this Journal, 1896, 292, 373, 469). Geraniol is also found in essence of roses. Schimmel's artificial essence of roses is obtained by distilling 1 kilo. of geraniol over 500 kilos. of rose petals.

Otto of Roses.—The value of this oil is now fixed by its content of stearoptene; but this substance is odourless, and so cannot increase the quality of the essence. The statement of certain authors that the stearoptene will change by gentle oxidation into the eleoptene cannot be practically confirmed. Pure Turkish otto contains 9–13 per cent. of stearoptene, and melts at 16° – 21° . German otto contains 26 per cent., and melts at 27° . Other pure samples, and especially French, have a lower melting point; thus the melting point is no criterion of purity. A relatively high melting point might indicate adulteration with paraffin, spermaceti, &c., and a low melting point with other essential oils, such as geranium oil. The solid otto of roses should be spangled with crystalline plates, which, on melting by the heat of the hand, should rise to the surface of the liquid. The stearoptene obtained by dissolving in chloroform, adding alcohol of 75 per cent. strength, washing and drying, should have a constant melting point. The addition of strong sulphuric acid to five drops of otto produces a thick reddish-brown mass, which, in the absence of essences of geranium, &c., will not evolve any acid tarry odours. The pure essence has a density of 0.865–0.880 at 20° , and contains the same mixture of geraniol and réniol (roseol) which has been called rhodinol.—A. C. W.

Eucalyptus Kinoo, Aromadendrin or Aromadendric Acid from the Turbid Group of. H. G. Smith. Journ. Royal Society, N.S. Wales, 1896, 135.

In a former investigation the author and J. H. Maiden found that the turbidity produced on cooling a solution of the kino of *Eucalyptus hemiphloia* in hot water was due to the presence of two bodies, to which the names eudesmin and aromadendrin were given. In the kino of *E. calopylla* the latter body occurs free from eudesmin. To extract aromadendrin, the finely-powdered kino is mixed with a little water, and extracted by ether, and the residue, after evaporation of the solvent, recrystallised from absolute alcohol.

Aromadendrin is readily soluble in ether, acetic ether, alcohol, and amyl alcohol; almost insoluble in chloroform; and quite insoluble in benzene and petroleum spirit. From any of the solvents mentioned it crystallises in acicular radiating tufts, it is soluble in hot water and in 2,777 parts of cold water. Analysis indicates the formula $C_{25}H_{36}O_{12}$ for the anhydrous substance; it crystallises with three molecules of water, two of which are lost at 100° and the third between 100° and 120° C.

The following table shows the difference between aromadendrin and eudesmin:—

	Eudesmin.	Aromadendrin.
H_2SO_4 , conc.	Dark solution, purple after half an hour.	Yellow solution, turning dark, and fading. Orange on heating.
HNO_3 , conc. or fuming.	Yellow solution, from which yellow crystals separate.	Fine crimson solution.
KOH	Little change	Fine yellow solution, colour persistent.

	Eudesmin.	Aromadendrin.
Glacial acetic acid	Dissolves. On addition of little water solution becomes turbid and then crystallises.	Dissolves. No turbidity on addition of water. Tufts of crystals on standing.
Melting point ...	30° C. either on surface of mercury or in glass tube.	216° C. (uncorr.) on surface of mercury. Determination in tube unsatisfactory.
Heated between watch glasses.	Melts at low temperature to clear liquid. Chars very slightly.	Melts at high temperature, and darkens at once. Chars quickly.
Chloroform	Readily soluble	Almost insoluble.
Formula	$C_{26}H_{36}O_{12}$	$C_{25}H_{36}O_{12}$ after heating to 120° . $C_{15}H_{26}O_{12} + 3H_2O$ when air-dried.

The strong solution of aromadendrin in hot water reddens litmus, gives a dense yellow precipitate with lead acetate, which contains 45 per cent. PbO or 2 atoms of lead in the molecule; with copper sulphate a light greenish precipitate is formed. Gold chloride, silver nitrate, and Fehling's solution are readily reduced; gelatin gives no precipitate; ferric chloride a purplish brown colour; alkalis a yellow to orange coloration. When boiled with copper sulphate or potassium bichromate and cotton, no colour is imparted to the latter. Aromadendrin, though similar to catechol in many respects, yet differs from it in others. Heated in glycerine it does not form pyrocatechol, but a yellow resinous substance, which can be extracted by ether, and has great tinctorial powers.—A. C. W.

Cacti, Chemical Characteristics of. Heffter. Chem. Zeit. 1896, 20, [81], 796.

Anhalonium Williamsii.—The fresh plant contains 0.9 per cent. of the alkaloid pellotine, $C_{11}H_{12}N(OCH_3)_2.OH$, a tertiary base. Pellotine, its salts, and double salts crystallise well; its action is hypnotic. Traces of a volatile alkaloid, also malic acid, and quercite, have been found in the plant (this Journal, 1895, 384; 1896, 554).

Anhalonium Lecinii.—This is botanically identical with the last species, but not chemically. It contains 0.5–0.6 per cent. of anhalonine, $C_{12}H_{13}NO_3$, which crystallises well, is levo-rotatory, and is also a hypnotic. It contains one methoxyl group. The plant contains in addition mescaline, $C_{11}H_{17}NO_3$, anhalonidine, $C_{12}H_{17}NO_3$, lophophorine $C_{13}H_{17}NO_3$, malic acid, and much potassium chloride. Lophophorine is a powerful convulsant.

Anhalonium fissuratum contains 0.02 per cent. of anhaline, $C_{10}H_{17}NO$, which gives a green coloration with nitric acid.

Anhalonium prismaticum contains a little of a very poisonous alkaloid not yet investigated.

A. Jourdanianum, a very powerful alkaloid, causing convulsions. Many other cacti have been shown to contain traces of alkaloids.—A. C. W.

Bismuth Salicylate, Testing of. [Free Salicylic Acid.] Pharm. J. 1896, 4, 215.

See under XXIII., page 834.

Nitrites, Detection of, in presence of Sulphites. Some Colour Reactions of Brucine. P. Pichard. Comptes rend. 123, [16], 590.

See under XXIII., page 820.

Formaldehyde, Detection and Quantitative Estimation of. F. C. J. Bird. Pharm. J. 1896, 57, 269.

See under XXIII., page 833.

Morphine in Opium, Determination of. G. Loof. J. Pharm. Chim. 1896, 16, 312.

See under XXIII., page 831.

PATENTS.

Hexamethylenetetramine, Manufacture of a Compound of Salicylic Acid and. O. Imray, London. From "The Farbwerke vormals Meister, Lucius and Brüning," Höchst a. M., Germany. Eng. Pat. 22,181, Nov. 25, 1895.

THE two substances mentioned in the title, when boiled together in molecular proportions in benzene, combine to form a new compound: 1.38 kilos. of salicylic acid, and 1.4 kilos. of hexamethylenetetramine are boiled with sufficient benzene to obtain a clear solution. The new compound separates out on cooling, and is filter-pressed and dried. It dissolves easily in water or alcohol, but is less soluble in ether, petroleum ether, or benzene, and melts at 95° C.—T. A. L.

Iodoform, New and Useful Bodies derived from. A. Kiehngrün, Bonn, Germany. Eng. Pat. 21,203, Nov. 8, 1895.

IODOFORM combines with hexamethylenetetramine and its alkylaloid derivatives, forming additive compounds, which easily decompose, liberating iodoform. To a solution of 14 grms. of hexamethylenetetramine in absolute alcohol is added 39.4 grms. of iodoform and the mixture is heated for a short time on the water-bath. The fine white powder of the compound, $C_6H_{12}N_4 \cdot CHI_3$ (iodoformin), separates out, being insoluble in water, ether, or alcohol. It melts at 178° C. In place of hexamethylene-amine, 23.4 grms. of phenolhexamethylene-amine may be taken, when the same compound is formed. If, however, 29.6 grms. of ethyl iodide-hexamethylenetetramine, and 39.4 grms. of iodoform be heated in an alcoholic solution for a short time, crystals are deposited, which consist of iodoformethylhexamethylene-iodide (iodoformal). They melt at 128° C., are insoluble in water, but soluble in hot alcohol, and by prolonged heating of this latter solution another compound is produced, melting at 172° C. Other compounds which have been obtained are iodoform-methylhexamethylene-amine iodide, light yellow needles, easily soluble in alcohol, melting at 179° C., and iodoform-methylene-iodidehexamethylene-amine, small yellow needles, m.p. 174° C. Similarly, bromethylhexamethylene-amine, which melts at 155° C., forms a new compound with iodoform, easily soluble in alcohol, crystallising in light yellow prisms, and melting at 111° C.—T. A. L.

Imide of Orthosulphobenzoic Acid [Saccharin], Impts. in the Manufacture or Preparation of the. G. W. Johnson, London. From the "Chemische Fabrik vorm. Goldenberg, Geromont, and Co.," Winkel-on-the-Rhine, Germany. Eng. Pat. 1956, Jan. 28, 1896.

By the action of concentrated caustic soda on *p*-nitrotoluene *o*-sulphonic acid a brownish-red condensation product is obtained, which, on reduction with zinc-dust, yields diamido-stilbenedisulphonic acid (Bender and Schultz, Ber. 19, 3236; this Journal, 1887, 817). From this substance the patentee obtains saccharin by the following process:—The product is first of all converted into the dihydrazine compound and 4 kilos. of the dihydrazidostilbene-*o*-disulphonic acid (short brownish-yellow needles almost insoluble in water), and 5 kilos. of crystallised copper sulphate are boiled together in about 50 litres of water until the evolution of nitrogen has ceased. The resulting stilbenedisulphonic acid, $HO_3C_6H_4 \cdot C_6H_4 \cdot SO_3H$, is converted into the soluble lime salt, filtered from calcium sulphate, and the solution evaporated to about 10 litres, when it is converted into the sodium salt by treatment with 1.1 kilos. of sodium carbonate. The sodium salt obtained by evaporating the filtered solution to dryness, is stirred to a thin paste with phosphorus oxychloride, to which 4.2 kilos. of finely-powdered phosphorus pentachloride are gradually added. After distilling off the phosphorus oxychloride a pulverulent mass of sodium chloride and stilbene-*o*-disulphochloride remains. This mixture is stirred into 6 kilos. of 25 per cent. ammonia, when stilbene-*o*-disulphonamide is produced, which, on distilling off the excess of ammonia, crystallises out in small needles. After

washing, to remove salt and ammonium chloride, the sulphonamide is dissolved in 22.4 kilos. of a cold 5 per cent. solution of potash, and oxidised with 4.3 kilos. of potassium permanganate in 70 litres of water, the whole being heated to 40°–60° C. until the clear liquor is of a yellow colour. The solution is then filtered, neutralised with hydrochloric acid, evaporated to about 5 litres, again filtered and treated with concentrated hydrochloric acid, when the imide of *o*-sulphobenzoic acid (Saccharine) separates out, and may be purified by recrystallisation.

—T. A. L.

Ozone Solutions, Impts. in the Production or Manufacture of. A. Spranger, Berlin, Germany. Eng. Pat. 18,924, Aug. 27, 1896.

THE process consists in passing ozone into essential oils, especially oil of citron, which may be used pure or else diluted with alcohol, in order to obtain permanent ozone solutions of definite strengths. For medicinal purposes a 60 per cent. alcohol is used, containing 0.5 per cent. of citron oil. Ozone is passed into this solution until saturated, and for use 40 drops are recommended to be taken in water as an anti-septic remedy.—T. A. L.

XXI.—PHOTOGRAPHY.

Developer, Photographic, Formaldehyde in. A. Helheim. Phot. Arch. 1896, 37, 203.

THE author has introduced formaldehyde into the alkaline pyrogallol developer, with the object of developing the image and hardening the film by the same solution. He finds that development is hastened, but the pyrogallol solution is rapidly spoiled by its use, depositing a brownish-yellow veil on the plate. A free use of potassium bromide prevents the latter action, but it is better to immerse the plate in a bath of 2 per cent. formaldehyde solution prior to the ordinary development than to mix the two solutions.

—W. G. M.

PATENT.

Photographic Printing Paper, Impts. in [Tinting first, Albuminising after]. G. Koppmann, Hamburg. Eng. Pat. 22,632, Nov. 27, 1895.

TINTED albuminised papers are usually prepared by coating with an albumin solution, to which some blue or rose coloured "aniline" dye has been added. As these tints are apt to be fugitive, the inventor prefers staining the original paper as a separate operation, whereby it becomes possible to use a permanent colour, such as cobalt blue.

—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

Peracide of Lead, Improved Method of Manufacture of. H. M. Warren. Chem. News, 1896, 74, 144.

See under XI. B., page 816.

PATENTS.

Nitrocellulose and Cellulose Compounds, Impts. in or relating to, and Articles Manufactured therefrom. U. Marga, Brussels, Belgium. Eng. Pat. 21,470, Nov. 12, 1895.

THE new material called "cellulodine," described in this patent, consists of a mixture of nitrocellulose (soluble in ether-alcohol), and cellulose, which is treated with ether-alcohol, and the mass after kneading can be cast or worked into any desired form. The proportion of cellulose used modifies the toughness of the product. Flour, &c., may be used instead of cellulose, and the nature of the product may be varied by the addition of castor-oil or other greasy matter. Cellulodine made with fine, well-dried wood powder is stated to be well suited for the manufacture of bullets (for practice or drill cartridge), adapted to fall to pieces under the action of the gases produced by the combustion of the powder.—W. M.

Explosive, A New. H. Boyd, Birmingham. Eng. Pat. 10,403, May 15, 1896.

This is a patent for an explosive composed of the following ingredients in about these proportions:—Potassium nitrate 7 parts, commercial sulphur 3, Irish bog-ore 2, barium nitrate 2, picric acid 1, wood-dust 1. The Irish bog-ore is used to absorb the fumes resulting from the firing of explosives.—W. M.

Explosive, An Improved, or Blasting Composition. B. Willcox, London. From Aetien Gesellschaft Dynamit Nobel, Vienna, Austria. Eng. Pat. 18,078, Aug. 14, 1896.

A BLASTING explosive is formed by mixing ammonium nitrate, potassium permanganate, and 1—3 per cent. of nitroglycerin. This mixture is stated to be very safe in the presence of fire-damp or coal-dust, on account of its low temperature of explosion.—W. M.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Pyrometer, Le Chatelier-Heraeus, Use of, in Iron Works. H. Wedding. Stahl u. Eisen, 1896, 16, 663.

OF the two pyrometers in practical use, the Siemens (resistance) and the Le Chatelier instruments, only the latter may be considered reliable according to the work of Holborn and Wien. As applied to the determination of the temperature of the blast, of the gases, or of the furnace itself, the customary porcelain or fire-clay protecting-tubes are not well adapted to rapid heating; and the author therefore recommends that the wires should be threaded through fragments of pipe-stems, whilst the junction itself is provided with a cap of asbestos cardboard. The pipe-stems are firmly bound round with asbestos cord, so that any evil effects of fracture may be guarded against. Such an arrangement may be applied to determining the temperatures of reheating furnaces or of iron-nickel alloys before and after rolling. But for use with molten metals or slags, the author fills the bulb of a porcelain flask with tungsten and ignited charcoal, closes the bulb with an asbestos stopper, and introduces the thermal couple into the neck of the flask. The whole is surrounded with asbestos, and covered with a cap of the same, so that no harm may result from the fracture of the tube. This arrangement will then float upright in the molten material. —W. G. M.

Hydrometer with Correction Scale. [Sugar Solutions.] Volquartz. Zeits. des Ver. Rübenzuckerind. 1896, 46, 392.

This hydrometer has a thermometer formed inside, which, instead of marking degrees of temperature, shows the correction to be made in the reading of the hydrometer.

—L. J. de W.

Glue, An Apparatus for Testing. R. Wischin. Chem. Zeit. 1896, 20, 827.

DOEBT having been thrown by Kissling (this Journal, 1896, 729) on the usefulness of an apparatus invented by the author, the latter writes that his method for testing glue has not been strictly adhered to, and thus accounts for the difficulties met with by Kissling, who asserts that it is impossible to tell whether the metal disc of the balance has already sunk into the glue or is only sinking. The observation is not to be taken during the sinking of the metal plate, but at the moment when the glue begins to split or tear, and this tearing is so evident that it cannot be mistaken. A glue to be tested is made up into a jelly consisting of 1 part of the glue to 3 parts of water, or 1 part of glue to 5 parts of water, the latter consistency giving the better results.

The method is useful for testing the glue used for closing up the interstices in petroleum barrels.

A glue solution was prepared of this degree of dilution, because the author had convinced himself, that glue solutions of such dilution as to form no jelly at 12° C., are

useless for protecting the interiors of petroleum barrels. Such glues would give negative results with the testing apparatus.—W. P. S.

Blowpipe Analysis, some Extensions of the Plaster of Paris Method. W. W. Andrews. J. Amer. Chem. Soc. 18, 10, 849—869.

THIS research indicates an extension of the practical art of blowpipe analysis by aid of plaster of Paris tablets in place of charcoal. Reactions are given for the following elements, both separately and when in presence of those which commonly accompany them in nature, viz., Cu, Ag, Au, Zn, Cd, Hg, Tl, C, Si, Ge, Sn, Pb, N, V, As, Sb, Bi, S, Se, Te, Cr, Mo, W, U, F, Mn, Cl, Br, I, Co, Ni, Pd, Os, Ir, Pt.

The reactions described have been obtained from a large number of the compounds of each of the above elements, except in the cases of Os, In, and Ir.—V. C.

INORGANIC CHEMISTRY.—QUALITATIVE.

Nitrites, Detection of, in Presence of Sulphites; some Colour Reactions of Brucine. P. Picard. Comptes rend. 123, [16], 590—592.

IN the presence of nitrites, hydrochloric acid colours brucine vermilion-red to clear yellow, the reaction being sufficiently delicate to reveal 1 part of "nitrous nitrogen" in 640,000 parts of water. Since the presence of sulphites decreases the delicacy of the Picini, Tromsdorff and Griess' methods of determining nitrites, the author proposes to employ instead, the above-named colour tests in cases—such as the drainage waters from land treated with sulphatic manures—where these two classes of compounds are associated.

The best method of detecting sulphur dioxide in such cases is by its odour, to which end it is liberated by the action of a strong acid, the evolution of hydrogen sulphide being prevented by precipitation with lead sulphate and filtration. If SO₂ be present then the nitrite test is applied, in the manner prescribed for the nitrate test. (See following abstract).

Chlorine and the hypochlorites do not colour brucine, but will give a vermilion-red with certain brucine salts, i.e., nitrate, chloride, acetate, and sulphate, the latter giving the most decided results.—C. S.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Nitrates in Vegetable Products, Rapid Estimation of. P. Picard. Comptes rend. 121, [22], 758—760.

TWO to 4 grms. of the organic matter, previously dried at 100° C., and pulverised, are rapidly heated nearly to boiling point, in 20 c.c. of water, in a flask with a long narrow neck, which is thereupon closed and set in a warm place for a quarter of an hour to dissolve the nitrates present, solution being assisted by occasional agitation. After cooling, the solution is filtered through animal charcoal, and collected in a small flask, the funnel being covered with a glass plate. The small flask is kept closed air-tight until the time of titration. Two c.c. of the liquid being transferred to a 50—60 c.c. test glass, one drop is removed by means of a glass rod and placed on a flat plate of white porcelain. To this is added a single drop of monohydrated sulphuric acid, and when thoroughly mixed together a piece of crystallised brucine, the size of a pin head, is dropped into the mixture. In presence of nitrates an intense red coloration develops immediately around the brucine and quickly spreads concentrically. The liquid in the glass is then diluted by successive additions of 2 c.c. of distilled water until, in a repetition of the test, the coloration no longer appears at the end of five minutes. The entire test is afterwards repeated with greater exactness by reducing the rate of dilution to fractions of a c.c. of water towards the end. At this point the liquid contains 0.0207 gm. of "nitric nitrogen" per litre, corresponding to 0.08 gm. of nitric acid, or 0.15 gm. of potassium nitrate, and the method is capable of detecting 1 part of nitrogen in 50,000 parts of water. When nitrites are present (these also giving a coloration with brucine) their amount is estimated

by one of the ordinary methods, and in the final test with bromine the nitrous nitrogen is oxidised by the addition of a drop of chlorine water, the total nitrogen being then estimated in the nitric condition, and the amount of nitrates ascertained by difference. Sulphides, sulphides, and acetates do not affect the coloration.—C. S.

Boric Acid, Estimation of. Schneider. Chem. Zeit. 1896, 20, 822.

In order to estimate the amount of boric acid in any substance, the latter is distilled with alcohol and the distillate evaporated with freshly-ignited sodium carbonate, then fused and weighed. The excess of sodium carbonate is determined by a carbonic acid determination, and subtracted from the above weight.

Meat preserved with boric acid offers some difficulties. To obtain the total amount of the acid present, the meat must be chopped up into small pieces, placed in a well-closed beaker, and then cooked by placing in a water-bath. The cooked meat is now rubbed down in a mortar with its own weight of anhydrous sodium sulphate, transferred to a flask, and extracted with alcohol in a reflux apparatus. When the extraction is complete, the alcoholic solution is filtered off and distilled, as already described.—W. P. S.

Aluminium and its Alloys, Analysis of. H. Gouthière. Ann. de Chimie Analyt. i., [14], 265—270. Analyst, 21, [247], 270.

Copper, Nickel, Lead, and Iron.—5 to 10 grms. of aluminium turnings are attacked in successive portions by sodium hydrate solution (1 in 3), in a conical 300-c.c. flask. Brisk effervescence occurs, with evolution of heat, and the operation is complete in about 20 minutes, care being taken to prevent the liquid cooling, or a grey deposit, difficult to dissolve, will be formed. The hot liquid is decanted on to a small filter, and the black deposit very quickly washed five or six times with boiling water, then dissolved in lukewarm dilute nitric acid, evaporated to a syrup, mixed with 2 c.c. of pure nitric acid, and electrolysed at a temperature of 50°—60° C., by the current from three or four Leclanché cells. Both electrodes are of platinum, the negative being a crucible or cylinder, and the positive preferably gauze. In two or three hours all the copper will be deposited as metal on the negative electrode, and the lead on the positive, as PbO₂, the weight of which, multiplied by 0.8661, will give the metallic lead.

The liquid, separated from the copper and lead, is united with the washings, and heated with excess of ammonia, to separate the iron and dissolve the nickel precipitate first formed. When the proportion of the latter metal is large, the iron precipitate should be redissolved in dilute nitric acid, and reprecipitated as before. After filtering and washing with boiling water, the iron oxide is dried, calcined, and weighed. The filtrate is heated, to drive off the excess of ammonia, then slightly acidified with sulphuric acid, concentrated, nearly neutralised by ammonia, and then electrolysed at about 60° C., the nickel depositing in the metallic state on the negative electrode.

Tin, Antimony.—5 or 10 grms. of aluminium are attacked by hydrochloric acid, and after nearly neutralising by ammonium carbonate, a current of hydrogen sulphide is passed, the precipitate formed being collected, washed with hydrogen sulphide water, and digested for some time with warm dilute ammonium sulphide. Then, after filtering and washing with ammonium sulphide water, the soluble sulphides are thrown down by heating. Sulphur is removed by carbon bisulphide. Antimony (which is rarely present) is recognised by the colour of the sulphide. Arsenic sulphide volatilises during calcination, and stannic oxide remains for weighing.

Arsenic.—The sulphides precipitated from 5 grms. of the metal are washed and dissolved in dilute nitric acid. The solution is filtered, evaporated with sulphuric acid until white fumes appear, and then placed in a Marsh apparatus. The gas evolved is passed through a solution of silver nitrate, and the precipitated silver converted into and weighed as silver chloride. This, multiplied by 0.0871, gives the arsenic.

Zinc is precipitated from the hydrochloric acid solution (after removal of the tin, antimony, &c.) by hydrogen sulphide, after adding sodium acetate. The precipitate is washed, calcined, and weighed as ZnO.

Silica.—The solution resulting from the action of hydrochloric acid and 3 c.c. or 1 c.c. of nitric acid on 5 grms. of the metal, is evaporated to dryness until the acid is driven off; the mass is then heated from 110°—120° C., taken up with hot dilute hydrochloric acid, digested for awhile, and after decanting and washing with boiling water, dried and calcined in a muffle.

Total Carbon.—Boussingault's method: chlorination by mercuric chloride, digestion in dilute hydrochloric acid, and heating in a current of hydrogen.

Creak and Ulgreen's method may also be used: solution of the metal in cupro-ammonium chloride, removal of the precipitated copper by hydrochloric acid, and combustion of the residual carbon by a mixture of chromic and sulphuric acids.

Sulphur.—Rollet's method: 2 grms. of the metal are heated to redness in a current of two-thirds hydrogen and one-third carbon dioxide, and the hydrogen sulphide formed, is passed into silver nitrate solution. The silver sulphide is washed and calcined, the silver multiplied by 0.1481 giving the weight of sulphur. A fairly accurate estimate of the silver may be rapidly made by the Eggertz' colorimetric method, noting the effect of the hydrogen sulphide on a silver plate.

Aluminium is generally estimated by difference. It may, if desired, be determined by one of the usual methods, or by that described by Moissan (this Journal, 1896, 136).

The results of 10 analyses of aluminium are given, the chief impurities being lead, iron, and copper. Tin, arsenic, and nickel were only found in two samples.—A. S.

Chrome Yellow and Chrome Red [Lead Chromes], Analysis of. H. Amsel. Zeits. angew. Chem. 1896, 613.

BESIDE the chromate and sulphate of lead of which they essentially consist, commercial chromes are liable to contain barium sulphate and carbonate, calcium sulphate, and chalk. Three processes have been suggested for their analysis: Duvillier's (solution in nitric acid and alcohol), Löwe's (in sodium thiosulphate), and Wittstein's (decomposition with aqueous sodium carbonate), but they are mostly unsatisfactory.

The author's process is as follows:—0.5 gm. of the sample is boiled for 5 or 10 minutes with 10 or 15 c.c. of 10 per cent. caustic potash and 10 c.c. of water. Without filtering, the mixture is strongly acidified with concentrated hydrochloric or nitric acid, boiled again, the barium sulphate filtered off, washed, ignited, and weighed. The filtrate is neutralised with sodium carbonate, bromine water added, the liquid heated on the water-bath till all odour has disappeared, and the lead and calcium removed by filtration. This filtrate is acidified with HCl, and evaporated to dryness to remove the last traces of bromine. The residue is taken up in 30 c.c. of water and a few drops of acid, 5 c.c. of alcohol added, the excess removed, ammonia added, and after 10 or 15 minutes' heating on the water-bath the chromium oxide is filtered off and weighed. The ammoniacal filtrate is then acidified, and the sulphuric acid (from the original lead and calcium sulphates) estimated as usual.

The precipitate of calcium carbonate and lead carbonate or otherwise lead peroxide, is dissolved in HCl, and the two metals separated in the ordinary manner. It is perhaps better to throw down the lead with sulphuretted hydrogen from an acetic acid solution, converting it afterwards into sulphate, in order that any zinc present may be determined in the filtrate. If, however, the lead be free from zinc, it may, provided sufficient bromine was employed to convert the whole of the original lead carbonate into peroxide, be treated with dilute nitric acid, which dissolves the calcium and leaves the lead unattacked. The latter can then be estimated as sulphate, or volumetrically with oxalic acid and permanganate.

The author quotes a number of analyses made of chromes of known composition, and the results he has obtained appear to be very satisfactory.—F. H. L.

ORGANIC CHEMISTRY.—QUALITATIVE.

Tannins, The Knowledge and Classification of. K. Krause. Chem. Zeit. 1896, **20**, 794.

THE tannins or tannic acids may be divided into two classes, *viz.*, tannins not of glucosidal nature, closely related to the oxybenzoic acids (gallic, protocatechuic acids, &c.), and tannins of glucosidal character which are mainly derivatives of substituted oxycinamic acids; these give a green coloration with ferrous salts, changed to violet or red by sodium bicarbonate; and in aqueous solution in the cold, on addition of nitrous acid (Liebermann's reagent), form hydrocyanic acid—a reaction characteristic of many compounds containing the group $\text{CH}:\text{CH}$. For this class of tannins the name "glucotannoids of the cinnaanic acid series," is proposed.

Albumin also forms hydrocyanic acid when acted upon by nitrous acid, and other reactions show it to be an unsaturated compound.—A. C. W.

Beef-Fat in Lard, Note on the Microscopic Detection of. T. S. Gladding. Analyst, 1896, **21**, 254.

THE author finds that in the preparation of crystals of lard and beef stearin for microscopic examination, the following method gives good results, the crystals being of distinctive form:—5 c.c. of melted lard are dissolved in a mixture of 20 c.c. of absolute alcohol and 10 c.c. of ether in a small Erlenmeyer flask, heating gently if necessary. A plug of cotton-wool is placed in the mouth of the flask used, which is then allowed to cool. The stearin crystallises out, leaving the olein in solution. The liquid is filtered rapidly through a paper wet with alcohol, and the crystals washed once with the alcohol-ether mixture (2:1). The crystals, after drying, are removed to the flask and dissolved in 25 c.c. of ether, the cotton plug is replaced, and the flask, resting in a slanting position in a beaker nearly full of water, is let cool over night. Crystals of stearin then separate. The author refers to plates contained in Bulletin No. 13, Part IV., Division of Chemistry, U.S. Department of Agriculture, giving characteristic forms of crystals of lard and beef stearin.—A. S.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Wool-Fat, The Iodine Absorption of. W. Herbig. Dingler's Polyt. J. **302**, [1], 17–23.

IN this paper the author gives a number of determinations of the iodine absorption of an American wool-fat prepared by extracting the raw wool, and also of the fatty acids obtainable from it. He has further determined the iodine absorption of cholesterol (see Lewkowitsch, this Journal, 1892, 142), using excess of iodine.

The fatty acids of the wool-fat were separated into different fractions, and the iodine absorption was determined for each fraction.

A quantity of the fat (about 200 grms.) was saponified with half-normal alcoholic potash in a reflux apparatus, whereby only part of the compound ethers is saponified. After neutralisation, the potassium salts of the fatty acids were converted into the corresponding calcium salts. A portion of these latter are soluble, and are separated by filtration. The insoluble salts, after drying, were further fractionated by extraction with acetone (see this Journal, 1896, 138) into soluble and insoluble salts. The insoluble part consists mainly of saturated acids, whilst that which passes into solution contains the unsaturated acids. The calcium salts soluble in water also contain unsaturated acids. Several determinations of the iodine absorption of pure cholesterol show that, with a sufficient excess of iodine, the maximum absorption, *viz.*, 73.32 per cent., is arrived at after 18 hours' action, the excess of iodine being 45 per cent. of the quantity used. With American wool-fat the absorption is also complete—23.53 per cent.—in 18 hours, the excess of iodine being 77 per cent. The fatty acids obtained from the calcium salts insoluble in acetone, have an iodine absorption of 4.95 per cent., whilst the acids of the soluble salts absorb from 46.69 to 51.79 per cent. of iodine. The iodine values of the fractions obtained from the calcium salts soluble in water, rise to 67.64 per cent.—W. P. S.

Polarisation, Influence of Temperature on [Sagar.] F. Sachs. Zeits. Ver. Rübenzuckerind. 1896, **46**, 264.

THE author found that in the polarisation of raw sugar at temperatures from 14° to 26° C. there were differences of almost exactly 0.1° per 2° C., as Wartze had already observed. But it is not sufficient to note the temperature of the solution polarised and to correct by the above factor unless regard is had to the temperature at which the 100-c.c. flask is made up to the mark. Thus, a normal solution made up and polarised at 25° C. showed a difference, not of 0.5°, but of 0.2° merely. In weaker solutions the influence is obviously still smaller. Finally, Sachs states that the quartz control plates are only very slightly affected by temperature. Pellet (La Suc. Indig. 1896, **31**, 494) is of opinion that the influence of temperature should not be neglected, and that a jacketed tube should be used to keep the temperature constant. He remarks that in order to obtain exact and comparable results, the gas, paraffin, or electric light used should be maintained at the same intensity of illumination. At present this is by no means the case, even with monochromatic flames, so that differences may be obtained of 0.2 to 0.5 in the readings. It appears, therefore, of advantage to have an arrangement to determine readily the intensity of the light used, and he describes one similar to that used in photography to study the sensitiveness of paper. Black numbers are written on a glass plate, and these are covered with layers of thicker or thinner paper. It is so arranged that before a polarisation the numbers must always be visible which are covered with, say, four layers of paper.

—L. J. de W.

Basic and Neutral Lead Acetate, Influence of, upon the Polarisation of Sugars. H. Pellet. Bull. de l'Assoc. des Chim. de Sucre et de Dist. 1896, **14**, 131–145.

THE author finds that whilst basic and neutral acetate of lead do not appreciably affect the rotatory power of aqueous solutions of cane sugar, yet the basic salt diminishes the rotation in alcoholic solution in proportion to the amount of alcohol present, or in the presence of certain salts, such as chlorides, &c. Solutions of levulose are acted upon by basic acetate of lead; and, according to the amount added and the concentration of the levulose solution, the rotatory power may be 0° or even dextro-rotatory. Consequently, in the presence of basic acetate, juices and solutions of syrups and molasses containing a small percentage of levulose may have a direct polarisation equal to or greater than that observed after inversion. In such cases the addition of acetic acid produces a normal rotation. The presence of salts favours the precipitation of levulosate of lead. Neutral acetate of lead does not affect the rotatory power of levulose, even when in the presence of considerable quantities of salts. Dextrose is unaffected either by the basic or neutral acetate; in alcoholic solutions more levulose than dextrose is precipitated. From these observations it is apparent that basic acetate of lead should never be used in the presence of alcohol for the analysis of sugar products. Conditions obtain which may bring about decompositions favouring the diminution of rotatory power or the precipitation of sugar. Differences in results of observers also arise from the degree of basicity of lead acetate. An excess of basic lead acetate diminishes the rotatory power of raffinose, either when the solutions are alcoholic or when salts are present; but in weak solutions, and especially in the presence of cane-sugar, raffinose remains unaltered.

In aqueous solutions of molasses the author finds that the polarisation is raised in proportion to the excess of basic lead acetate added; the reducing power, on the other hand, is diminished on account of the levulose, either alone or with the dextrose, having been precipitated. Neutral lead acetate may be used for defecating aqueous solutions of molasses, the excess of lead being removed by sulphurous acid.

Invert sugar behaves as a mixture of levulose and dextrose towards basic lead acetate; the varying rotatory powers observed are due only to the levulose.

In analysing cane molasses, whatever may be the lead reagent employed, the direct polarisation should be observed in a solution rendered strongly acid with acetic acid, so

that a reading may be made comparable with that of the inversion; polariscopic readings should also be taken at the same temperatures before and after inversion.

In the estimation of reducing powers it is advisable to employ a half per cent. solution, as in this concentration the sulphurous acid used for the elimination of lead does not influence the reduction (this Journal, 1896, 746).—J. L. B.

Defecated Sugar Liquors, Precipitation of Lead in. Zamaron. Bull. de l'Assoc. des Chim. de Sucre et de Dist. 1896, 14, 181—182.

According to the author, the excess of basic lead acetate may be conveniently removed by ammonium oxalate in solutions of molasses containing more than 0.3 per cent. of reducing sugar. It is considered difficult to estimate amounts less than 0.3 per cent. of glucose, and it is proposed in such cases to add a known quantity of glucose or invert sugar to 100 grms. of molasses, to estimate the reduction by the copper method, and to correct the number so obtained for the known amount of added reducing sugar present.—J. L. B.

Beetroot Juice, Determination of Free Alkali in. J. Cotrait. Bull. de l'Assoc. des Chim. de Sucre et de Dist. 1896, 14, 182—183.

The author finds iodide of starch to be a convenient indicator for caustic alkali, and, unlike phenolphthalein, it is not influenced by ammonia or alkali carbonates and bicarbonates. 25 c.c. of clear or thick juice is placed in a beaker, together with a little starch paste and four or five drops of tincture of iodine. If the alkalis present are in a state of carbonate, the liquid, when shaken, becomes intensely blue; but, if they are caustic, a colourless alkaline hypo-iodide is formed, which is decomposed by an acid, without influence on iodine of known titre. A correction is made for the quantity of iodine added which behaves as an acid.—J. L. B.

Raw Sugars, Determination of Water in. Herzfeld. Sugar Cane, 1896, [321].

The author has shown that when pure sugar, combined with 3 per cent. or more of pure water, is heated for 3—5 hours in a current of dry air at 105°, the whole of the moisture is lost. Drying *in vacuo* does not offer perceptible advantages; care should only be taken to increase the temperature slowly. If the sugar is combined with water containing inorganic salts or organic non-sugar, such as in the case of raw sugars, a loss of acids and volatile bases occurs when they are heated to 108° in a current of dry air or gas free from oxygen. When the sugar has an alkaline reaction, carbon dioxide is liberated from the bicarbonate formed during carbonation, or by the action of sugar on neutral carbonate. According to Gunning (this Journal, 1895, 338), the content of carbon dioxide in raw sugars does not exceed 0.07 per cent.; with white or nearly white sugars, this number often falls to 0.03 per cent., whilst if the sugar be slightly acid the maximum will be 0.01 per cent. The proportion of volatile bases is much smaller—in terms of ammonia 0.002 per cent.; these are not exclusively produced from ammonia, for when converted into neutral sulphates, an amount higher than that given by Nessler's solution is obtained. Beetroot sugars, being generally acid, evolve very little carbon dioxide, but give off a considerable quantity of fatty acids. It is recognised that these acids are not formed during desiccation; they pre-exist in the sugars, for after drying they become neutral. The inverse phenomenon is observed in sugars from the cane. The author recommends that raw beetroot sugars should be dried by heating for five hours to 108° in a current of dry air.

With cane sugars the estimation of moisture is complicated by the presence of levulose, and of organic non-sugar possessed of particular properties; the former losing water and becoming converted to levulose (this Journal, 1895, 338). Therefore raw cane sugars containing levulose, when heated to 108°, lose hydrogen and oxygen, which do not form part of the moisture. The organic non-sugar also gives rise to acids, thus augmenting the

amount of levulose. The only method available with cane sugars is to heat *in vacuo* at a maximum temperature of 95°.—J. L. B.

Starch, A Study of Methods for the Determination of. H. C. Sherman. School of Mines Quart. 1896, 17, [4], 356—365.

In discussing the principal methods which have been proposed for the estimation of starch, the author points out that in many of them the high results obtained are due to the susceptibility to hydrolysing agents of the pentosans, xylan, and araban. The diastase method affords satisfactory results, and it cannot be vitiated by the presence of pentosans, glucosides, or any substances known to occur in cereals or the more common grasses. The following method, which is due to Reinke, is carried out by boiling the sample, previously freed from soluble matter, with water, to completely gelatinise the starch. The solution is cooled to 62° C., malt extract is added, and the whole kept at this temperature until the iodine reaction has vanished. It is then filtered, washed, and the filtrate inverted by boiling for 30 minutes with one-tenth its volume of 25 per cent. hydrochloric acid. The glucose is determined according to Saehsse's method.—J. L. B.

Caseine in Milk, A Rapid Volumetric Method of Determining. Denigès. Bull. Soc. Chim. 15, [18—19], 1116—1126.

1r to 10 c.c. of decinormal potassium cyanide solution there be added 10 c.c. of decinormal mercuric-potassium iodide, 10 c.c. of ammonia solution, and 100 c.c. of water, then on adding decinormal silver nitrate, a turbidity of silver iodide appears when 4.8 c.c. have been added, instead of 10 c.c., owing to the mercury appropriating some of the potassium cyanide, and thus preventing it from forming the silver compound.

If milk be previously added to the mercury salt, the caseine is precipitated along with a portion of the mercury; and on now adding silver nitrate a larger amount than 4.8 c.c. is needed (owing to the greater quantity of free potassium cyanide present) before the turbidity of silver iodide appears. The difference between this amount and 4.8 c.c. gives a measure of the caseine in the milk taken.

Taking for analysis different quantities of the same milk, or equal quantities of milks of different caseine-content, it was found that the result given by this method (as compared with the result by the gravimetric method of Adam and Roux) was too low where the amount of caseine was small, and too high where it was large. A curve and a table of differences were therefore constructed from the results of analysis of a number of known samples; and the results interpreted by this curve, in the cases of a large number of samples of milk of different origin, and also of cooked and sterilised milks, agree very closely with those obtained by the gravimetric method.

For details of these comparisons, and of the precise way in which the method is to be carried out, the original paper should be consulted.—J. T. D.

Zinc, Determination of, in Foods. Janke. Chem. Zeit. 1896, 20, 800.

The difficulty in the determination is to remove the organic substances from the large quantity of material required. The author's method, which is not lengthy, is as follows:—50—100 grms. of substance, cut in thin slices, are dried at 125° for three hours; the dark brown mass is powdered and mixed with 25 c.c. of nitric acid (sp. gr. 1.31) and 10 c.c. of strong sulphuric acid. When the violent action is over, the residue may be easily burnt; this must be done, at the most, at an incipient red heat, for higher temperatures will cause loss of zinc; this part of the process may last four hours. The ash is evaporated with a little hydrochloric acid, the residue dissolved in water, exactly neutralised by sodium bicarbonate, and the iron, aluminium, and phosphoric acid precipitated by sodium acetate and acetic acid. In the filtrate the zinc is precipitated as sulphide; the zinc sulphide must be dissolved and reprecipitated.

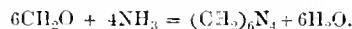
tated if it is not quite free from iron. The percentage of the zinc present found by this method, lies between 98.8 and 104.5, the total amount of zinc varying from 0.01 to 0.05 grm.—A. C. W.

Formaldehyde, Detection and Quantitative Estimation of.
F. C. J. Bird. Pharm. J. 1896, 57, 269—271.

Nessler's reagent gives a distinct yellow precipitate with a solution containing 1 part of formaldehyde in 200,000. With solutions of 1 part in 50,000 to 100,000, a yellowish opalescence first appears, quickly changing into a copious orange precipitate, which on standing or gently heating, becomes darkened in colour and reduced. From 1 in 100,000 to 1 in 200,000, the opalescence develops into a lemon-yellow precipitate on standing, and little or no reduction takes place. The effect produced by formaldehyde is quite distinct from that of a weak solution of ammonia, giving about the same depth of colour, as the latter remains quite clear and transparent, even on boiling. With strong solutions of acetaldehyde, an orange precipitate and immediate reduction occur, the same as with formaldehyde, but traces hardly affect Nessler's reagent, and even when it is in sufficient quantity to communicate its odour to the liquid, a yellow precipitate is the only result. Its reaction is very much less energetic than that of formaldehyde, and the two aldehydes can easily be distinguished from one another when only traces, such as would be met with in the ordinary course of analysis, are present (see also this Journal, 1896, 382 and 772).

The Ammonia Micro Test (Remijn).—The substance or liquid under examination is distilled with water, a drop of the distillate evaporated on a slide with a drop of ammonia, and the crystalline residue tested with mercuric chloride in excess. Crystals are immediately formed, hexahedral at first, but becoming octahedral after a time. The crystals are easily obtained from a 1 in 10,000 solution, and are visible in a 1 in 100,000 solution. The evaporated residue also gives precipitates with platinum chloride, phosphomolybdic acid, and other alkaloidal reagents.

Quantitative Determination.—(1.) Titrate the solution with standard ammonia, using rosolic acid to indicate the complete conversion of the formaldehyde into hexamethylene-amine. (2.) Add excess of standard ammonia, and titrate back again with standard acid. (3.) Evaporate to dryness with excess of standard ammonia, and weigh the hexamethylene-amine formed, calculating the formaldehyde from the following equation:—



(4.) Heat for several days in a closed vessel on a water bath with excess of sodium hydrate; sodium formate and methyl alcohol are produced, and the excess of sodium hydrate may be determined by titration with acid (Allen). As the whole of the formaldehyde cannot be separated by distillation, even when three-fourths of the volume of the liquid containing it has been collected as distillate, the first four of the foregoing methods, if accurate results be desired, are only applicable to solutions in which no other interfering constituent exists. A method for completely removing the formaldehyde, is apparently necessary for its exact quantitative determination in complex mixtures.—A. S.

Wood Pulp in Paper, Some Methods for the Detection and Estimation of. Wood Pulp, 1, [3], 1896, 61—64.

The detection of wood pulp in paper is easily performed by the aid of the microscope, but a trustworthy method for the exact estimation of either chemical or mechanical wood pulp is not so easily found. In the case of ground wood the following methods give fairly accurate results, if the experiments are carefully conducted.

Microscopical Examination.—Small pieces of paper are cut from different parts of the sample to be tested, and are boiled for a short time in a 1 per cent. solution of caustic soda. The fibres are then separated in a mortar, or by shaking them in a bottle containing a few pieces of broken glass; or a better way is to soak the paper in glycerin, and tease it out with needles, when it will be ready for examination. In the former cases the fibres are placed on the glass

slide, and covered with a drop of glycerin or solution of Canada balsam in benzene, and a cover glass.

Under the microscope, chemical wood pulp appears as flat, riband-like fibres, showing unbroken ends, not unlike cotton, but distinguished from the latter by not being twisted. The presence of small pitted vessels in the fibres is characteristic of pine wood. Mechanical wood is distinguished from chemical wood pulp by having the ends of the fibres torn and jagged, and by the fact that the fibres are rarely separated, but are generally bound together in bundles by the incrusting substances. The pitted vessels before referred to are generally more distinct than in chemical pulp.

Chemical Examination.—The use of certain chemicals and colours is useful in indicating the presence of certain fibres, and in assisting to bring out more clearly the characteristics of the various fibres. Dilute solutions of the aniline colours are very suitable for the latter purpose.

Nitric Acid, concentrated, produces a characteristic brown stain on paper containing mechanical pulp, and outside the laboratory this is the indication most generally used.

Aniline Sulphate.—A saturated solution of the salt in alcohol gives a deep yellow coloration with a ground wood. It may be added, however, that imperfectly boiled and bleached chemical pulp will be coloured by these reagents.

Phloroglucinol, prepared by dissolving 2 grms. of the reagent in 25 c.c. of alcohol, and adding 5 c.c. of concentrated hydrochloric acid, gives a deep magenta coloration, which is very characteristic of lignified tissues.

Iodine is absorbed from its solutions in potassium iodide in large quantity, colouring the fibre a deep brown.

Chlorine combines with the fibre with avidity; the chlorination is made evident with sodium sulphide solution, which develops a deep magenta coloration.

Ferric chloride colours the fibre substance to a dark greenish tint, the reaction being due to traces of tannins.

Ferric ferriyanide, the red solution obtained by mixing together ferric chloride and potassium ferriyanide in equivalent proportions, gives a highly characteristic reaction, the fibre substance rapidly decomposing the compound to Prussian blue.

Potassium permanganate is rapidly reduced, the MnO_2 produced, colouring the fibre a deep brown.

The above tests apply to lignified fibres generally.

The following is said to be of use for the detection of sulphite pulp:—A dilute solution of sodium auric chloride is employed, and a little of the paper moistened with it. With unbleached sulphite cellulose it gives a red-brown colour, whereas with bleached sulphite and soda cellulose it gives a bluish colour.

Estimation of Chemical Pulp.—The only trustworthy method of estimating the amount of chemical wood pulp present in a sample of paper, is by making a number of examinations under the microscope, actually counting the various fibres in the field, and averaging the results. In identifying the fibres, iodine and sulphuric acid will be found to be of assistance.

Estimation of Mechanical Pulp.—This may be done with fair accuracy by the comparison of the depths of colour obtained by the qualitative tests already given. A standard set of samples is prepared, containing known proportions of ground wood, and the colours obtained by treating these with aniline sulphate, nitric acid, or phloroglucinol, are compared with the colours obtained by treating the sample with the same reagent. These tests indicate lignified fibre, so that if jute or imperfectly reduced sulphite fibre were present, they would be rendered inaccurate.

Several other methods have been suggested, for example: by the volume of chlorine disappearing in chlorination; by the estimation of furfural; by methyl estimations, in the absence of straw and esparto; and by a method discovered by Wurster, *viz.*, the oxidation of the methylated derivatives of paraphenylenediamine to red colouring matters. The reagent is incorporated with a pure cellulose paper, and this is pressed into a moistened piece of the sample under examination. The depth obtained is compared with a colour scale, and the percentage of ground wood calculated from it.

In Godeffroy and Coulon's method two equal portions of paper are taken, boiled in 10 per cent. ammonia, then washed and dried. One portion is burned and the ash determined. The other portion is boiled with a solution of gold chloride, washed, dried, burned, and the residue weighed, and from this is deducted the weight of ash from No. 1, which leaves the weight of the reduced gold, and from this is calculated the quantity of ground wood present, 100 parts of wood reducing 21.2 parts of gold.

The microscopic estimations and the colour tests will, however, generally be found to give sufficiently accurate results for practical purposes.—S. P. E.

Bismuth Salicylate, Testing of [for Free Salicylic Acid]. Pharm. J. 1896, 4, 215.

DOTT (Pharm. J. [3], 25, 582) has drawn attention to the fact that commercial bismuth salicylate contains uncombined salicylic acid. The free acid may easily be determined by the following method:—A known weight of the salt is digested in cold methylated spirit, filtered, and the filtrate evaporated to dryness in a tared vessel, when the free acid will be left as a residue, which may be weighed. A sample has been met with containing more than 50 per cent. of uncombined acid; this was of exceptionally "good colour," and further examination of light-coloured samples showed that these invariably contained more than traces of free acid (this Journal, 1895, 295).—A. S.

Salicylic Acid, Quantitative Determination of. F. Freyer. Chem. Zeit. 1896, 20, 820—821.

WHEN the tetra-bromide obtained by treating phenol with bromine water is acted on by potassium iodide, substitution takes place and iodine is liberated, as shown in the equation:—



A similar reaction takes place with the compound formed from salicylic acid.

To test the reaction as regards its suitability for the quantitative determination of salicylic acid, experiments were made as follows:—5.071 grms. of pure calcium salicylate are dissolved with the addition of a little hydrochloric acid and diluted with water to 1 litre. This solution then contains 4 grms. of salicylic acid. A solution containing 1.7 gm. of potassium bromate and 6 grms. of potassium bromide, a 10 per cent. solution of potassium iodide and a $\frac{1}{10}$ N thiosulphate solution, are also required. 100 c.c. of bromate solution correspond to 0.138 gm. of salicylic acid. Of this solution, 100 c.c. are diluted with an equal bulk of water, 20 c.c. of dilute hydrochloric acid added, and then 10 c.c. of the salicylic acid solution. After three or four minutes 15 c.c. of the potassium iodide solution are added, and the liberated iodine titrated with $\frac{1}{10}$ N thiosulphate solution. A check experiment is made without the addition of salicylic acid, and the difference between this figure and the one obtained above calculated into salicylic acid.

If starch solution be used in the titration, it must not be added until the reaction is almost complete, as the flocculent precipitate present encloses the blue starch iodide, and the solution is liable to be over titrated before the blue tint disappears.

Analyses carried out in the above manner with varying quantities of salicylic acid, gave results which only varied 0.5 per cent. from the amounts of acid taken.

The author also gives the results of experiments made with regard to the delicacy of the ferric chloride reaction with salicylic acid. 100 c.c. of wine preserved with this substance were distilled off as far as possible, the distillate collected in separate portions, and tested with ferric chloride. The experiments show that none of the salicylic acid comes over in the first 50 c.c., the characteristic coloration being obtained in the latter portions of the distillate. Wine containing 0.001 per cent. of salicylic acid gives no coloration with ferric chloride. As the acid only comes over towards the end of the distillation, the testing for this substance may be combined with the alcohol determination, the latter being collected in the first portion of the distillate. The author is unable to confirm the statement made by Horn (Chem. Centralbl. 1888, 1125) that beer, known to be

free from salicylic acid, yields a distillate which gives a violet colour with ferric chloride, and asserts that the above distillation method is quite applicable for testing this beverage.—W. P. S.

Morphine in Opium, Determination of. G. Loof. J. Pharm. Chim. 1896, 16, 312.

SALICYLATE of soda is found to be an excellent precipitant for the resins in opium; a portion of the narcotine is also thrown down; this may be extracted from the dried precipitate by benzene. The following is the procedure in a determination of morphine:—6 grms. of finely powdered opium are triturated with 6 grms. of water and washed into a tared flask, the total weight of liquid being made up to 51 grms.; after shaking for 15 minutes the liquid is filtered through a folded filter, 42 grms. of the filtrate are taken, and 1 gm. each of sodium salicylate and water added. On shaking, the precipitate collects into a compact mass; after filtering, to 36 grms. of the filtrate, there are added 4 grms. of ether and 1 gm. of ammonia, and the whole is well shaken for 10 minutes. The morphine is precipitated and does not adhere to the sides of the flask; it is transferred to a filter; the flask is twice rinsed out with 5 grms. of water; after drying, the morphine is washed with benzene, and finally dried.—A. C. W.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Hyponitrous Acid. Hantzsch and Kaufmann. Annalen, 292, [3], 317—340.

ZORN'S process was employed, whereby a solution of sodium nitrite and caustic soda was caused to act upon sodium in the form of sodium amalgam. Thus silver hyponitrite was produced. The action was, however, conducted at a low temperature, and the amalgam added very gradually. The filtered solution was precipitated by silver nitrate, and the yellow precipitate purified by repeated solution in weak nitric acid and reprecipitation by ammonia. From this salt hyponitrous acid was prepared by precipitation with hydrochloric acid in ethereal solution. The acid appears on evaporating the ether in white crystalline plates. It is extremely unstable, exploding, when dry, on the slightest touch, though much more stable in aqueous solution. The molecular weight, as determined by the lowering of the freezing point, agrees with the formula $H_2N_2O_2$. The acid, both in the behaviour of its salts and its conductivity for electricity, is similar to carbonic acid.—J. T. D.

Bromides, The Double. R. Varet. Comptes rend. 1896, 123, 497.

THE heat evolved by the union of mercuric bromide with the bromides of mono- and divalent metals in solution, was measured. These compounds have heats of formations which are of the same order of magnitude for the same series of double salts; the differences are due to the unequal thermal effects of dilution in the different cases. These double bromides must be regarded as derivatives of the acids H_2HgBr_2 and H_2HgBr_4 .

The salts formed by the union of cobalt and manganese bromides with the alkaline bromides, suffer considerable dissociation on dialysis; their formation in the state of solution is not accompanied by appreciable thermal effects.

—A. C. W.

Mercury, Oxy-Salts of. Varet. Bull. Soc. Chim. 15, [18—19], 1081—1086.

A THERMO-CHEMICAL study. The oxy-salts of mercury obey the usual thermo-chemical law of substitutions, i.e., the evolution or absorption of heat when the mercury exchanges with another metal, is independent of the particular acid of the salt.

Mercuric nitrate exists in solution as the normal salt.

Mercuric sulphate, dissolved in excess of sulphuric acid, behaves exactly like the corresponding sodium or potassium salt, i.e., is in a state of partial dissociation—a fact demonstrable by dialysis.—J. T. D.

Basic Nitrates. Athanasesco. Bull. Soc. Chim. 15, [18—19], 1078—1081.

Digestion of normal lead nitrate with ammonia, even for a year, does not yield the salt $\text{Pb}(\text{NO}_3)_2 \cdot 5\text{PbO} \cdot 11\text{H}_2\text{O}$, but only a tetrabasic salt, $4\text{PbO} \cdot \text{N}_2\text{O}_5 \cdot 21\text{H}_2\text{O}$. The first-mentioned salt is, however, obtained by a year's digestion with strong ammonia of the salt $\text{PbOH} \cdot \text{NO}_3$, obtained by boiling the solution of normal nitrate with litharge.

Normal zinc nitrate in strong solution, heated alone or with a little zinc oxide in sealed tubes to 310° , yields nearly needles of a salt having the formula $4\text{ZnO} \cdot \text{N}_2\text{O}_5 \cdot 31\text{H}_2\text{O}$.

Partial precipitation of normal zinc nitrate with ammonia yields no definite salt, but mixtures varying with the amount of ammonia.

Boiling strong solution of zinc nitrate with zinc gives another definite basic nitrate of the formula $4\text{ZnO} \cdot \text{N}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$. Constitutional formulae of these salts are suggested.

—J. T. D.

Diamonds in Steel. L. Frank. Stahl u. Eisen, 1896, 16, 585.

MINERALOGICAL evidence points to the diamond being a product of high temperatures. Moissan showed that diamonds could be produced by chilling melted iron containing carbon with the aid of the pressure of the solidified outer crust. Rosel considered that all steel contained diamonds (see this Journal, 1896, 682). The author now states that nearly all varieties of steel contain more or less considerable quantities of crystallised, transparent carbon. The diamonds may be extracted by dissolving the steel (300 grms.) in nitric acid, and treating the residue successively with boiling hydrochloric and hydrofluoric acids, with sulphuric acid, with fused potassium chlorate, with acids again, and finally with bromoform. The diamonds are minute octahedra, and sink in methylene iodide. Hammered or rolled steel shows only fragments and splinters. It is of especial interest to note that the largest artificial diamonds yet found have been met with in a mass taken from the hearth of a blast furnace. The iron diamonds are usually very brittle, and tend to break off their own accord.—W. G. M.

Nickelo-Nickelic Hydrate, $\text{Ni}_3\text{O}_3 \cdot 2\text{H}_2\text{O}$. W. L. Dudley. J. Amer. Chem. Soc. 18, 10, 900—903.

This compound is prepared by fusing sodium dioxide in a nickel crucible with metallic nickel at a cherry-red heat. It appears that in order to obtain the new substance absolutely pure it would be necessary to use a crucible of absolutely pure nickel, owing to the activity of sodium dioxide, which oxidises the small quantity of cobalt present in the nickel of commerce.—V. C.

Melezitose, Hydrolysis of, by Soluble Ferments. E. Bourquelot and H. Hérissé. J. de Pharm. et de Chim. 1896, 16, [6], 385—387.

ALEKHINE (Bull. Soc. Chim. 1877, 27, 98) has shown that melezitose is a hexatriose isomeric with raffinose: the authors have endeavoured to ascertain if this sugar-like raffinose is hydrolysed by soluble ferments. The purified melezitose when dried at 100° , melted at 148°C , was non-reducing, and had a specific rotatory power of $[\alpha]_D^{20} 88^\circ 15$. No birotation was observed. A solution of the sugar treated with an aqueous extract of *Aspergillus niger* for three days reduced Fehling's solution strongly, whilst the rotatory power had sunk to $61^\circ 2$. With acids, the hydrolysis of melezitose takes place in two phases—in the first to dextrose and touranose, the mixed products rotating $[\alpha]_D^{20} +63^\circ$; in the second, the touranose becomes converted into two molecules of dextrose. It thus appears that the authors have attained the limit of the first phase.

—J. L. B.

Aldazine, Ketazine, and the Benzosazones of Aldoses and Ketoses. E. Davidis. Ber. 1896, 29, 2308—2311.

A GENERAL method for the preparation of aldazines and ketazines of the sugars consists of treating the carbohydrate with a slight excess of hydrazine hydrate and warming the mixture with methyl alcohol. Glucose-aldazine, which may

be taken as a type, is a white hygroscopic microcrystalline powder, soluble in water and methyl alcohol, but insoluble in ether, chloroform, and benzene. Decomposition with acid shows that the compound consists of one molecule of hydrazine combined to two of the sugar, so that it has the composition $(\text{CH}_2\text{OH})_6 : [\text{CH}(\text{OH})]_6 : (\text{CH} : \text{N} : \text{N} : \text{CH})$.

The benzosazones of aldoses and ketoses are prepared by heating benzhydrazide and the sugar in a weak alkaline solution. These compounds differ from the phenylsazones in that one molecule of the sugar condenses with four molecules of the hydrazide. Thus the composition of glucosebenzosazone is expressed by the formula—



—J. L. B.

Developer, Photographic, Occurrence of Luminosity in Use of. A. Helheim. Phot. Arch. 1896, 37, 203.

A GELATINO-BROMIDE plate was half-developed in a solution of 1 of pyrogallol, 1.5 of sodium carbonate, and 2 of formaldehyde (a 40 per cent. solution) in 30 of water, and then laid aside. After a few minutes a strong glimmering light was observed on the plate; it was strongest at the edges, but soon became equally bright to the centre. The phosphorescence appeared when the solution had been completely absorbed by the film, so that the surface had become dry. The light lasted for several minutes; it was bluish-white, and so strong that it was visible even in that of the dark room lantern. The addition of 30 c.c. of alcohol, as a dehydrating agent, to the developer itself produced in the flask a very strong phosphorescence, which soon faded, but became stronger again on shaking. This indicates that the phenomenon was independent of the presence of the gelatin plate.—W. G. M.

New Books.

CHEMIKER-KALENDAR, 1897. Von Dr. RUDOLF BIEDERMANN. 18ter Jahrgang. Mit einer Beilage. Julius Springer, Berlin. H. Grevel and Co., 33, King Street, Covent Garden, London. 1896. Price 4s. 6d. post free.

THIS pocket book for chemists, analysts, and technologists now appears in its 18th annual edition. It is strongly bound in cloth, contains an almanack for 1897, and a table of frequently used atomic weights and their multiples. A Chronological Table is added of the principal events in the history of the Sciences, more especially of Chemistry. A Note-book Calendar is also supplied, with blank pages for the different days of the year, wherein notes, data, &c. may be recorded. Tables next follow of specific gravities of Gases, and Liquids, Salts and Alcohols. Tables also of Solubilities and Properties of Inorganic Chemical Substances; another set being devoted to similar data for Organic Substances. The remainder of the little book is devoted to tabulated data as to Qualitative and Quantitative Chemical Methods, Volumetric Analysis, Spectrum Analysis, Gas Analysis, and Mineralogy. The Supplementary Volume or "Beilage zum Chemiker-Kalendar" is virtually a pocket book more especially designed for technologists. After some data, statistics, &c., of mathematical, physical, and general interest, the following groups of subjects receive special attention:—I. Water. II. Assaying. III. Fuels. IV. Sulphuric Acid. V. Alkali. VI. Bleaching Powder. VII. Nitre and Explosives. VIII. Ceramic Arts. IX. Glass. X. Mortar and Cement. XI. Illuminating Gas. XII. Starch and Sugar. XIII. Fermentation Industries. XIV. Fats and Oils. XV. Tannins. XVI. Textile Fibres, Paper. XVII. Photography. XVIII. Colours and Dyes. XIX. Physiological-Chemical Analysis. Various useful recipes are finally given.

CHEMISCH-TECHNISCHES REPERTORIUM. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. EMIL JACOBSEN. 35. Jahrgang. 1896. Erstes Halbjahr. Erste Hälfte. Mit in den Text gedruckten Illustrationen,

Hermann Heyfelder, R. Gaertner, Schönabergerstr. 26, Berlin. A. Grevel and Co., 33, King Street, Covent Garden, London.

THE first issue for the first half-year of 1896, of Dr. Jacobson's *Repertory of Chemical Technology*, containing reports of the progress of the following branches of chemical industry:—I. Building Materials, Cements, &c. II. Dye-stuffs, Dyeing and Calico Printing. III. Fats, Oils, Illuminating and Heating Materials. IV. Fermented Liquors. V. Tanning, Leather and Glue Manufacture. VI. Textiles. VII. Glass and Earthenware. VIII. Wood and Horn. IX. India-Rubber and Gutta-Percha. X. Cements and Adhesives. XI. Lacquers, Varnishes, and Paints. XII. Metals.

THE DEVELOPMENT OF THE PERIODIC LAW. F. P. VENABLE, Ph.D., F.C.S., Professor in the University of North Carolina. Chemical Publishing Co., Easton, Pa., U.S.A. 1896. Price 2/50 dols.

SMALL. 8vo volume, containing prefatory sketch, subject-matter covering 281 pages, a bibliographic index to the literature relating to the Periodic Law, filling 24 pages, a list of authors alphabetically arranged, and a general alphabetical index to the volume. The general scheme of the work may be gathered from the following abstract of the leading contents:—I. Prout's Hypothesis and the Dobereiner Triads. II. Dumas and the Period from 1850 to 1860. III. The Immediate Forerunners of the Periodic Law. IV. The Announcement of the Periodic Law (1869—1871). V. Development of the Systems (1870—1880). VI. The Development of the Natural Law (1880—1885). VII. Ditto (1885—1890). VIII. Ditto (1890—1896). The work is illustrated with diagrammatic charts, &c.

CHEMISTRY FOR BEGINNERS. By EDWARD HART, Ph.D., Professor of Chemistry, Lafayette College, Easton, Pa. Third Edition, revised and greatly enlarged. Chemical Publishing Company, Easton, Pa., U.S.A. 1896. Price 1/50 dols.

SMALL. 8vo volume, containing preface, table of contents, subject-matter filling 224 pages, and an alphabetical index. The text is illustrated with 62 engravings and 2 plates.

The work is divided into three sections, devoted as follows:—I. Non-metals; II. Metals; and III. The Carbon Compounds.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

RUSSIA.

Tariff Classifications.

Note.—Pond = 36 lb. avoirdupois. Rouble (gold) = 3s. 2d.

Quinozol and creoline—disinfecting preparations—to be cleared under section 112. Duty, 1 rouble 50 copecks gold per pond gross.

UNITED STATES.

Tariff Divisions.

Tannin powder, being an extract from nut galls in the form of a powder, is liable to duty as tannin or tannic acid at 60 cents a pound under paragraph 5 of the same Act.

Carbonate of potash is entitled to a free entry under paragraph 595.

Sarsaparilla is entitled to free entry under paragraph 555, which enumerates on the free list, among other articles, "lemonade, soda water, and all similar waters."

Potash water is free of duty under the same paragraph.

Ground carbonate of baryta (witherite), is to pay duty at 20 per cent. *ad valorem* under section 3.

VICTORIA.

Classification of Articles in Customs Tariff.

Tariff No.	Description of Articles.	Rate of Duty.
495	Medicated preparations containing alcohol:— Succus taraxaci, over 25 per cent. Strophanthus, tincture of, 44-6 over proof. Tonic verumifuge, Jayne's, over 50 per cent.	12s. per gallon of the strength of proof by Sykes' hydrometer, and so in proportion for any greater or less strength than the strength of proof, when not dutiable at a higher rate under the heading of Medicines liable to 25 per cent. <i>ad val.</i>
295	Medicines, &c.:— Balsamic amykos aseptic, recommended. Creosote carbonate or creosotal is a chemical, in packages of 1 lb. Ichthyol, in 1-oz. bottles Phenacetine, in 1-oz. bottles, Phenazone, Swiss (being another name for antipyrin), consists of ingredients in chemical combination, and when not packed for retail sale or recommended.	25% <i>ad val.</i> Free. Free. Free.

GENERAL TRADE NOTES.

TIN-PLATE INDUSTRY IN PENNSYLVANIA.

Journal of the Franklin Institute, 1896, 142, 315.

In Pennsylvania there are 17 tin-dipping works, and 10 others where black-plate is manufactured as well; they employ altogether about 3,000 persons. The total produce of the State for the year ending December 31 last was 104,375,366 lb. of finished tin- andterne-plate, representing roughly one half the entire capacity of the American factories. The average value of both materials was 81.20 dols. per nett ton, and of the tin-plate alone, 89.62 dols. per ton. The plants were in operation about 240 days during the year; and the average daily wage of skilled and unskilled labour in the two classes of works was 1.79 dols., or 1.38 dols. in the dipping works only.—F.H.L.

COAL AND SALTPETRE IN SOUTH AFRICA.

Imperial Institute Journal, November 1896, 402.

If reports are reliable, Namaqualand holds forth glorious prospects for enterprising miners. Discoveries of copper and coal are reported, and news comes from the Karoo that a bed of nitrate of potassium at least 15 feet thick, covering 50 square miles, has been found and can be worked to pay. The bed lies in the Newveld district, and the main railway line runs through it. Again, conveniently situated almost on the line of the new railway, a discovery of coal has been made about 25 miles due north of Pretoria. This discovery is likely to prove valuable, as the quality of the coal is reported to be excellent. Something like 1,000 square miles of coal are supposed to be in the wide district traversed by the railway between Pretoria and Delagoa Bay, and in the midst of these coal-beds is the outcrop of iron ore. In one colliery not six miles from Johannesburg, coal 70 ft. in thickness has been found.

THE GOVERNMENT METALLURGICAL WORKS IN NEW SOUTH WALES.

The metallurgical works of the New South Wales Government were to have been in active operation before the end of September, according to the *Australian Mining Standard*. They are situated on the Duck River, not far from Parramatta. By some inexplicable oversight cyanide and chlorination works were omitted from the original plan, but these are now to be added. The crushing and amalgamating machinery is nearly complete. The regulations and scale of charges have been prepared, and will be issued by the department in the course of a few days. They provide that bulk samples of gold ores up to 10 tons in weight from any one mine, or distinctive section of a mine, will be received with a view of determining the value of the ore, and the best and most economical method to be adopted for

its treatment. Cases of prospectors who are not in position to pay for testing their ores have been taken into consideration, and the Minister has approved of parcels being treated for them at the works free of charge. The only conditions to be attached to such a concession are that the applicants will get the ore, bag it, and place it on trucks at the nearest railway station, the department defraying the cost of railway carriage and treatment. Should the stone, however, yield any metal of value it will go towards the cost of the treatment. A report will be furnished to the owner in each case, showing the process to which the ore has been subjected, and offering suggestions as to the best and most economical methods of dealing with it, so that the loss of metal may be reduced to a minimum. The charges for crushing, sampling, assaying, amalgamating, and concentrating gold ores will be as follows:—For 1 ton, 15s.; 2 tons, 30s. per ton; 3 tons, 25s. per ton; 4 tons, 22s. per ton; 5 tons, 21s. per ton; 6 tons, 20s. per ton; 7 tons, 19s. per ton; 8 tons, 18s. per ton; 9 tons, 18s. per ton; 10 tons, 18s. per ton. Less than 1 ton will be charged as 1 ton.

NEW PHOSPHATE DISCOVERIES IN TENNESSEE.

Eng. and Mining J., Oct. 31, 1896, 418.

Much interest has been created recently in middle Tennessee by the discovery of a new source of available phosphate rock in large quantities. This new source, says State Geologist James M. Safford, in the *American Geologist*, is one wholly different from that yielding the now well-known rock of Swan Creek. The rock of Swan Creek is Devonian; the one to be described is Trenton. That is a true rock itself; this is a residuum after the leaching of a rock. The rock is found in workable bodies over a wide area, including, it may be, 15 or 20 square miles of surface.

The centre of the present workings is in the town of Mount Pleasant, in Maury County. Here the phosphate is found, after stripping off the soil, in banks from 3 to 8 ft. in vertical thickness. Half a dozen companies are busily engaged in getting it out. The rock is light yellowish or grayish, of an open, spongy structure, and occurs in layers or plates of various thickness from 1 in. to 6 ins. or more. The material is easily quarried, picked out in blocks without blasting. All the stripping required is the removal of soil.

An analysis, made in Atlanta, by Mr. J. M. McCandless, gave: Calcium phosphate, 77.54; iron and alumina, 1.50; calcium carbonate, 6.83. Other analyses show calcium phosphate ranging from 60 per cent. to 81 per cent., the proportion of iron and alumina being usually within the limits required for a commercial product. The layers are evidently a residuum left after a natural leaching of certain highly phosphatic limestones from the long-continued action of atmospheric waters. There are four divisions in Tennessee of the limestones of the Trenton age. All of these are more or less phosphatic, but it is the Capital division which is the great source of the phosphate. Parts of this limestone show upon analysis from 15 per cent. to 25 per cent. of phosphate, the dark lines marking the lamination of the rock being especially rich.

BORNEO COAL.

Eng. and Mining J., Nov. 7, 1896, 436.

The influence of the coal mines of Borneo is beginning to be felt in Eastern markets, imports from that island at Singapore having increased in four years from 5,531 tons to 17,843 tons. As these imports compete chiefly with coal from India, the Indian Mining Association recently had assays made of three samples of Borneo coal, from the Sadong, Labuan, and Muara mines, the results being given as follows:—

	Sadong.	Labuan.	Muara.
Volatile matters.....	42.04	42.34	47.54
Fixed carbon.....	56.27	54.97	50.79
Ash.....	1.69	2.69	1.67
Total.....	100.00	100.00	100.00

These analyses, according to *Indian Engineering*, are quite equal to any of the best Bengal coal. The same authority says that Borneo coal is delivered at Singapore at 6.50 dols. to 7 dols., ex-ship, which is quite as low as Indian coal operators can do.

MINING IN JAPAN.

The *Japan Weekly Mail* states that, according to a native paper (the *Jiji*), the value of the mining output in Japan in 1892 amounted to 15,145,817 yen; in 1893 it was 16,385,817 yen; and in 1894, 20,199,874 yen. An increase of more than 40 per cent. in three years is not a bad record. The following table gives the value of the principal minerals obtained during the two years 1893 and 1894:—

	1893.	1894.
	Yen.	Yen.
Coal.....	6,837,809	9,385,155
Copper.....	4,903,515	5,967,917
Silver.....	2723,402	2,716,769
Gold.....	407,365	788,574
Iron.....	392,473	567,491

This table shows that the principal minerals of Japan are, but it would be erroneous to infer that other minerals are of small importance in Japan. That is not the case. In point of fact, gold, iron, and other mines have developed to a greater or less extent because of the facility for working them. Yet the output of kerosene increased from 200,000 yen in 1893 to 260,000 yen in the following year. Sulphur, plumbago, tin, lead, manganese, and so forth, all show a similar increase. It would not be an exaggeration to say that the supply of various ores is almost inexhaustible in Japan, and that the mining industry has not yet advanced beyond its threshold.

THE GERMAN CHEMICAL INDUSTRY.

Chemist and Druggist, Nov. 21, 1896, 759.

The German census returns recently published contain some interesting facts relative to the development of the chemical industry in Germany. There are at present in that country 102,923 persons whose principal active pursuit is connected with the chemical industry. The census of 1882 contained only 57,530 such, showing an increase of nearly 80 per cent. in 15 years, which represents a relatively much larger development when taking into account that labour-saving processes have greatly increased during that period. The greatest increase is in the branch relating to chemical, pharmaceutical, and photographic goods, where the numbers have risen from 18,561 to 36,428. The colour industry occupied 10,548 persons in 1882, and 19,418 in 1895; that of explosive substances, including matches, fireworks, &c., 9,067 in 1882, and 19,382 in 1895. Chemical manure-making and the treatment of waste products employed 6,932 people in 1882, and 12,661 in 1895. On the other hand, the number of pharmacists and persons engaged in pharmacy has only slightly increased, owing, of course, to the law limiting the number of concessions. Pharmacists in business on their own account numbered 4,829 in 1882, and 5,487 in 1895, while the total number of persons engaged in pharmacies, including principals, has increased from 12,422 to 15,634. The number of persons engaged as principals in the manufacture and trade in chemical, pharmaceutical, and photographic preparations has risen from 1,485 to 2,398; that similarly engaged in the colour industry from 823 to 909. On the other hand, the number of persons in this position in the chemical manure and waste products industries has declined from 1,735 to 1,387, and in explosives from 602 to 379, probably on account of the tendency, especially pronounced in these branches, to convert industrial undertakings into companies. In 1882 the entire German chemical industry occupied 42,422 manual labourers—viz., 37,501 males and 5,921 females. In 1895 it gave employment to 81,878 labourers, of which 67,782 were males and 14,096 females, the male element having thus increased by 81 per cent., the female by 138 per cent. Female labour is chiefly engaged

in explosives, match-making, colour-making, and next to that in the manufacture of pharmaceutical and photographic preparations. The general development of the German chemical industry is further shown by the fact that in 1882, 553,084 tons of crude material for use in that industry were imported from abroad, and in 1895, 1,326,160 tons, the export of chemical goods having increased during that period from 315,393 tons, worth 227,000,000 m., to 510,322 tons, worth 302,000,000 m.

THE ALCOHOL QUESTION.

Chemist and Druggist, Nov. 21, 1896, 740.

In the course of the discussion last week on the proposed new law regulating the sale of alcohol, the Senate fixed the duties on acetic acid of chemical origin manufactured in France, as follows:—(1.) Acetic acid, or dilutions of acetic acid containing 8 per cent. of acid and below, 10 fr.; 9 to 12 per cent. of acid, 15 fr.; 13 to 16 per cent. of acid, 20 fr.; 17 to 30 per cent. of acid, 37 fr.; more than 40 per cent. of acid will pay 105 fr. (2.) Crystallised acetic acid in a solid state will pay 125 fr. per 100 kilos. The same duties will be charged independently of Custom-house duties on acetic acids, dilutions of acetic acid, and crystallised acetic acid imported from abroad.

BOARD OF TRADE NOTICES.

CARRIAGE OF LIQUID AMMONIA ON BOARD SHIP.

The Board of Trade are advised that both the aqueous solution of ammonia and ammoniacal gas compressed into liquid form should be classed as dangerous goods, not only on account of the danger of explosion involved when they are contained in vessels not sufficiently strong to withstand the pressure which may be produced by a rise in temperature, but also on account of the highly dangerous nature of the gas.

The following precautions should be adopted when either of these liquids is carried on board ship:—

It should only be packed in iron vessels which have been carefully tested up to a pressure of 675 lb. per sq. in., and should be stored in a part of the ship beyond the influence of any heat from boilers or furnaces, and remote from the living quarters.

Ammonia solution of a specific gravity of 0.959 and upwards is exempted from the operation of the above instruction.

METHYLATED SPIRIT.

The surveyors are informed that the carriage of methylated spirit, or other similar inflammable liquid, as cargo on board emigrant ships is prohibited, and that no vessel having such spirit or other inflammable liquid on board as portion of her cargo should be allowed to clear under the Passengers Acts.

In the case of vessels which do not require to be cleared under the Passengers Acts, and which do not carry explosives, the following conditions should be observed if methylated spirit is carried below the weather deck:—

(a.) The spirit should be in substantial iron drums properly closed and secured.

(b.) The drums should be placed (and securely fastened to prevent violent movement) in a compartment by themselves, so constructed that, in the event of a fire, the burning spirit could not run out and spread over the vessel. With this view, the compartment (which should be of the character of the depots contemplated by the Inflammable Liquids Bill of 1891) should be proof against escape of liquid, whether burning or otherwise, and this condition would perhaps be best satisfied by means of an iron tank to be entered only from above.

(c.) The compartment should not be entered with naked lights, but only with safety lamps.

The volatile character of the methylated spirit, and the fact of its being a liquid, render it most necessary that some such provision should be made against what might otherwise be the very serious consequences of a leaky drum.

USE AND STOWAGE ON BOARD SHIP OF OILED MATERIALS.

The attention of the Board of Trade has been called to the danger arising from materials which have been dressed or soaked with oils, either raw or boiled, such as oiled clothing, oiled silk or cotton goods, and oiled paper, &c., whether in the piece or used for packing purposes.

The Board have reason to believe that materials which have been so treated are liable to spontaneous combustion, more especially in newly manufactured goods that have been insufficiently dried.

The Board of Trade think it desirable to inform all persons interested, that it is very important that cases containing oiled goods intended for exportation as merchandise, should be perforated or otherwise ventilated, and should be distinctly and conspicuously marked at full length in English, as required by section 146 of the Merchant Shipping Act, 1894.

When oiled materials are used for packing purposes great care should be exercised that they have first been properly dried, and also that the various folds do not overlap to such an extent as to bring several thicknesses of the material together.

On board ship, when oiled goods are carried under deck, care should be taken that they are stowed in a cool place, and in such a position that they can be readily got at.

SHIPMENT OF SULPHIDE OF SODIUM AND SULPHIDE OF POTASSIUM.

The attention of the Board of Trade has recently been called to a case of fire on board a steamship which is attributed to spontaneous combustion of sulphide of sodium forming part of her cargo.

The Board are advised that the chemical in question, as well as sulphide of potassium, is very liable, under certain conditions, to spontaneous combustion; and therefore caution shipowners and shipmasters against the dangers attending the stowage of either of them on board ship below the weather deck.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st October	
	1895.	1896.
	£	£
Metals.....	1,017,964	1,708,863
Chemicals and dyestuffs.....	457,542	491,570
Oils.....	721,726	709,394
Raw materials for non-textile industries.....	4,528,819	4,518,091
Total value of all imports....	36,559,868	39,576,290

SUMMARY OF EXPORTS.

Articles.	Month ending 31st October	
	1895.	1896.
	£	£
Metals (other than machinery)....	2,761,583	3,139,132
Chemicals and medicines.....	706,716	651,412
Miscellaneous articles.....	2,951,370	3,166,584
Total value of all exports....	24,828,866	26,654,997

IMPORTS OF METALS FOR MONTH ENDING
31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore..... Tons	11,897	10,280	53,007	46,375
Regulus..... "	8,690	8,271	216,355	211,780
Unwrought..... "	2,977	5,572	141,075	268,778
Iron:—				
Ore..... "	408,125	381,553	276,580	263,837
Bolt, bar, &c. "	7,472	5,981	59,058	49,182
Steel, unwrought..... "	2,656	1,713	15,868	15,892
Lead, pig and sheet..... "	14,541	18,532	157,659	144,640
Pyrites..... "	40,359	38,276	65,920	63,761
Quicksilver..... Lb.	42,840	9,218	3,577	922
Silver ore..... Value £	..	..	115,146	115,186
Tin..... Cwt.	74,443	75,547	240,822	222,137
Zinc..... Tons	6,751	8,297	103,178	132,867
Other articles... Value £	..	..	198,819	179,497
Total value of metals	..	..	1,647,964	1,708,863

IMPORTS OF CHEMICALS AND DYE STUFFS FOR MONTH
ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	13,042	12,024	9,005	8,359
Bark (tanners', &c.) .. "	38,810	24,611	14,638	7,708
Brimstone..... "	30,663	28,830	8,523	6,887
Chemicals..... Value £	..	..	135,829	116,641
Cochineal..... Cwt.	725	1,081	4,544	7,290
Cutch and gambier Tons	1,812	1,369	37,916	26,645
Dyes:—				
Alizarin..... Value £	..	..	27,593	24,559
Anilin and other .. "	..	..	39,317	44,555
Indigo..... Cwt.	1,590	1,440	17,984	17,817
Nitrate of potash .. "	19,333	17,714	18,476	14,399
Valonia..... Tons	1,833	1,618	20,310	16,444
Other articles... Value £	..	..	123,294	113,766
Total value of chemicals	..	..	457,312	404,570

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian .. Cwt.	2,629	1,430	£ 4,271	£ 2,288
Bristles..... Lb.	477,786	372,407	73,437	51,499
Caoutchouc..... Cwt.	29,777	36,933	323,109	463,435
Gum:—				
Arabic..... "	8,151	1,192	24,967	3,145
Lac, &c. "	7,558	5,184	43,571	24,868
Gutta-percha..... "	2,538	4,474	22,886	44,802
Hides, raw:—				
Dry..... "	46,969	31,413	120,340	71,995
Wet..... "	52,650	59,943	120,380	123,164
Ivory..... "	1,304	1,093	52,980	45,130
Manure:—				
Guano..... Tons	1,425	257	10,985	1,475
Bones..... "	4,568	7,987	18,964	29,418
Nitrate of soda..... "	7,237	2,383	53,880	19,058
Phosphate of lime .. "	23,458	18,448	39,723	25,857
Paraffin..... Cwt.	70,168	83,692	79,283	79,186
Linen rags..... Tons	2,665	1,579	20,647	16,508
Esparto..... "	15,042	14,125	64,590	61,446
Pulp of wood..... "	28,114	30,588	143,208	165,423
Rosin..... Cwt.	114,494	35,064	29,791	9,827
Tallow and stearin .. "	136,463	135,844	164,596	140,779
Tar..... Barrels	20,607	16,809	13,674	13,099
Wood:—				
Hewn..... Loads	231,380	203,177	402,637	410,943
Sawn..... "	703,812	721,412	1,434,410	1,613,349
Staves..... "	18,414	13,494	70,998	56,233
Mahogany..... Tons	1,727	7,778	13,961	68,601
Other articles... Value £	..	..	1,181,498	1,004,009
Total value .....	..	..	4,528,819	4,548,061

Besides the above, drugs to the value of £89,152, were imported, as against 101,478, in October 1895.

IMPORTS OF OILS FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa nut..... Cwt.	30,849	24,130	£ 34,562	£ 26,003
Olive..... Tons	1,625	424	53,319	11,678
Palm..... Cwt.	68,630	90,003	71,830	104,038
Petroleum..... Gall.	15,248,848	17,169,471	369,430	316,216
Seed..... Tons	2,640	3,316	55,451	72,943
Train, &c. Tons	1,462	2,484	23,882	40,011
Turpentine..... Cwt.	64,315	29,774	65,490	29,802
Other articles .. Value £	..	..	107,852	108,583
Total value of oils...	..	..	721,726	709,394

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,263	9,586	£ 37,320	£ 42,485
Copper:—				
Unwrought..... "	70,388	27,706	172,606	68,798
Wrought..... "	24,132	19,251	71,370	61,006
Mixed metal..... "	20,061	27,525	45,456	65,443
Hardware..... Value £	..	..	181,166	199,045
Implement..... "	..	..	115,863	128,725
Iron and steel..... Tons	268,333	344,615	1,910,208	2,200,345
Lead..... "	4,227	2,808	53,108	35,453
Plated wares .. Value £	..	..	40,056	48,238
Telegraph wires .. "	..	..	39,769	162,054
Tin..... Cwt.	10,890	11,567	37,665	36,417
Zinc..... "	18,449	12,274	12,016	9,256
Other articles .. Value £	..	..	47,980	81,897
Total value .....	..	..	2,764,583	3,139,132

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder..... Lb.	971,900	1,008,800	£ 20,322	£ 23,830
Military stores.. Value £	..	..	171,671	244,137
Candles..... Lb.	2,181,500	2,068,100	35,589	30,406
Caoutchouc..... Value £	..	..	113,903	116,279
Cement..... Tons	31,532	32,593	53,218	53,117
Products of coal Value £	..	..	126,671	150,422
Earthenware .. "	..	..	181,931	167,846
Stoneware..... "	..	..	12,814	15,219
Glass:—				
Plate..... Sq. Ft.	147,035	172,144	8,122	9,916
Flint..... Cwt.	8,771	9,680	22,015	22,514
Bottles..... "	62,247	78,172	29,438	41,102
Other kinds.... "	23,968	24,755	18,526	19,494
Leather:—				
Unwrought	13,473	12,031	126,918	107,964
Wrought .....	..	..	45,514	41,088
Seed oil..... Tons	3,905	5,068	83,211	99,925
Floorcloth	1,440,900	1,734,900	65,641	75,984
Painters' materials Val. £	..	..	145,542	138,302
Paper..... Cwt.	79,479	100,177	132,340	152,171
Rags..... Tons	3,881	4,660	22,946	25,193
Soap..... Cwt.	73,165	60,371	74,848	63,372
Total value .....	..	..	2,931,370	3,166,534

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 31ST OCTOBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	624,084	447,743	159,314	113,849
Bleaching materials ..	131,355	104,753	46,117	24,299
Chemical manures. Tons	23,093	26,621	130,319	116,635
Medicines..... Value £	..	..	93,886	97,615
Other articles.... "	..	..	277,080	289,014
Total value .....	..	..	706,716	651,412

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

23,137. H. Booth. Improvements in filters for extracting oily matter from the feed-water supply of steam generators or the like. Oct. 19.

23,140. S. Mycock and F. C. Carter. Improvements in valves for controlling the flow of fluids. Oct. 19.

23,189. A. S. Barham and L. de Wittenbach. Improvements in apparatus for sterilising milk and other liquids. Oct. 19.

23,379. H. F. Stanley and The Farrington Works, Lim. Improvements in apparatus for refrigerating air and other gases. Oct. 21.

23,401. H. Desmarest. Improvements in refrigerating apparatus. Oct. 21.

23,723. T. C. Taylor and J. E. Tolson. Improvements in retorts for carbonising machines. Oct. 26.

23,792. R. Thiel. Improvements in or relating to closing device for receptacles for sterilising. Complete Specification. Oct. 26.

23,991. L. Sterne.—From The De La Vergne Refrigerating Machine Co. Improvements in refrigerating and ice-making apparatus. Complete Specification. Oct. 28.

24,405. R. M. McDougall. Improvements in the packing of the tubes in the rectifiers of Coffey's distilling apparatus. Nov. 2.

24,559. A. Helzel. Improvements in muffle furnaces. Nov. 3.

24,755. A. McQueen. Pressure gauge or indicator and safety valve for liquids and gases. Nov. 5.

24,850. J. T. Pearson. Improvements in the method of and apparatus for crushing steel and other hard substances. Nov. 6.

24,921. A. McDonadd. Improvements in retorts or vulcanisers. Nov. 6.

25,031. P. Funfak. Improvements in vessels for holding corrosive substances or the like. Complete Specification. Nov. 7.

25,250. W. E. Pedley. See Class X.

25,612. C. G. J. Moller. Improvements in apparatus for drying granular and other material. Nov. 13.

25,643. M. H. Smith. Improved apparatus for cooling purposes and for diffusing heat. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

20,292. S. S. Bromhead.—From C. Dicker. Distilling apparatus. Oct. 28.

22,920. W. E. Heys.—From J. Hundhausen. Method and apparatus for separating insoluble substance from liquids. Nov. 4.

22,924. W. E. Heys.—From J. Hundhausen. Method and apparatus for drying sensitive substances. Nov. 4.

24,943. T. B. Jones. Apparatus for filtering sewage and other liquids. Nov. 18.

25,049. D. A. Peniakoff. Rotatory apparatus for calcining substances. Nov. 18.

23,665A. L. Mond. Apparatus for treating solid and pasty substances with gases at elevated temperatures. Oct. 28.

1896.

75. W. W. R. Warn and L. F. King. Calcium carbide gas generators. Nov. 4.

17,408. H. Hirzel and R. Hoffmann. Apparatus for mixing and roasting materials of approximately equal specific gravity, and for separating materials of different specific gravity. Oct. 28.

17,821. T. B. Booth and A. Robinson. Apparatus for carbonating liquids. Nov. 11.

18,287. W. M. Fowler. Clarifying liquids. Nov. 4.

18,383. J. F. Stephenson. Apparatus for automatically removing solid matter from water or other liquids. Nov. 11.

19,761. W. R. Lake.—From A. Schwabe. Method of and apparatus for maintaining a uniform temperature in laboratory ovens, incubators, drying rooms, and the like. Oct. 28.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

23,147. W. J. Mackenzie. Improvements in apparatus for generating acetylene gas. Oct. 19.

23,233. C. S. Fletcher. "Fletcher's patent coke oven" for the reduction of the percentage of sulphur in coke. Oct. 20.

23,289. C. F. J. B. Becherel. Improvements in or relating to apparatus for the manufacture of acetylene gas. Filed Oct. 20. Date applied for June 27, being date of application in Belgium.

23,290. C. F. J. B. Becherel. Improvements in or relating to apparatus for the manufacture of acetylene gas. Oct. 20.

23,454. F. G. Bartlett. An improvement relating to burners for incandescent gas lighting. Complete Specification. Oct. 22.

23,483. F. B. Grundy and J. Moeller. Improvements in the manufacture of appliances for effecting self-lighting of gas. Oct. 22.

23,591. G. Trouve. Improvements in apparatus for producing and storing acetylene gas. Complete Specification. Filed Oct. 23. Date applied for April 14, 1896, being date of application in France.

23,592. G. Trouve. An acetylene lamp. Complete Specification. Filed Oct. 23. Date applied for May 11, 1896, being date of application in France.

23,595. E. Theisen. Improvements in purifying gases or vapours and gaining by-products therefrom, and in subjecting gases or vapours to the action of solid or liquid substances, and the converse by means of centrifugal action, and apparatus therefor. Complete Specification. Oct. 23.

23,669. H. E. Oving. Improved process and apparatus for the production and treatment of acetylene gas. Oct. 24.

23,670. H. E. Oving. Improvements in or relating to the treatment of acetylene or other gas for lighting, heating, or other purposes. Oct. 24.

23,701. H. Lane and B. T. L. Thomson. Improvements in the production of gas from petroleum and heavy oils for lighting and heating purposes, and in apparatus therefor. Oct. 24.

23,752. W. J. Mackenzie. Improvements in apparatus for generating acetylene gas. Oct. 26.

23,812. R. Haddan.—From H. Colberg. Improved apparatus for the automatic production of acetylene gas. Complete Specification. Oct. 26.

24,064. S. H. Crocker. Improvements in mantles for incandescent light. Oct. 28.

24,120. A. J. Boulton.—From A. Vandenbergh and A. Gardener. Improvements in or relating to the production of acetylene gas. Oct. 29.

24,208. D. M. Hughes. Improvements in incandescence burners adapted for consuming oil-gas. Oct. 30.

24,274. R. Turr. Improvements in apparatus for the production and combustion of acetylene gas. Complete Specification. Oct. 30.

24,344. H. V. R. Reed. Improvements in means for charging bottles and other vessels with compressed gases. Oct. 31.

24,378. G. Severac. Improvements in acetylene gas lamps and generators. Oct. 31.

24,411. F. S. Cripps. Improvements in the manufacture of illuminating gas. Nov. 2.

24,414. A. J. Smith and A. G. Smith. An improved automatic acetylene gas generator. Nov. 2.

24,440. P. de Resener and H. L. A. Luchaire. Improvements in apparatus for the manufacture of acetylene. Filed Nov. 2. Date applied for June 8, 1896, being date of application in France.

24,558. H. H. Lake.—From V. Hanotier and G. Hostelet. Improvements in lamps adapted for producing and burning acetylene gas. Nov. 3.

24,611. A. Kay. Improvements in portable apparatus for generating and storing acetylene gas. Nov. 4.

24,809. A. Schoenemann. Improvements in drying peat. Complete Specification. Nov. 5.

25,194. J. Byrom. Improvements in apparatus and valves for the generation and storage of acetylene gas. Nov. 10.

25,224. I. N. V. Bablon. Improvements in the production of acetylene gas and in apparatus therefor. Nov. 10.

25,236. E. Chesney, L. Pillion, and C. Bertolus. Improvements in apparatus for automatically producing and storing acetylene. Nov. 10. Date applied for May 9, 1896, being date of application in France.

25,339. T. B. Younger. Improvements relating to the manufacture of gas and coke. Nov. 11.

25,488. A. Fournier. Improved apparatus for the production of acetylene gas. Nov. 12.

25,498. A. I. Van Vriesland. Improved process and apparatus for producing gas or vapour from air and liquid hydrocarbons. Complete Specification. Nov. 13.

25,695. V. R. Lewes. Improvements in the manufacture of illuminating gas. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,915. R. F. Strong. Manufacture of coal briquettes. Nov. 4.

23,051. O. Heimann. New process for making porous coke. Oct. 28.

23,436. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik. Apparatus for refining crude petroleum and analogous oils by means of fuming sulphuric acid. Nov. 18.

23,639. T. Birnbaum. Apparatus for burning illuminating gas. Oct. 28.

24,689. C. J. Yarnold. Manufacture of ozone, and apparatus therefor. Nov. 11.

24,381. L. Denayrouze. Method and apparatus for charging air with combustible matter and applying it for illuminating. Nov. 18.

24,384. S. Cutler. Improved oil atomiser for gas carburetters. Oct. 28.

24,505. A. Taylor and W. S. Taylor. Mantles for incandescent gas lighting. Nov. 11.

1896.

1750. J. C. Mewburn.—From La Société Anonyme du Combustible. Manufacture of fuel briquettes or blocks. Nov. 11.

5336. R. Lavender and W. Tice. Appliances for increasing the illuminating power of gas under combustion. Nov. 11.

12,628. A. Bryce. A universal fuel injector. Nov. 18.

14,009. E. Fatham. Means for obtaining light and heat. Nov. 18.

14,213. A. Peugeot. A new system of air carburetter. Nov. 18.

16,541. M. Ekenberg. Manufacture of solidified petroleum. Oct. 28.

16,735. S. Marcus. Burners for gasifying and burning hydrocarbons, chiefly designed for the production of light by incandescence. Oct. 28.

19,957. H. Wellstein. Process of manufacturing mantles for incandescent burners. Nov. 4.

19,973. P. Bode. Incandescent gas burners. Oct. 28.

20,602. W. B. Rickman.—From J. Pintsh. Apparatus for the production of acetylene gas. Nov. 4.

20,903. V. Sardi. Apparatus for the manufacture of acetylene gas. Oct. 28.

21,267. G. Lowenberg. Composition to be used in the manufacture of glow bodies for incandescent lamps. Nov. 11.

21,468. S. Kon. Generators for acetylene gas. Nov. 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

APPLICATION.

23,649. J. Meikle. Improvements in obtaining benzene, toluene, and other products from mineral oils and liquid tars. Oct. 24.

COMPLETE SPECIFICATION ACCEPTED.

1896.

8718. E. Morrice. Naphthalene. Nov. 11.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

23,175. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of new violet mono-azo dyestuffs for wool dyeing a fast brown by oxidation with chrome. Oct. 19.

23,358. J. Grossmann. Improvements in the manufacture and preservation of white indigo. Oct. 21.

23,554. T. A. Myers. Improvements in the manufacture and packing of blue for laundry purposes, liquid dyes, and other liquids. Oct. 23.

24,134. S. Pitt.—From L. Cassella and Co. Introduction of a blue dyestuff suitable for dyeing wool. Oct. 29.

24,408. I. Levinstein and Levinstein, Lim. Production of a new colour base and of colouring matters therefrom. Nov. 2.

25,128. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of new colouring matters dyeing from blue-green to blue, and of new chloro-derivatives and sulphonic derivatives of benzoic aldehyde therefor. Complete Specification. Nov. 9.

25,269. J. F. Schillis and P. Teichmann. The crown liquid bluing. Nov. 10.

25,592. C. W. Anderson, H. Benjamin, and J. Mendess. An improved liquid compound for dyeing purposes, also applicable for detergent, purifying, and disinfecting purposes. Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,417. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of dyestuffs for cotton. Oct. 28.

21,194. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Production of para-nitro-phenetol and ortho-nitro-toluene-para-sulphonic acid. Nov. 4.

1896.

2196. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation. Manufacture of direct-dyeing azo colouring matters. Nov. 18.

19,516. O. Imray.—From The Society of Chemical Industry in Basle. Manufacture of colouring matters of the group of the rhodamines and of rhodol. Oct. 28.

V.—TEXTILES, COTTON, WOOL, SILK, ETC.

APPLICATIONS.

23,259. H. K. Tompkins. Improvements in the manufacture of artificial silk. Oct. 20.

23,427. C. J. Dear. A machine relating to the decortication of ramie and other fibrous plants. Oct. 22.

23,693. T. Ferguson. A liquid for blueing and clearing yarns and cloth manufactured from flax, hemp, cotton, silk, ramie, and other fibres. Oct. 24.

25,362. V. Bona. Improvements in the manufacture of textile fabrics. Complete Specification. Nov. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,183. G. E. Wright and W. Monk. Method and apparatus for cleansing and recovering grease and oil from cotton and other waste and wool. Nov. 18.

14,760. G. C. Dymond.—From Erste Deutsche Patent-Linolium-Fabrik. Improved calendering machine for the production of running linoleum with inlaid coloured strips. Oct. 28.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

23,635. E. Makin, jun. Improvements in connection with kiers and like vessels for bleaching, dyeing, and similarly treating textile materials, yarns, and fabrics. Oct. 24.

23,718. H. Bentley. Improvements in apparatus for scouring and dyeing hanks of yarn or fibrous material. Oct. 26.

23,741. A. Liebmann and W. Kerr. Improvements in the methods or means for mordanting yarns, threads, fabrics, and other materials composed of fibres having a vegetable origin. Oct. 26.

23,797. M. Beraud and A. Lantmann. Improvements in dyeing fabrics. Oct. 26.

24,628. E. Beutz and F. J. Farrell. New or improved methods of dyeing animal fibres in a manufactured, partly manufactured, or unmanufactured state. Nov. 4.

25,348. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. A method of dyeing wool with mordant dyestuffs in a single bath. Nov. 11.

25,492. W. Watson and Co., Lim., and E. Beutz. A new or improved method of fixing on cotton fabrics basic oxy-azo colouring matters produced on the fibre. Nov. 12.

25,581. E. J. Stewart. Improvements in dyeing. Nov. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,185. M. H. Smallwood. Apparatus for bleaching washing, dyeing, and drying yarn in the cop. Oct. 28.

23,466. G. White. An improvement in drying spot, random, or any other parti-coloured dyed yarns. Oct. 28.

1896.

1375. J. Berry. Printing waterproof fabrics and apparatus therefor. Nov. 11.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

23,245. J. Pattison. Improved ammoniacal compounds. Oct. 20.

23,389. M. Sandecki. A new process of extracting carbonate of zinc from calamines. Oct. 21.

23,391. J. W. Fox. An improvement in the treatment of brine for the manufacture of table salt. Oct. 21.

23,614. J. W. Weston and T. I. Weston. Improvements in the manufacture of salt from brine and in apparatus therefor. Oct. 23.

23,853. F. M. Spence, D. D. Spence, and A. Shearer. Improvements in the manufacture of alumina and carbonate of soda. Oct. 27.

24,573. C. Hoepfner. Production of chloride of zinc and chlorine. Nov. 3.

25,100. A. Schmidt. Process for purifying crude acetic acid. Complete Specification. Nov. 9.

25,273. T. J. Vick and C. C. Askew. Perfected table salt. Nov. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,715. R. England. Concentration of sulphuric acid. Oct. 28.

22,765. F. G. Powell, A. Powell, M. E. W. Powell, and R. H. R. Powell. Manufacture of vinegar. Nov. 4.

1896.

75. W. W. R. Warn and L. F. King. See Class I.

17,488. A. Kumpfmüller and E. Schultgen. Evaporation and concentration of solutions of salts. Nov. 4.

20,598. J. A. Denther. Improvements in and relating to calcium carbide and the treatment of the same to form a uniform composition. Nov. 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

23,402. H. H. Lake.—From J. E. Winzer. Improvements in and relating to the burning and enamelling of earthenware and porcelain goods in kilns or ovens. Oct. 21.

23,724. J. Morton. Improvements in the method of and means for manufacturing glazed bricks. Oct. 26.

23,725. J. Morton. A new or improved method of and means for manufacturing glazed bricks. Oct. 26.

23,814. W. H. Godwin and T. Pickerill. Improvements in slabbing tiles, mosaics, and other similar appliances. Complete Specification. Oct. 26.

23,863. G. Boulton. Improved method or process of treating decorated ceramic ware for obviating the passing of such ware through a hardening-on kiln. Oct. 27.

24,033. J. Jacques, W. E. McCalla, and J. Nicholson. Improvements in the manufacture of articles in glass, tile, pottery, metals, and like substances by a process for producing thereon letters, figures, or designs in permanent colours. Oct. 28.

24,095. J. W. Knights. An improved method of making coloured tiles for floors or building purposes. Oct. 29.

24,249. J. Aynsley. Improved means for preventing the clinking or cracking of pottery ware in course of firing. Oct. 30.

25,326. A. J. Boulton.—From P. A. J. Gasse. Improvements in or relating to the decorating of earthenware, china, glass, tiles, bricks, and the like. Nov. 11.

25,665. J. Duckett and Son, Lim., J. Duckett, and J. W. Bullock. Improvements in the construction of muffled and semi-muffled kilns for burning bisquit and glazed ware. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,054. J. Gordon. Glazing bricks, tiles, and other surfaces. Oct. 28.

24,286. A. J. Boulton.—From La Société Anonyme Belge pour la Fabrik des Emaux artistiques. Manufacture of glass. Nov. 4.

24,907. J. Phillips. See Class IX.

1896.

177. The Worcester Royal Porcelain Company, Lim., and E. P. Evans, and C. F. Binns. Manufacture of plates and other similar articles of pottery or earthenware. Nov. 4.

19,123. H. Knutze. Improved printing process for producing metallic decorations on earthenware, glass, and the like. Nov. 11.

21,762. D. Laffan, G. Moore, and T. J. Glynn. Apparatus for blowing or forming bottles and other glassware. Nov. 18.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

23,244. L. A. Smart and H. Robertson. Improvements in cement compositions for application in steel and iron ships and otherwise. Oct. 20.

23,360. R. Walker. Improvements in the manufacture of artificial stone blocks and building concrete walls therewith. Oct. 21.

24,242. A. Clery. Improvements in the manufacture of artificial stone. Complete Specification. Oct. 30.

24,711. R. Hunter. Improvements in the manufacture of finely pulverised substances for use in the production of Portland cement, pigments, and the like. Nov. 5.

24,902. A. Gries. Improvements in and relating to the production of slabs or such like for building and other purposes. Complete Specification. Nov. 6.

25,103. J. E. Whiting. Improvements in the processes for preserving timber and other organic products or substances by subjection to hot compressed air. Nov. 9.

25,132. S. W. Margetts and J. Cuthbert. An improved machine for grinding cement, clinker, and other hard substances. Nov. 9.

25,292. C. Craig and G. K. Craig. Improved forms of building blocks and method of using same. Nov. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,773. M. M. Dessau. Paving blocks and slabs. Nov. 18.

24,907. J. Phillips. Continuous kilns for burning bricks, tiles, terra-cotta, lime, &c. Nov. 4.

1896.

759. G. R. Hilslop. Apparatus for revivifying spent limes, and for calcining cements and ores, or like materials. Nov. 18.

17,830. J. Foster. Construction of kilns for burning limestone, cement, and other similar material. Oct. 28.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

23,275. E. B. Parnell, A. Smith, and C. E. Monkhouse. Improvements in or relating to the treatment of ores and in apparatus therefor. Oct. 20.

23,470. B. E. Chaster. Improvements in extracting gold and platinum from ores or substances containing same. Oct. 22.

23,597. B. H. Thwaite and F. L. Gardner. Improvements in the method of working iron blast furnaces so as to utilise the gases evolved for producing motive power. Oct. 23.

23,788. H. E. Fry and N. G. Mackney. Improvements in the treatment of slags and ores containing zinc. Oct. 26.

23,817. B. Meyer. Improvements in the treatment of weldable iron. Complete Specification. Oct. 26.

23,836. G. A. Dick. Improvements in means or apparatus employed in the manufacture of wire rods or bars from various copper alloys and other metals. Oct. 27.

23,954. J. Y. Johnson.—From J. J. Deeble. Improvements in apparatus for use in the extraction of gold from auriferous material by the aid of chemical solvents. Complete Specification. Oct. 27.

23,958. G. W. Petersson. Process of manufacturing briquettes of iron ore or other iron compounds and briquettes thus made. Complete Specification. Filed Oct. 27. Date applied for March 27, 1896, being date of application in Sweden.

24,053. S. O. Cowper-Coles. Improvements in or connected with means for separating gold or other metals from solutions thereof. Oct. 28.

24,233. S. Neffgen. Improvements relating to processes and materials for treating poor iron and other ores and residues previous to the extraction of metal in the furnace. Oct. 30.

24,243. G. J. Atkins. Improvements in the treatment of ores, tailings, slimes, sands, and the like for the separation of metal therefrom. Oct. 30.

24,244. G. J. Atkins. Improvements in the recovery of metals from solutions of their salts by substitution and precipitation. Oct. 30.

24,417. B. C. Molloy. Improvements in extracting gold and silver from ores and compounds. Nov. 2.

24,657. R. F. Strong. Improvements in the treatment of ores for the production of iron, steel, and other metals. Nov. 4.

24,673. C. Jennings.—From A. F. Crosse. An improvement in the recovery of gold and silver from cyanide solutions containing the same. Nov. 4.

24,703. R. A. Hadfield. Improvements in the manufacture of iron alloys. Nov. 4.

24,705. R. A. Hadfield. Improvements in the manufacture or production of metallic alloys. Nov. 4.

25,045. J. R. Vellacott. Improved process for preventing any desired portions of iron or mild steel articles from being carbonised while the whole article is exposed to the action of carbonising agents while hot. Nov. 7.

25,133. A. Macdonald. See Class XIII.

25,250. W. E. Pedley. Improvements in apparatus for subjecting ores or other matters to heat or to the action of gases or liquids. Nov. 10.

25,375. S. O. Cowper-Coles. Improvements in the recovery of zinc, or of zinc and other metals, from zinc ores. Nov. 11.

25,461. W. P. Thompson.—From La Société Civile d'Etudes du Syndicat de l'Acier Gerard. Improvements in the manufacture of steel. Nov. 12.

25,462. W. P. Thompson.—From La Société Civile d'Etudes du Syndicat de l'Acier Gerard. Improvements in the pulverisation of metals with a view to the manufacture of steel and for other purposes. Nov. 12.

25,611. H. Maxim. An improved method and apparatus more especially intended for manufacturing calcium carbide and for the reduction of metals from their oxides. Nov. 13.

25,721. H. H. Lake.—From M. E. Waldstein. Improvements relating to the extraction of metals from their ores. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

14,783. E. A. Ashcroft. Process for the treatment of metalliferous ores and products. Nov. 11.

19,784. J. Jones. A twyer for the better distribution of blast in blast furnaces and cupolas. Oct. 28.

22,092. C. Mason. Process for the prevention of articles made of suitable metals or alloys rusting after they are electro-plated. Nov. 18.

22,137. W. Woolf and J. Andrews. New or improved metallic alloy, and process for producing same. Oct. 28.

22,727. J. Gjers. Manufacture of cast steel and homogeneous iron. Nov. 18.

23,045. J. A. Kendall. Manufacture of sodium and potassium. Oct. 28.

23,543. T. Parker and J. Pullman. Process for treating sulphide ores containing zinc and other metals. Oct. 14.

23,665. I. Mond. Apparatus for treating nickel ores, and other materials containing nickel, with carbon monoxide, partly applicable to other purposes. Nov. 11.

1896.

123. J. Giers. Furnaces for the manufacture of cast steel and homogeneous iron. Nov. 11.

549. W. Blackmore. The treatment of antimonial and arsenical ores, materials, or furnace products containing gold, silver, or platinum. Nov. 18.

19,883. E. Fischer and C. G. Penney. Apparatus for extracting metals. Nov. 11.

22,715. J. W. Clarke. Amalgamating apparatus for extracting gold and silver from their ores. Nov. 4.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

23,258. B. E. Preston and C. Simkins. Improvements in primary electric batteries. Oct. 20.

23,663. P. Garuti and R. Pompili. New and useful improvements in the apparatus for the production of oxygen and hydrogen by electrolysis (System Garuti). Complete Specification. Oct. 24.

23,827. E. W. Bonson. Improvements in and connected with electrical storage batteries. Oct. 27.

23,868. L. Honig. Insulating compound. Complete Specification. Oct. 27.

24,019. L. J. H. Rochatte. Improvement relating to electric batteries. Filed Oct. 28. Date applied for April 21, 1896, being date of application in France.

24,473. H. Leitner. Improvements in and connected with primary and secondary galvanic elements. Nov. 2.

25,036. J. L. Dobell. Improvements in or connected with electric batteries. Nov. 7.

25,360. F. H. Snyder. Improvements relating to the coating, covering, or amalgamating of metals with metals, and of other substances with metals, and other materials by the aid of electricity, and to apparatus therefor. Complete Specification. Nov. 11.

25,365. H. Woodward. An improved electrode for secondary batteries. Nov. 11.

25,601. J. M. Moffat. Improvements in the cells or boxes of electric batteries. Nov. 13.

25,631. T. Parker. Improvements in the means employed in the electrolytic production of the chlorates of sodium and potassium. Nov. 14.

25,701. J. H. May and F. King. Improvements in or connected with secondary batteries. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

20,542. G. Bell and G. W. Bell. Apparatus for the electrolytic decomposition of brine. Nov. 4.

22,142. P. Falle. Improved electric battery. Nov. 11.

22,233. M. Engl and F. Wüste. Improvements in accumulators and their electrode plates, partly applicable to primary batteries. Nov. 18.

23,097. R. Heathfield and W. S. Rawson. Improvements connected with the electrical deposition of zinc. Nov. 11.

1896.

557. R. Collins and F. Cogan. Electric batteries. Nov. 18.

1144. W. Heraeus. Electrodes for electrolytical purposes. Oct. 28.

12,250. C. Marschner. Plates for secondary galvanic batteries and a method of producing the same. Oct. 28.

15,129. F. W. Golby.—From O. Arlt. A process and apparatus for effecting electrolysis. Oct. 28.

19,301. A. Preiss. Storage batteries. Oct. 28.

20,505. H. Murray.—From R. J. W. Grindle. Electrodes for secondary voltaic batteries. Nov. 11.

20,600. J. A. Deuther. Electrodes. Nov. 11.

20,601. J. A. Deuther. Electric furnaces. Nov. 11.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

18,589A. J. Hargreaves and R. Armstrong. Improvements in the manufacture of soap and in the method of obtaining glycerin therefrom. Nov. 10. Date claimed Aug. 22, 1896.

23,216. P. Vachey and J. G. D. de Miomandre. Apparatus for extracting by volatile or other solvents vegetable and animal fats and oils, vegetable, mineral, and animal waxes, tannins, pharmaceutical products, and tinctures, balsams, and resinous products, gums, and all direct essences of whatever kind. Oct. 19.

23,324. G. R. Redgrave. An improved process of oxidising oils. Oct. 21.

24,090. T. H. Bateman. A new or improved liquid soap. Oct. 29.

24,727. F. L. Bartelt. Improved scap or washing compound. Nov. 5.

24,728. F. L. Bartelt. A caustic detergent. Nov. 5.

24,875. W. McDonnell. Improvements in or connected with and apparatus for the manufacture of margarine. Nov. 6.

24,909. G. W. Hansen. Improvements in and relating to the manufacture of waterproof dubbing for leather and leather goods. Complete Specification. Nov. 6.

25,050. C. Bauer. Improvements in and relating to soap and other articles. Nov. 9.

25,472. J. Davidson. Improvements in the manufacture of fatty matter from certain animal tissues. Complete Specification. Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,183. G. E. Wright and W. Monk. See Class V.

18,940. F. Sahlfeld. A process of obtaining sebacic acid from wool or felling grease. Oct. 28.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

23,216. P. Vachey and J. G. D. de Miomandre. See Class XII.

23,221. C. O. Weber. Improvements in the vulcanisation of india-rubber and gutta-percha. Oct. 20.

23,294. The Non-Corrosive Preserving and Fire-Resisting Paint Co., Ltd., F. White, and J. Thomson. Improved non-corrosive preserving and fire-resisting paint. Complete Specification. Oct. 20.

23,446. K. F. Lindstram. Lindstram's non-fouling composition for preserving and protecting wood, iron, and metallic substances under water. Oct. 22.

23,700. J. Speir. An improved preparation or composition suitable for use as a substitute for linoleum india-rubber, and analogous substances. Oct. 21.

23,716. H. H. Lake.—From G. Hermegnies. Improvements in the manufacture of zinc white. Oct. 24.

21,318. E. A. Longbottom. A new or improved compound for marking sheep. Oct. 31.

24,711. R. Hunter. See Class IX.

25,133. A. Maedonald. Improvements in the manufacture of white lead pigment and in the separation of metallic lead from lead sulphide. Complete Specification. Nov. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

21,085. J. McGillivray. Preservative coating for metals. Oct. 28.

22,797. W. Howarth and A. Marchbank. A new or improved blacking. Oct. 28.

23,969. C. D. Ismay. Manufacture of white lead. Nov. 11.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

23,742. J. T. McQuinn. Improvements in and connected with tanning hides, skins, and the like. Oct. 26.

24,812. A. M. Clark.—From Les Fils de F. P. Heinrich. An improved tanning process. Nov. 5.

24,819. H. Meister. Improvements in the manufacture of glue and gelatin cakes. Nov. 5.

24,885. L. de Barville, J. F. Roulleau, and L. V. Rance-lant. The manufacture of a substitute for leather and the like, and apparatus for use therein. Nov. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,865. H. Riches and W. Riches. A novel and quick process in preparing skins and hides and making them into buff or oil leather in less than 24 hours. Nov. 18.

23,291. W. Sander.—From L. Lessmann. Improvement to preserve sole leather and make it absolutely water-tight. Nov. 4.

1896.

289. J. Hudson. See Class XV.

XV.—AGRICULTURE AND MANURES, Etc.

APPLICATIONS.

24,776. O. Heymann and A. Nitsch. Process and apparatus for the drying and disintegration of super-phosphates. Complete Specification. Nov. 5.

24,879. T. Twynam. Improvements in the utilisation of blast-furnace slag for the production of compounds suitable for use in agriculture and for the treatment of sewage effluent. Nov. 6.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,160. W. Barclay. Process for the production of blood and slag manure. Nov. 11.

1896.

289. J. Hudson. A process for rendering waste leather soluble and applicable as a manure. Nov. 11.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

23,318. J. Grosse. Improvements in the granulation of crystallisable liquids, and especially of the by-products of sugar manufacture. Complete Specification. Oct. 20.

24,038. F. W. Golby.—From J. Hensel. See Class XVIII. A.

24,760. R. W. Macadam and W. W. Macadam. The extraction, recovery, and manufacture of the saccharine matters in cereals, malted or otherwise, with their subsequent use in medical, culinary, domestic, and any manufac-

turing purposes as a substitute for or in conjunction with dextrose, saccharose, levulose, and such sugars as are commonly called grape sugar. Nov. 5.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,859. A. Wohl. Extracting sugar from its solutions. Nov. 11.

1896.

1101. M. Sachs. An improved process for treating the by-products of sugar works and sugar refineries. Nov. 18.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

23,326. S. H. Wright. An improved method of dealing with yeast and apparatus therefor. Oct. 21.

24,945. R. D. Bailey. The extraction of tannin and resins from hops for use in brewing beer. Nov. 7.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

14,501. A. Moller. Manufacture of sparkling wine and apparatus therefor. Nov. 4.

17,183. A. Lippke. Process for the preservation of beer. Nov. 4.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS

APPLICATIONS.

A.—Foods.

23,126. W. P. Thorapson.—From Kietz and Co. An improved process for the manufacture of strengthening and flavouring food extracts. Oct. 19.

23,311. F. Faulkner. New or improved manufacture or production of a substance suitable for use as food. Oct. 20.

23,400. H. H. Lake.—From A. Astolfi and E. Brugnattelli. An improved alimentary substance. Complete Specification. Oct. 21.

23,785. W. Luplau. Improved apparatus for use in the aëration of milk, and for attachment to milk cans and the like receptacles. Oct. 26.

24,038. F. W. Golby.—From J. Hensel. Process for the production of a food of a high nutritive value from the molasses of raw beet-sugar. Complete Specification. Oct. 28.

24,195. G. Jackson. An improved method for preservation of fish. Oct. 30.

24,587. J. Garton, M. E. G. Finch-Hatton, and R. Garton. Improvements in the treatment of grain and the manufacture of foodstuffs therefrom. Nov. 3.

25,127. G. J. Epstein. Improvements in the manufacture or production of cocoa and chocolate. Nov. 9.

25,204. H. D. Perky. Machines for the reduction of cereals and other products to useful, artistic, and convenient forms for food. Complete Specification. Nov. 10.

25,205. H. D. Perky. Method and means for the reduction of grain to thread-like or shredded form, and for the disposition of the same in the manufacture of biscuit and other forms of bread. Complete Specification. Nov. 10.

B.—Sanitation.

23,676. S. de Petroff. A new or improved method for the treatment of town sewage refuse and the like, for the destruction of animalculæ and the production of a fertilising compound. Complete Specification. Oct. 24.

24,833. B. Walker. The Walker process for treating sewage sludge. Nov. 6.

25,708. B. H. Scheibler. New or improved apparatus for the carbonising of rags. Complete Specification. Nov. 11.

C.—Disinfectants.

24,410. E. Domergue. A composition for preserving vines and fruit trees from the attacks of insects. Nov. 2.

25,592. C. W. Anderson, H. Benjamin, and J. Mendess. See Class IV.

COMPLETE SPECIFICATIONS ACCEPTED.**A.—Foods.**

1895.

22,989. L. P. J. Revel and J. M. Campagne. An improved process for the preservation of meat, fish, and other animal substances, and the manufacture of foodstuffs therefrom. Nov. 11.

1896.

18,275. L. G. Fagersten and C. E. P. Korsell. Improved process of sterilising or pasteurising milk and cream. Nov. 18.

B.—Sanitation.

1895.

22,132. H. L. Doulton and R. Meldrum. Process and apparatus for purifying water. Nov. 4.

22,502. R. H. Reeves. Improved means and appliances for the treatment of sewage at precipitating and at outfall works. Nov. 18.

C.—Disinfectants.

1896.

20,246. H. Hiscott. The manufacture of an improved disinfectant or composition for antiseptic, disinfecting, sanitary, and other purposes. Nov. 4.

20,792. W. O. Quibell, T. O. Quibell, O. Quibell, and W. B. B. Quibell. Sheep-dip powder. Oct. 28.

XIX.—PAPER, PASTEBOARD, Etc.**APPLICATIONS.**

21,010. D. C. Simpson. A new or improved composition for treating paper, cardboard, wood, or other materials of a similar nature, to render such material waterproof, and the markings with writing inks thereon indelible. Oct. 28.

25,068. D. N. Bertram and J. Blaine. Improvements in and relating to the straining of pulp in paper-making and like machines. Nov. 9.

25,077. P. Willmot. A new or improved process of treating paper to produce a washable surface for temporary drawing, sketching, and the like. Nov. 9.

25,693. W. B. Leachman. Improvements in or connected with the finishing process in the manufacture of paper and in apparatus therefor. Nov. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

22,625. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. Manufacture of water- and grease-proof paper. Nov. 18.

24,275. T. A. Marshall.—From G. Smidth. Separating fibres from the waste liquors of paper-making machinery. Nov. 4.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.**APPLICATIONS.**

23,216. P. Vauchey and J. G. D. de Miomandre. See Class XII.

23,879. J. F. F. von Mering. New therapeutic substance, benzyl-morphine. Oct. 27.

24,568. A. Maile. An improved process for the manufacture of artificial musk. Nov. 3.

24,799. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. Improvements in the production of a pharmaceutical compound. Nov. 5.

25,377. W. Bevan. Improvements in the manufacture of white arsenic. Nov. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

24,517. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of hydroxy phenacetate salicylate. Oct. 28.

1896.

816. E. Darkopf. An improved process of producing methylenedinitric acids from formaldehyde and tannin. Oct. 28.

21,026. W. L. Wise.—From The Chemische Fabrik von Heyden Gesellschaft mit beschränkter Haftung. Manufacture of saccharine. Nov. 11.

XXI.—PHOTOGRAPHY.**APPLICATIONS.**

24,555. J. Ewing and T. R. Watson. Improvements in and connected with photography. Nov. 3.

24,817. C. C. Balston. Chromo-photography. Nov. 5.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

371. A. M. Clark.—From Lembach and Schleicher. Photographic developers. Nov. 18.

20,080. A. C. Edwards. Means or apparatus employed in the manufacture of photographic films.

20,387. T. C. Marceau. Producing photographs in relief. Nov. 11.

XXII.—EXPLOSIVES, MATCHES, Etc.**APPLICATIONS.**

23,612. W. Hope. Improvements in gunpowders and other explosives. Oct. 23.

23,613. W. Hope. Improvements in pellets and grains of gunpowder of any kind. Oct. 23.

24,955. A. Brock. Improvements in the manufacture of pyrotechnic compounds. Oct. 28.

25,704. A. E. Pike and W. H. Thew. Improvements in and in the manufacture of explosives or explosive compounds. Nov. 14.

25,711. C. Mortier and H. A. Sandon. Improvements in the manufacture of gunpowder. Complete Specification. Nov. 14.

COMPLETE SPECIFICATION ACCEPTED.

1896.

22,120. F. A. Halsen and W. C. Savage. Smokeless gunpowder. Nov. 11.

PATENT UNCLASSIFIABLE.**COMPLETE SPECIFICATION ACCEPTED.**

1896.

24,163. L. Grote. Improved process of manufacture of mouldable mass from asbestos fibre or other fibrous material. Oct. 28.

THE JOURNAL OF THE Society of Chemical Industry: A MONTHLY RECORD

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NOTICES.

COLLECTIVE INDEX.

A collective index, embracing the whole Journal from the Proceedings of the First Annual General Meeting, 1881, to the close of 1895, is now in preparation, and will be ready shortly. It will contain both a subject-matter and authors' names portion, and will be a volume of about 500 pages, uniform in size with the Journal.

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Members are reminded that the subscription of 25s. for 1897, payable on January 1st next, should be sent in good time to the Treasurer, in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation, should reach the General Secretary not later than January 15th, 1897.

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SESSION 1896-97.

Jan. 4th, 1897:—

Mr. A. Caldecott, B.A. "The Smelting and Refining of Cyanide Brillion."

Prof. W. Roberts-Austen, C.B., F.R.S. "The Industrial Use of a Recording Pyrometer."

Jan. 18th, 1897 (extra meeting).—Mr. W. J. Dibdin. "Some Recent Features in Water Analysis."

Meeting held on Monday, December 7th, 1896.

DR. R. MESSEL IN THE CHAIR.

NOTES ON THE SPONTANEOUS OXIDATION OF ALUMINIUM IN CONTACT WITH MERCURY.

BY H. F. HUNT AND L. J. STEELE, A.I.E.E.

OUR attention was first drawn to this subject towards the end of March 1895, when we noticed that a piece of commercial aluminium which had been standing in dirty mercury for several days, became coated with a white substance of an extremely light and fragile nature.

Owing to the growing use of aluminium for industrial purposes, we consider the matter of sufficient interest to warrant our publishing the following results of our own observations; and in order to make this paper as complete as possible, we have added a summary of the chief facts which have hitherto been published, dealing with the influence of mercury on the spontaneous oxidation of aluminium.

We found that the formation of this peculiar white substance alluded to above could be made to occur more rapidly by vigorously rubbing the specimen after removing it from the mercury. The aluminium appears at first to be tarnished, and then becomes covered with a whitish substance. At edges or corners, and along scratches on the surface, this substance is denser and its growth more rapid than at other parts. Curious motions accompany the growth, and the fact of an inorganic substance visibly growing out of a homogeneous piece of metal greatly increased the interest of the phenomenon.

Below are the conditions under which we found the substance to form:—

1. By allowing the aluminium to stand on mercury, covered with a thick film of oxide. In this case the aluminium does not visibly amalgamate, and the white formation occurs on almost all parts of the metal, even where not directly in contact with the mercury.

2. By keeping the aluminium beneath dirty mercury. It was found on removal that the action was far weaker than in the previous case.

3. By standing the aluminium on distilled mercury. The white substance produced in this case was so slight as to be scarcely visible, whilst none at all was produced by keeping the aluminium submerged under distilled mercury.

4. By amalgamating the surface of the aluminium with mercury, in the presence of either potassium cyanide, or nitric or sulphuric or hydrochloric acid, or by the presence of sodium amalgam. The white concretions resulting from this amalgamated aluminium are thicker, but much more uniform in their growth, than those resulting by leaving the aluminium on a film of mercurous oxide, as described

above. But one does not get such curious motions from the amalgam as from aluminium which has stood on slightly oxidised mercury.

When examined under an $\frac{1}{8}$ -inch objective, this white substance is seen to consist of dendritic masses of an apparently homogeneous material. After a polished surface of aluminium has been in contact or rubbed with mercury and then allowed to oxidise for an hour, the surface when again cleaned is seen to be pitted when examined under the microscope. An examination of the piece of aluminium used in this experiment revealed very small traces of iron. This phenomenon has been obtained with as pure brands of aluminium as could be commercially obtained, but in these cases the action is far less vigorous.

The result of an analysis gave aluminium as the only metal present in this white material. It was found to be soluble in dilute acids before ignition, but after ignition to be insoluble even in concentrated mineral acids; at the same time it underwent a loss of weight compatible with that required in the conversion of $Al_2(OH)_6$ into Al_2O_3 (aluminium hydrate into aluminium oxide). We therefore concluded that the white substance was a hydrate, and not a mere oxide of aluminium.

One of our first experiments was to find out whether this aluminium hydrate would form under oil. Two or three different kinds of oils were tried, but in no case did the hydrate form under them.

In another experiment we lowered a piece of aluminium foil, previously rubbed with sodium amalgam, into a jar of moist oxygen, but no appreciable increase of oxidation was observed, compared with a similar experiment carried out in moist air.

On immersing a piece of amalgamated aluminium in water, we found that a very flocculent greyish sediment was formed. When dried, this sediment turned white and proved to have the same composition as the white hydrate of the previous experiments. During the formation of this grey deposit, which in some cases would continue for 24 hours or more, there was a continual evolution of hydrogen gas.

We find on referring to previous work on this subject that the phenomenon of the rapid oxidation of aluminium after being rubbed with mercury was first described by Carl Jehn and H. Hinze (Ber. der D. Chem. Gesell., Nov. 12, 1874). The authors of that paper describe accurately how in a few moments masses of white material make their appearance and grow to a height of about 3 mm. We have frequently obtained it 15 mm. and more in height. Its composition there is given as almost pure alumina, Al_2O_3 , and not the hydrate as found by us.

In Thorpe's Dictionary of Chemistry, we find it stated that pure aluminium combines with mercury, although not readily, when the metals are heated together in an inert gas such as carbonic anhydride. The two metals combine rapidly in presence of alkalis. The amalgam may also be prepared by electrolysis of mercuric nitrate, using a negative plate of aluminium dipping in mercury.

According to Hinze (D.P.J. 227, 277), this oxidation does not take place in dry air, and is due to galvanic action on the water. We ourselves are inclined to support this view that the action is electrical. Aluminium becomes covered with alumina when pressed against moist platinum, and we are now carrying out experiments on the effect of contact between aluminium and other metals. The fact of the hydrate forming more thickly at corners and edges, where the electrical resistance would be lowest, tends also to support the theory of the action being electrical. We have, indeed, obtained galvanometer deflections between the aluminium and the mercury, but we do not base much reliance on this fact, as it may possibly have been due to other causes.

The Ber. 1895, 28, 1323—1327 gives an account of the first practical application of amalgamated aluminium. It had then (1895) been known for some years that amalgamated aluminium rapidly decomposed water, but mention is made in that paper for the first time of how much this amalgam can be used as a neutral reducing agent; for instance, nitrobenzene has been very successfully reduced to aniline in aqueous alcoholic solution by this method.

The rapid corrosion of aluminium under certain circumstances has thrown some doubt on the successful use of this metal for industrial purposes. Several brands and alloys containing small percentages of manganese, titanium, German silver, &c., have been recommended as being capable of thoroughly withstanding all atmospheric conditions, but there is undoubtedly room for investigation here. Examples of the corrosion of commercial aluminium are common enough. As an instance we may quote an experiment of the Sydney University, where two shallow aluminium dishes $\frac{3}{4}$ in. thick were left exposed on a honsetop for 54 weeks. The surfaces corroded badly and the weight of the dishes increased by about 1 per cent., doubtless owing to the formation of hydrated oxide. Then again in the report issued last year on the Texas torpedo boats with aluminium fittings, we find it stated that wherever such fittings touched the salt water, holes were eaten through, and even those on deck began to crumble on account of the salt air. One of us was recently told by the surgeon at a hospital that some difficulty had been experienced in the use of aluminium splints, owing to a whitish film sometimes forming upon them. The physician had put this down to want of care on the part of his assistants, and did not suspect that the perchloride of mercury, used as an antiseptic, had any connection with it.

Both English and French navies have tried aluminium as a means of lightening their torpedo boats, but we fear the experiments were not altogether a success. In one instance an aluminium boat was chained to the same buoy as another boat plated with copper; the galvanic effect in this case was extraordinary. The English torpedo destroyer "Boxer" has had its aluminium torpedo tubes removed owing to their rapid corrosion. Numbers of other instances could be cited showing the deteriorating effect of salt water on aluminium; the French indeed have shown that the metal loses 4 per cent. per annum of its weight in salt water. Aluminium utensils are now coming into rather extensive use, notably in the French army, and not very much trouble has been experienced by corrosion, except where the articles have been washed in alkali or where the metal contained impurities. Aluminium, when quite pure and thoroughly homogeneous, is not nearly so liable to attack as that containing impurities such as sodium. Pure aluminium, on the other hand, is mechanically so much weaker than many of its alloys that consideration has to be taken as to whether the metal is required to resist stresses or to withstand corrosion.

DISCUSSION.

Mr. O. GUTTMANN wished to draw attention to a new experience resulting from the behaviour of aluminium which was *à propos* to the facts brought before them by the authors. A friend of his had recently used large aluminium vessels for the purpose of nitrating cellulose, and found that, although the metal was attacked by either sulphuric acid or nitric acid alone, it was not appreciably attacked by a mixture of the two acids, and had in fact stood the work with perfect success for the last three months.

Mr. R. TERVET drew attention to a remarkable effect produced upon a plate of aluminium when brought in contact with mercury in presence of a weak solution of silver nitrate and nitric acid. After about 12 hours' contact the aluminium swells enormously, and splits up into a hundred or more exceedingly thin plates, which gives the mass a laminated appearance. These thin plates form at the same time the boundaries of small lenticular-shaped cavities, from which a constant stream of gas issues so long as unoxidised aluminium remains. When once started the oxidation of the amalgamated aluminium proceeds as actively under distilled water as it does in the presence of the silver nitrate and nitric acid.

With regard to the case of oxidation, which was the subject of the paper, he might remark that it had been referred to earlier by other observers, and the most successful way of producing the effect was to place the piece of aluminium in a flat dish, cover with a strong solution of sulphate of zinc, and rub the aluminium with the mercury. The aluminium, after being washed and rapidly dried with a cloth, would oxidise rapidly and

become so hot as to be unbearable in the hand, while the growth of oxide would shoot out several inches in the course of three or four minutes.

The behaviour of aluminium with copper sulphate moistened with dilute sulphuric acid was interesting, but for some reason uncertain.

A MEMBER observed that some years ago he had used aluminium in the construction of electric batteries with precisely the same result. On rubbing the metal with corrosive sublimate, oxidation immediately took place, and so the use of aluminium for that purpose had to be abandoned.

Mr. O. HEHNER said that results similar to those obtained by the authors had been described in the *Chemical News* in or about the year 1878. In fact it had been discovered over and over again. The action of the aluminium amalgam was doubtless similar to the copper-zinc couple of Gladstone and Triebel, and, like the latter, it might be found to be practically applicable to various chemical reactions.

A MEMBER asked if the authors had proved that the white substance produced was a hydrate. It was stated in the paper that it was practically a hydrous oxide, but that there was not sufficient water present to hydrate the whole.

Mr. STEELE, in reply, said that he and his colleague were quite aware that work had been done on the subject before, but they having found that the action was accompanied by the phenomena stated in their paper, thought the matter of sufficient interest to bring before the Society. They had, with the aid of Mr. Julian Baker, carried out several analyses of the white substance, and the result led them, in every case, to believe that it was a hydrate.

Mr. O. HEHNER asked if they had determined the amount of water given off.

Mr. STEELE replied that some recent experiments of theirs had fully confirmed the view that the substance under consideration was a hydrate and not an oxide. Mr. Julian L. Baker, to whom they had sent samples for analysis, had reported that aluminium was the only metal present. Before ignition the substance was soluble in dilute hydrochloric acid, but afterwards it was insoluble in concentrated hydrochloric acid. As shown by the following figures, it lost during ignition an amount of water compatible with that required on the conversion of $Al_2(OH)_6$ into Al_2O_3 :—

(1.) 0.0898 gram. of substance, dried at $100^\circ C$, lost 0.0323 gram. when ignited over a blow-pipe flame in a platinum crucible. In this case the observed loss of water was 35.9 per cent., against the theoretical 34.6.

(2.) 0.0520 gram. of another sample, also dried at $100^\circ C$, lost 0.0199 gram., or 38.4 per cent., against the theoretical 34.6.

These numbers showed that they were dealing with hydrate of aluminium. Additional proof was afforded by the behaviour of the substance towards hydrochloric acid before and after ignition.

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W. D. Herman.
C. L. Higgins.

F. Hurter.
W. Norris Jones.
E. K. Muspratt.
T. W. Stuart.
A. Watt.

Hon. Treasurer: W. P. Thompson.

Hon. Local Secretary:

T. Lewis Bailey, University College, Liverpool.

SESSION 1896-97.

Jan. 13th, 1897.—Dr. F. Hurter and Dr. Zahorski. "On the Efficiency of an Electrolytic Cell."
Feb. 3rd, 1897.—Mr. S. Stein. "Recent Improvements in Sugar Refining."

Meeting held Wednesday, December 2nd, 1896.

DR. C. A. KOHN IN THE CHAIR.

RESCUE APPARATUS FOR USE IN NOXIOUS ATMOSPHERES.

BY ARTHUR CAREY, M.S.C.

TOWARDS the end of last session I promised to read a paper before this Society on the results of some experiments conducted by the United Alkali Co., on the best practicable means of avoiding accidents from what is popularly known as "gassing;" or at any rate of preventing those accidents when they do occur from having fatal results.

Since that time, however, the ground has been largely cut from under my feet, in the first place by Mr. Herman who read a paper before this Section in April last on this same subject, and in the second by the publication of a very excellent article in the Chemical Trade Journal, of October 24th, which embodies most of the results I wished to lay before you.

All that is left for me to do this evening is to give you, by permission of the Directors of the United Alkali Co., an account of the steps taken by them to meet the clauses contained in the Special Rules for Chemical Works, issued by Her Majesty's Chief Inspector of Factories under clause 8 of the Factory and Workshops Act of 1891.

The clauses in these special rules bearing on this subject are the following:—

Clause No. 5. "Suitable respirators shall be provided for the use of the workers in places where poisonous gases or injurious dust may be inhaled."

Clause No. 9. "Respirators charged with moist oxide of iron or other suitable material shall be kept in accessible places ready for use in cases of emergency arising from H_2S or other poisonous gas."

These two clauses refer each to a definite use of a respirator; No. 5 to the use of a respirator during normal work; No. 9 to the use of a respirator in cases of emergency, and therefore only for short spaces of time.

Nearly two years ago the United Alkali Co. instructed Messrs. V. C. Driffield, Percy Bateson, J. Marsh, and myself to investigate the subject of respirators and rescue apparatus generally.

In accordance with the conditions of work in the United Alkali Co., our investigations were almost exclusively directed to emergency respirators and apparatus, as required under clause 9 of the special rules. But very naturally many of the facts bearing on emergency apparatus, bear equally on apparatus for use during normal work, and, as a matter of fact, we eventually came to the conclusion that with a very slight alteration (which I will explain later), the same apparatus is applicable to both cases.

In considering the question of the best emergency respirator or other apparatus to enable men to exist without injury in a noxious atmosphere, we found that there are three main points to be weighed:—

1. Safety.
2. Rapidity of adjustment.
3. Minimum interference with active exertion or powers of observation.

We further found that all appliances for this purpose may be classed under three heads:—

(A.) Those which purify the atmosphere by absorbing its noxious constituents.

(B.) Those which supply fresh air from outside.

(C.) Those which contain in themselves the oxygen necessary to maintain life.

Our early investigations were made almost entirely on appliances belonging to class (A). I will therefore deal with them first.

After a considerable number of inquiries and experiments, we selected as a temporary solution of the difficulty a modification of the "Zimmer respirator."

We were quite aware that this respirator was, for our purpose, not completely satisfactory, but we did not realise how far it was from approaching to the first "desideratum" of a respirator, *i.e.*, safety.

I personally did most of the experiments with this muzzle, and I made the very serious error of using chlorine as the "test gas." I failed to realise how important a part is played in the efficiency of a respirator by the relative affinity of the different gases for even the most powerful absorbents.

We tried various absorbents, and finally selected carefully ground charcoal saturated with caustic soda solution.

As a practical trial, I went into a Weldon B. P. Chamber, containing dense yellow chlorine (4—6 grs. per cub. ft.) wearing this respirator and a pair of goggles, and remained in for several minutes without inconvenience.

In our modification of the "Zimmer" respirator we abolished the outlet valve and the opening for the nose. We also made the respirator oval so as more closely to fit the face, and deepened the absorption chamber.

Shortly after this we made some experiments at the request of Mr. Richmond, Her Majesty's Inspector of Workshops and Factories with the "Tyndal fire helmet."

In this and in our later experiments we were assisted by Mr. Towers, of Widnes who, together with my assistant, Mr. J. Betney, performed most of the experiments.

The Tyndal fire helmets are fitted with an absorption chamber consisting of a tin cylinder 4 ins. long by $2\frac{1}{2}$ ins. diameter closed at each end by wire gauze.

The packing of this cylinder consists chiefly of cotton-wool. Part of the cotton-wool is saturated with glycerin, and there is also a thin layer of charcoal and another of lime.

Such an absorbent is absolutely valueless for any purpose but that of a dust and smoke filter, for which purpose it was originally designed.

As we could find no respirator on the market which gave any promise of being suitable for our purpose, we commenced to experiment on lines of our own.

We considered that the reason for our former failures was chiefly the small size of the purification chamber, and that granted a sufficiently large chamber, *i.e.*, granted sufficient time of contact, there was no reason why chemical absorbents should not completely remove all traces of such gases as H_2S and CO_2 .

We therefore made a series of experiments, starting with a large absorber and gradually decreasing the size, in order to determine the minimum dimensions compatible with efficiency.

We used in each case a number of different absorbents.

H_2S was our test gas, and was collected together with air in varying but known proportions in a gas holder of 6 cubic feet capacity. The gases in the holder were tested before and after each experiment; and were drawn through the purifier to be tested by means of a "Fletcher's bellows aspirator," in order to imitate, as nearly as possible, the intermittent character of ordinary respiration.

We also, as nearly as we could, aspirated the gases at about the rate of normal respiration, *viz.*, about one-third cubic foot per minute. The exit gases were tested by lead acetate paper, which was found to blacken in an atmosphere containing 0.01 per cent. H_2S by vol. We further found that a mouse placed in an atmosphere containing 0.1 per cent. H_2S by vol. became insensible in about six minutes, but recovered again in fresh air. In another experiment a mouse placed in an atmosphere containing about 0.05 per cent. H_2S showed no signs of distress after 30 minutes.

There is therefore no doubt that gas which will not blacken lead paper will not harm men.

The only two absorbents we found of any practical use were granulated soda lime and charcoal saturated with caustic soda. In the latter case we found, as would be expected, that the absorptive power increased with the fineness of the charcoal and with the per cent. of Na_2O contained in it.

We tried absorbers of the following dimensions:—

No. 1 with a capacity of 138 cb. ins.

" 2 " " 31 "

No. 3 with a capacity of 26 cb. ins.

" 4 " " 12½ "

The following table contains the results:—

Capacity of Absorber.	Description of Packing used.	Gas used.	Result.	
			Cubic feet aspirated before Paper blackened.	C. Ft. × (H ₂ S + CO ₂).
138	Charcoal passed through 1-inch mesh sieve, saturated with 30% Twad. caustic soda solution.	7 H ₂ S	3.75	26
		13.5 "	1.5	20
		14 "	A mouse became insensible at 3.5 cubic feet, but came round in fresh air.	49
138	Charcoal caught between 16 and 60 mesh sieves, containing 10% Na ₂ O.	8.5 "	"	76
138	Granulated soda lime.....	24.7 "	Not blackened at 12 cubic feet	296
31	Charcoal passed through 1-inch mesh sieve, saturated with 30% Twad. caustic solution.	14 "	Blackened at once.	
31	Charcoal caught between 16 and 60 mesh sieves, containing 10% Na ₂ O.	5 "	2.5	12
31	Charcoal caught between 30 and 40 mesh sieves, containing 20% Na ₂ O.	14 "	5	70
31	Granulated soda lime.....	7.5 "	9	67
26	Charcoal caught between 20 and 40 mesh sieve, containing 26% Na ₂ O.	21 "	3.5	73
26	Charcoal caught between 20 and 40 mesh sieve, containing 26% Na ₂ O.	15 CO ₂ 7 "	2.5	55
12.5	Packing used in Tyndal Fire Helmet.....	11.5 H ₂ S	Blackened at once.	
12.5	Charcoal passed through 1-inch mesh sieve, saturated with 30% Twad. caustic solution.	8 "	0.33	3
12.5	Charcoal caught between 20 and 30 mesh sieves, containing 20% Na ₂ O.	20.6 "	1	21
12.5	Granulated soda lime.....	8 "	Not blackened after 5 cubic feet, but the absorber rose to 400° F.	10

As is shown by the table, the gases used were not of a uniform strength, and in order to get roughly comparative figures I have in column four calculated all the results for a gas containing 1 per cent. H₂S by vol.

There does not appear to be much difference between the absorptive power of the granulated soda lime and the very finely-divided charcoal, caught between a 20 and a 60 mesh sieve and containing 26 per cent. Na₂O. We were led, however, to choose the charcoal because we found that, when hot, small quantities of caustic were carried over from the soda lime, and though, of course, this was not sufficient to be dangerous, it was decidedly unpleasant.

I must mention that the use of the very finely-divided charcoal containing a high percentage of Na₂O, was the idea of Mr. Towers, who prepared all we used in these experiments.

Figures 1 and 2 show the apparatus which was adopted by the United Alkali Co. as a result of these experiments. This apparatus is made by Mr. Towers and has been patented by him. It contains an absorption chamber with a capacity of 50 cubic inches.

The absorber is attached to a belt and is carried on the middle of the wearer's back.

Fig. 1.

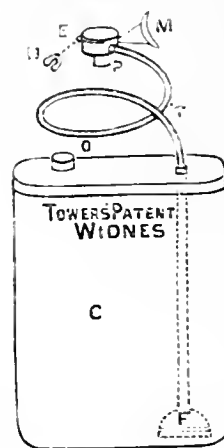


Fig. 2.



The connection with the mouth is made by a flexible india-rubber tube passing over the shoulder and terminating in a mouth piece.

The mouthpiece is the design of Mr. Towers and has an automatic outlet and an inlet valve. A small nose clip is attached for the use of those who are not accustomed to breath exclusively through the mouth.

The belt carrying the absorber is made strong enough to carry a man, and is fitted with a strong iron ring for the rope, which should be invariably attached, except when either the man has an intricate path to follow while in the noxious atmosphere, or when there is no one outside to hold the free end.

This arrangement, the method of wearing which is shown in the accompanying photograph (Fig. 3), appears to us to combine speed of adjustment with freedom from danger of unnecessarily impeding the actions of the wearer.

Fig. 3.



We now come to the consideration of appliances belonging to class (B.), i.e., those which involve direct connection with the open air by a pipe, through which the fresh air is either drawn or pumped into the lungs of the wearer.

As we were dealing with emergency work, in which, as I have pointed out before, speed of adjustment is one of the first considerations, we came at once to the conclusion that any apparatus which involves pumping of air is out of the question. The presence of the pump involves also a more complicated apparatus, and one therefore more likely to get out of order. In addition to this, we found that a man can without much inconvenience draw his breath through as long a pipe as he can drag after him.

The well known "Denayrouze" apparatus is constructed on this principle. This apparatus consists simply of a length of india-rubber piping attached to the wearer by a stout leather belt, and carrying a mouthpiece connected with an inlet and an outlet valve. The apparatus is also supplied with a face piece to protect the eyes, and at the same time to close the nose by pinching it.

Fig. 4 is a photograph of a man wearing the apparatus we finally selected. It consists of a length (50—60 ft.) of india-rubber piping (with embedded wire), $\frac{3}{4}$ inch internal diameter, the weight of which is carried from the centre of the wearer's back by a stout leather belt fitted, as in the case of the respirator, with a stout iron ring.

The pipe from the belt to the mouth is of light flexible india-rubber, and terminates in one of Mr. Towers' mouthpieces.

As it is very rarely that in the United Alkali Co.'s works gases will be met which quickly attack the eyes, we discarded the cumbersome face piece and substituted for it a small nose-clip.

Fig. 4.



For use on the rare occasion when the eyes are likely to be attacked, the case in which the apparatus is carried contains a pair of goggles, which are very fairly efficient and very easily adjusted.

There are some obvious risks in the use of such an apparatus, as either the "Denayrouze" or the "safety pipe" I have described, and they are that through negligence, the free end of the pipe may be drawn after the wearer into the noxious atmosphere, that a kink or crack may occur in the pipe itself or the valves may get out of order.

To meet these difficulties there should be always two men on the job, one to rescue and one to look after the free end of the pipe. The pipe itself must be wired and the whole must be subjected to periodical and thorough examination.

There is still another risk, and that is, that if the atmosphere is thick and there are pillars or machinery about, a man may not take the same path out that he took in, and may get his pipe wound round an immovable obstacle.

This risk is one which can only be avoided by care on the part of the wearer, and cannot be otherwise guarded against.

In spite of these disadvantages, however, the use of an apparatus such as the "safety pipe" is absolutely necessary under certain conditions. For instance, when there is reason to suspect the absence of oxygen or the presence of some injurious gas which a respirator will not absorb.

There yet remain appliances of the 3rd class, i.e., those which contain within themselves the oxygen necessary for respiration.

For emergency work, where the apparatus may be years without use, we came to the conclusion that apparatus of this class is valueless.

Our investigations have led us to the conclusion that in all cases where there is no reason to suspect the absence of oxygen or the presence of gases not absorbed by caustic soda, such as CO, or oxides of nitrogen, a respirator such as that I have described, containing an absorption chamber of about 50 cubic inches capacity, and charged with finely-powdered charcoal containing about 26 per cent. Na_2O , is the most serviceable rescue appliance.

Where, however, there is reason to suspect the absence of oxygen or the presence of such gases as CO or oxides of

nitrogen, direct connection with the open air is essential, and the use of a "safety pipe" is necessary.

Earlier on in this paper I stated we had found that a very small alteration was necessary to make apparatus designed for rescue purposes suitable for normal work in places where either there is or may be quantities of noxious gases; such, for instance, as sewers, "Chance" carbonators, or vitriol chambers, all of which have to be entered occasionally for cleaning.

When men have to do severe physical work for any length of time they are bound to breathe, not only through the mouth, but through the nose also, and to meet this we have found it necessary to substitute for the mouthpiece and nose-clip previously described an arrangement similar to that used by dentists in the administration of nitrous oxide. This consists of a metal funnel, the stem of which acts as an inlet pipe; it fits with a pneumatic pad against the face, and is fastened on by a strap buckling behind the head.

A safety pipe, fitted with this face piece, is regularly used by men working in the United Alkali Company's sewers, and when cleaning out "Chance" carbonators, vitriol chambers, &c.

The reason we did not adopt this face piece for the rescue apparatus itself was that we felt most strongly the imperative necessity for simplicity and speed of adjustment.

This face piece requires blowing up before use and then buckling on. This was a decided disadvantage, for when the average man is excited and nervous, as he invariably is in cases of emergency, the fewer straps he has to buckle and taps to turn, or stoppers to put in, the better.

I do not think I should conclude this paper without describing the means adopted by the United Alkali Company to ensure that the emergency apparatus which they have placed in each of their works should be in an efficient condition and in its right place.

Each works has to keep a book, in which the results of a monthly examination of all such apparatus is entered. On the front page of this book the following instructions are printed:—

Examination of Emergency Apparatus.

1. Let all apparatus, "safety pipes," "Towers' absorbers," "oxygen cylinders," "ropes and belts," "galvanic batteries," and "eyewash bottles" be examined once a month, and the result recorded in the "emergency apparatus" book.

(A.) The "safety pipe" case contains 50 feet of pipe, a belt with ring, eye protectors, mouthpiece, and nose-clip (attached to mouthpiece), candle, candle stand, and lead acetate papers.

(B.) The "Towers' absorber" consists of absorbing cylinder, leather case, belt with ring, and mouthpiece with nose-clip attached.

(C.) The "oxygen cylinder" should be accompanied by a regulating valve and an inhaler.

2. Test the valves and tubing of the "safety pipes" and "Towers' absorber" in the following way:—

(A.) In the case of the "safety pipe," place a stopper in the inlet end of the pipe; in the case of the "Towers' absorber," pinch the india-rubber tube. Place the mouthpiece in the mouth and suck. If all is tight, the tubing of the "safety pipe" and the outlet valves in both cases are in good order.

(B.) Remove the stopper from the end of the "safety pipe," also do not pinch the tube of the "Towers' absorber;" place a stopper over the outlet valve in both cases. Put the mouthpiece in the mouth and blow. If all is tight, the inlet valves are in good order.

3. Wherever the "Towers' absorbers" have been used, replace the old cylinders with freshly-charged cylinders.

In addition to this, the apparatus in each works is examined once a quarter by a special inspector appointed by the central office in each district.

Of course, the best laid plans have their flaws—flaws which experience alone can discover. The arrangements made and apparatus adopted by the United Alkali Company are new, they have fortunately not yet had occasion to be

used, and all we can say of them is that they indicate an honest attempt to meet the spirit of the special rules laid down by Her Majesty's Inspector of Factories, which is to take the best practicable means of avoiding accidents, and when accidents do occur, of minimising their effects.

NOTES ON POISONING BY CARBONIC OXIDE.

BY DOUGLAS HERMAN.

THE rapidly increasing use of gases containing more or less of the highly poisonous carbonic oxide for heating and illuminating purposes, together with the dense ignorance generally prevailing outside the chemical trades proper, both as to the symptoms exhibited by persons suffering from its effects, and the proper methods of treating them, will, I trust, be sufficient justification for again bringing before you a subject on which I addressed you some nine months ago (this Journal, 1896, 247).

Carbonic oxide is produced in all cases where there is incomplete combustion of carbon, and is present to a greater or lesser extent in producer gas, blast-furnace gases, the so-called "water-gas," either plain or carburetted, in which latter form it is very largely used in America for illuminating purposes, and is rapidly coming into use in Great Britain, in ordinary coal-gas, lime-kiln gases, the spent gases from carbonators in the ammonia-soda process and the after-damp in coal pits, &c.

In the tables given are analyses of these gases.

The introduction of carbonic oxide for heating purposes practically dates from the introduction of the Siemens regenerative furnace. Attempts had been previously made to use it, but the fact that the thermal duty obtained was from 30 to 50 per cent, less than that of the original fuel, and that the pyrometrical effect was also much lower, more than counterbalanced any advantage that could be expected from its employment. The use of the regenerator, however, so modified the working conditions, that where high temperatures are required, producer gas is the more economical fuel. The earlier producers were worked by draught, so that any leakage was that of air into the producer, where it burnt up a portion of the gas, generating heat in the producer where it was not wanted, and leaving less heat to be evolved in the furnace where it was wanted. The forcing of air through the fuel by pressure altered this state of things. A richer gas was obtained at the furnace, and a smaller producer capacity was needed to gasify a given amount of fuel; but the direction of the leakage was reversed, so that the producer gases escaped through any openings into the atmosphere. Bricks and mortar are very pervious to gases. This evil is partially remedied by the pores and crevices being filled with tar and soot, from the distillation and partial destruction of the hydrocarbons; but in the lower part of the producer this filling up of the crevices is much less complete, because there is little or no distillation taking place at that part. In addition to the porosity of the materials there is always less or more heaving of the brickwork, owing to changes of temperature and settling of foundations, which produce fissures and allow the escape of gas. It will sometimes happen that a set of producers which has worked for a long time without accident suddenly becomes dangerous. In such a case it will generally be found to arise from a small fissure, allowing the gas to flow in the direction where the men have to work, or where they may happen to be when at leisure. Hence it is important that the men's resting-places should be at some distance from the producers, and where there is a free circulation of air. There is not much danger from producer gas when the products of distillation of hydrocarbons are present; the men know what they are dealing with, and can take proper steps to avoid danger. The great risk is from the carbonic oxide from the coke alone; the men may continue to breathe it and know nothing about it until it is too late to save themselves. You will notice that in the gases from producers and those from blast furnaces, which are practically big producers, the carbonic oxide varies from 8 to 28 per cent. by volume.

My first experience of carbonic oxide poisoning dates back more than 25 years, when I was called in to ascertain

the cause of the death of two cart horses which had been found dead one morning in the stable of a neighbouring iron works. I noticed that there were many mice dead in all parts of the stable and suspected gaseous poisoning. To ascertain if this suspicion was well founded I had the stable thoroughly cleaned out, to prevent any chance of poisoning by possibly poisoned fodder, and secured in the stable mice, rats, a cat, and a dog. All died except the dog, which had broken loose, and was found in a fainting condition near the door. After being in the stable for a few minutes on this occasion with one of the works staff we both felt a singing in the ears, accompanied in his case with dizziness, and in mine with headache. A cat and dog were also found dead in a store-room adjoining the stables, and men engaged in the store-room had often complained of headache. The only possible source of poisonous gas, in this case, was some producers situated about 50 yards off. On digging a trench across the yard to isolate the producers, it was found that the ground was very open and porous, consisting mainly of cinders. When the trench was filled up with impervious material all complaints of headache, &c. ceased.

The producers in this case were of the open grate type, but they were placed low down and had large cooling siphon tubes, so that there was sufficient pressure to cause the gas to pass for a long distance through ground of the porous nature described.

In the course of this investigation, I noticed that mice were particularly sensitive to the action of carbonic oxide, and I would strongly support the recommendation of Dr. Haldane that they should be employed as a means of giving early indication of the presence of carbonic oxide. In an admirable report, dated this year, to the Secretary of State for the Home Department, "On the causes of death in colliery explosions and underground fires," he says:—"In small animals the rate at which blood becomes saturated with carbon monoxide is far more rapid than in man: hence a small animal, such as a mouse, shows the effects of the gas far more rapidly than a man, although a given percentage of it seems not to be, in the long run, more poisonous to a mouse than to a man. Practically speaking, the condition of a mouse which has been for a very short time in a poisonous percentage of carbon monoxide indicates what will be the condition of a man carrying it after a much more prolonged stay in the same atmosphere. With a man at rest it takes about 20 times as long for the man as for the mouse to be distinctly affected by the gas. Thus, to take an example, I found that with 0.4 per cent. a mouse was distinctly affected in 1½ minutes, and quite helpless in 3 minutes, while I myself was not distinctly affected until after half an hour. The air I was breathing contained about the same percentage as is so often fatal to rescuers. These experiments show distinctly how valuable the indications given by a mouse, or other small animal, would be to men exposed to danger from after-damp. The mouse may be carried in a small cage, or a lamp chimney closed at the ends with wire gauze. When dangerous percentages of carbon monoxide are encountered, the mouse will begin to pant, and show signs of weakness in the legs; should the mouse suddenly become unconscious, danger is imminent. A few white mice might easily be kept in the engine room of the winding engine, or in stables or other places in the pit."

Until very lately, but little was known by toxicologists as to the indications presented in cases of poisoning by carbonic oxide. The only practical indication is in the altered condition of the blood corpuscles, the detection of which depends more upon the observation of the physiologist than anything the chemist can show.

The first indication of poisoning by CO is a dizzy drunken feeling, which very nearly resembles that of intoxication by alcohol.

Another indication is the feeling of cold experienced by the patient in the extremities and indeed the whole surface of the body.

Intoxication by CO and alcohol may perhaps be due to the same cause, i.e. deoxidation of the blood, owing to the presence therein of reducing substances. The principal difference is that alcohol stimulates the action of the heart, the diaphragm and the pectoral muscles, thus increasing the

quantity of air passing through the lungs, so that, within certain limits, its supplies its own antidote. But CO has no stimulating effect, its action is rather to paralyse the whole muscular system. When the limits above referred to are passed, the two forms of intoxication are so similar in appearance that even an expert may mistake one for the other; the only ready means of distinguishing them being the odour of the breath. The absence of any stimulating action by CO makes it all the more necessary for the respiration to be supplemented by other means than that furnished by the organism which is affected by the poison. When the dizzy, intoxicated feeling occurs, the man should be at once taken to the fresh air, for it is likely that worse may follow as soon as the remaining deoxidised blood has had time to reach the nerve centres. Oxygen should be administered with the least possible loss of time. It is of course much more easy to administer it while the man has the use of his own strength and his senses, than after he has become insensible. The similarity of the immediate cause of the two forms of intoxication, suggests the use of oxygen in cases of severe alcoholic poisoning.

In a case of carbonic oxide poisoning reported to me by Mr. James Hargreaves, the cause of the sudden attack was found to be a small fissure in the side of a gas producer, by which a jet of CO issued close to the man's face where he had happened to be sitting down to take a short rest, and so had inhaled a much larger quantity of CO than would occur under ordinary working conditions. This was found by applying lights to the walls of the producer. It is easily conceivable, however, that the CO might be diluted with so much CO₂ and other incombustible gas, that it would not have taken fire, and yet contain enough to do mischief. It will not do to conclude that CO in dangerous quantity is absent because the issuing gas will not produce a flame when a light is applied.

According to Dr. Haldane's report "the key to the peculiarly insidious action of carbon monoxide is afforded by the following two facts. (1.) The affinity of carbon monoxide for hæmoglobin is a very powerful one, so that even when a very small percentage of it is present in the air, absorption by the blood may go on steadily, though slowly, until finally the oxygen carrying power of the hæmoglobin is reduced to a dangerous extent. (2.) The symptoms produced by deficiency in the oxygen supply to the tissues are very slight, up to the point at which there is loss of power over the limbs. When the limbs completely fail, it is of course impossible for a man to get out of the poisonous atmosphere. The affinity of carbon monoxide for hæmoglobin is about 250 times as great as that of oxygen. In other words the hæmoglobin of blood brought into contact with air containing about 0.1 per cent. of carbon monoxide will finally become about equally saturated with carbon monoxide and oxygen. If the same blood be afterwards brought into contact with pure air, constantly renewed, the carbon monoxide is gradually driven out. This process of driving out occurs about five times as fast in pure oxygen. When the blood of the living body has become about 50 per cent. saturated with carbon monoxide there is loss of power over the legs. These facts make it possible to understand the process of gradual poisoning, or of recovery in fresh air. With less than 0.1 per cent. of gas in the air the blood does not become more than 50 per cent. saturated, so that even a prolonged exposure does not cause complete helplessness. With 0.2 per cent. the blood will become about 67 per cent. saturated, and complete helplessness, with loss of consciousness, would doubtless occur. Probably this percentage would finally cause death, from the gradual damage produced by the diminished supply of oxygen to the tissues. 0.30 per cent. would certainly cause death in time. Very little actual distress accompanies the action of carbon monoxide. After paralysis of the limbs the senses are gradually more and more benumbed, as by an anæsthetic. If the percentage of carbon monoxide is large (more than 1 or 2 per cent.) loss of consciousness is followed by convulsions, &c., as in suffocation from rapid deprivation of oxygen. If there is less than 1 per cent. of carbon monoxide death is very gradual and peaceful.

Men who have been for some time unconscious from CO poisoning, or, what is essentially the same thing, want of oxygen, but who have been afterwards rescued, may suffer

for many days or weeks from after symptoms of a most formidable character. A man who has been only partially disabled by CO, or who has only been helpless or unconscious for a short time, will usually recover completely within a few hours. Recovery is accompanied by very severe headache and often by nausea and vomiting. The headache and nausea seem to be more severe the longer the exposure. Dr. Haldane has found, by experiments on himself, that an exposure of several hours to as little as 0.07 per cent. of CO will cause not merely dizziness, &c. on exertion at the time, but a headache afterwards, lasting for about 12 hours."

The second source of carbonic oxide, to which I will refer, is lime burning. Ordinarily the limestone and fuel are thrown in together, and sometimes the fuel is used in somewhat thick masses. In such a case, where the fuel is burnt in the hot air which has been heated by the mass of hot lime below, the high temperature of combustion favours the formation of CO, and if this can get to any point of leakage before a supply of O has reached it, it of course escapes in that condition. If this gas escapes into open gravelly ground, where the upper surface has been rendered dense by being trampled on, &c., there is no knowing at what point it may escape. The composition of the gas that escaped would be very irregular; sometimes CO, at others CO₂, sometimes free O only would pass along with the atmospheric N and as there is no smell to indicate the difference, it could only be judged of by the results, so that a room into which the leakage escaped might be quite healthy for a week together, and then in an hour all its inmates might be killed.

A practical and very instructive illustration of this took place in 1887, at Malaunay, in the neighbourhood of Rouen, where a certain Druaux kept a wine shop, situated in close proximity to a lime-kiln. Druaux and his wife's brother were found dead in the house, and Madame Druaux in a state of supposed intoxication. She was unable or unwilling to give any account of what had happened, or any explanation of the fatalities, and was at once suspected of having administered poison.

Madame Druaux was tried and found guilty. Her avocet was convinced of the innocence of his client, and more by threats than by persuasion he succeeded in having his client set at liberty after an incarceration of five years and nine months.

In October last, the matter was brought before the Court of Assize at Amiens, when the evidence then produced distinctly proved that CO from the lime-kiln was not only the cause of the death of her husband and brother, but also of her supposed intoxication at the time. She was formally declared innocent and awarded 40,000 francs as compensation for false imprisonment.

The limits of these notes will not allow this case to be treated with the fulness which it merits. It is full of suggestions which deserve serious study by manufacturers, chemists, sanitarians, legal practitioners, and medical men.

Mr. T. A. Reid has kindly supplied me with analyses of lime kiln gases, and of the waste gases from the carbonators in the ammonia-soda process. (See table.)

Mr. Reid informs me of a case of carbon monoxide poisoning in which a young man fell into a lime-kiln which had been lit up the previous night, but which was fortunately not in full blast, although the atmosphere was considerably worse than if it had been so, containing quite 9 or 10 per cent. of carbonic oxide. The man was very expeditiously got out, in fact, was in the kiln under five minutes, but the case was such a bad one that four hours was necessary to bring him back to consciousness. Oxygen was administered to him within five minutes of his being got out of the kiln. The effect was quite marvellous, and the renewal of the circulation was quite apparent by the actual change which took place in his face.

The method Mr. Reid uses in applying the oxygen gas to the men simply consists in having the ordinary cylinder fitted with a regulating valve and a length of black india-rubber tubing, into the end of which is put about a couple of inches of clay tobacco pipe stem. This prevents the man compressing the tube with his teeth. The mouth is held and pressure brought to bear on the chest, and while

the pressure is maintained the nostrils are closed as well as the mouth. The oxygen gas acts until it distends the cheeks. The oxygen is allowed to pass out through the nose, the chest being again subjected to pressure. The operation is repeated until the man is conscious.

Mr. James Stelfox, manager of the Belfast Corporation Gasworks, who was one of the first to introduce into this country carburetted water gas on a large scale for illuminating purposes, has been good enough to send me analyses of carburetted water gas and of ordinary coal gas. (See table.)

With respect to these analyses he remarks that 27 to 29 per cent. is the usual proportion of carbonic oxide present in water gas, and 6 or 7 per cent. in coal gas. He mixes the water gas with the coal gas, and has supplied as much as 50 per cent. of the former.

Deaths from inhalation of coal gas are of frequent occurrence—there have been several during the last few weeks. Less than a fortnight ago two women were poisoned at Bath through a chandelier having been drawn down too low.

Dr. Samuel Craddock, of Bath, who attended the victims, writes me that they evidently died from carbonic oxide poisoning, as shown by the crimson hue in the face. One peculiarity he noticed was rigidity from the commencement in the muscles of the arms and legs.

Mr. Stelfox does not consider that there is any evidence to prove that water gas is more deadly than coal gas in practice, both will kill if inhaled in quantity for a sufficient length of time. I have no practical experience with carburetted water gas, but should imagine its action would be similar to that of ordinary producer gas, and that the dangerous constituent in each case, as well as in coal gas, is the carbonic oxide. If this is so, and I think there can be very little doubt upon the point, it is evident that a gas containing a large proportion of CO must, when it escapes into a room, be more likely to prove fatal to the occupants than one containing a much smaller proportion. In this connection the following table by Dr. Haldane, who has devoted very special attention to this subject, and which I have abstracted from his report already referred to, will be of interest. (See table.)

Having regard to the manifest advantages under certain conditions, of carburetted water gas, I should not be disposed to oppose its use under proper regulations, but I hope before its use becomes general here similar precautions will be taken as, according to Dr. Wynter Blyth, are observed in America, to guard against the danger from escapes owing to the careless manner in which gasfitters usually perform their work. In America, before the gasfitter asks the company to make the connection with their main he proves the pipes. All the outlets which have been left for brackets and pendants, &c. are, with one exception, stopped up either with plugs or screwed caps. A force-pump containing a few drops of sulphuric ether is then attached to the outlet which has been left, and the pump is set to work until a high pressure has been registered. A high pressure is necessary, for the iron pipes may have many latent weaknesses—pinholes filled with grease, seams just ready to burst, &c.; these, when a high pressure is employed at once become apparent. When the gauge indicates a certain figure the pumping ceases, and if the mercury falls it is evident that there is one or more palpable leaks, which are at once sought for and remedied; the sulphuric ether will aid in their detection. Before the connection with the main is made, an inspector in the employ of the gas company carefully and closely scrutinises all the pipes, bends, joints, plugs, &c. where brackets and chandeliers are intended to be fixed, and should he in any of these discover the slightest weakness or departure from the rules, he insists upon all being made right. The pump is set in action before him, and if the pipes are now airtight, he has simply to cast an eye upon the gauge, the column of which will no longer sink; and if all is satisfactory he signs the requisite order.

I do not purpose saying anything to-night about the last two gases on the table, "after-damp," and the gases left along the track of an explosion in coal pits. They are fully dealt with in Dr. Haldane's valuable report.

I commenced my notes by lamenting the ignorance prevailing with regard to the treatment of sufferers from carbonic oxide poisoning, and I cannot perhaps conclude more appropriately than by calling your attention to some very useful work on the part of the "Chemical Trade Journal." Impressed by the fact of the gross ignorance generally existing with respect to gaseous dangers, and by the alarming frequency with which accidents of this kind have been converted into fatalities, to the consequent great discredit of the chemical trade, this paper set before itself the task of popularizing and promulgating a knowledge of the dangers and of the most effective means for their prevention and remedy. This information is codified and condensed in an article which appeared on the 24th of October last, and the whole matter is summed up in a series of rules which the proprietors issue in the form of a poster. You will, I am sure, be interested in hearing that already the manufacturing world, both here and on the other side of the Atlantic, has shown a keen appreciation of this effort to meet a cogent though, perhaps, somewhat ill-defined want.

Producer Gases.

	Siemens	Wilson, closed Air in- jected with Steam.	High-Pressure Air and Steam Heated.	Weak Gas.	Strong Gas.	Blast Furnace Gases, Coke used.
	Open Grate.					
CH ₄	4.3	4.5	5.7	9.5	4.5	..
CO.....	23.4	24.6	28.0	27.0	8.7	28.4
H ₂	7.4	11.3	13.5	16.0	24.4	2.0
CO ₂	4.2	4.3	4.0	2.0	15.6	7.1
N ₂	60.7	55.3	51.8	45.5	46.8	62.5
Combustible...	36.1	10.4	17.2	52.5	37.6	30.4
Incombustible.	61.9	59.6	52.8	47.5	62.4	69.6

	Carburetted Water Gas purified.	Illuminating Gas (Retort) purified.
CO ₂	None	0.6
Oxygen.....	None	..
Unsaturated hydrocarbons	19.7	3.2
Carbonic oxide.....	31.9	3.7
Saturated hydrocarbons	16.2	39.5
Hydrogen.....	33.7	19.9
Nitrogen.....	7.5	3.1
	100.0	100.0

	Lime-Kiln Gases.	Waste Gases from Carbonating in Ammonia-Soda Process.
CO ₂	32.0	2.0
CO.....	1.5	2.5
O ₂	1.5	2.5
N ₂	65.0	93.0
H ₂ S.....	..	From trace to 1 grain per foot.
	100.0	100.0

"After-Damp" Undiluted (Haldane).

Roughly Approximate Compo- sition of Gases left along Track of Explosions in Coal-Pits (Based on Haldane).

N and argon.....	88.3	CO ₂	5.00
CO ₂	11.7	CO.....	1.25
	100.0	O ₂	12.50
With variable quantity of CO		N and argon.....	81.25
			100.00

Carbon Monoxide, CO.		Carbon Dioxide, CO ₂ .		Fire-damp (or Methane), CH ₄ .		Oxygen, O.	
Per- centage present in Air.	Effects on Man.	Per- centage present in Air.	Effects on Man.	Per- centage present in Air.	Effects on Man.	Per- centage present, remainder being N.	Effects on Man.
0.05	After half an hour or more, giddiness on exertion.	3.5 6.0 10.0	Breathing deeper. Marked panting. Severe distress.	5.5 15.0	Nil. Breathing slightly deeper.	17.3 12.0	Nil. Breathing slightly deeper.
0.1	After half an hour or more, inability to walk.	15.0	Partial loss of consciousness.	70.0	Life endangered.	9.0	Breathing deeper and more frequent. Face bluish.
0.2	After half an hour or more loss of consciousness, and perhaps final death.	25.0	Final death.			5.0	Loss of consciousness and final death.
1.0	After a few minutes, loss of consciousness and final death.					0	Death with convulsions.

45 per cent. CH₄:-

O.....	11.5
N.....	43.5
CH ₄	45.0
	100.0

70 per cent. CH₄:-

O.....	6.3
N.....	23.7
CH ₄	70.0
	100.0

DISCUSSION.

MR. FORBES CARPENTER said he had listened with deep interest to the two papers which had been read. It would be known to them that Mr. A. E. Fletcher (late Her Majesty's Chief Inspector of Alkali, &c. Works), who was a member of the Committee, was consulted in the drawing up of the rules issued by the Home Office, and therefore, although not officially, they came under the cognisance of his Department. He would like to ask Mr. Carey if among the subjects which came under his notice, during the course of the investigations, any absorbents had been found which were capable of successfully dealing with the oxides of nitrogen. He was interested to see that Mr. Davis, who was responsible for the article in the "Chemical Trade Journal" of October 24, had placed the oxides of nitrogen

amongst the most dangerous gases, more dangerous even than sulphuretted hydrogen. In his (Mr. Carpenter's) address to the Manchester Section in 1894 he commented on a book that had then recently appeared on the "Diseases of Occupations," by Dr. J. T. Arlidge, and he noted there that he did not think the author had fully grasped how serious were the effects of exposure to oxides of nitrogen. It was a fact that the effects were not felt at the time, but only after a lapse of some hours, and when the man, who had been exposed to these gases, was compelled to call in medical assistance, the case had often been found to be very serious, pneumonia setting in, followed in many cases by death. It was important that this subject should be ventilated and discussed, because he did not think the factory inspectors were perhaps aware that this was one of

the cases which science had not, so far as he knew, been able to deal with in the way of absorption. It had led to a little friction between the Factory Acts Department and manufacturers, inquiries having been made as to why respirators were not used in certain cases.

With regard to Mr. Herman's paper he might say he was at Bath quite recently and had some conversation with the manager of the Gas Company's Works, where they had recently installed a water-gas plant; he put to the manager the argument that Mr. Herman had used as to the increased percentage of carbonic oxide being a source of danger to consumers, especially of the poorer classes. Mr. Ellery's reply was that the odour of the mixture of coal-gas and carburetted water-gas was sufficient to draw attention to the existence of a leak, so that it was more a theoretical than a practical objection which would be raised. Further, he had stated that in America there were not more deaths due to water-gas than in England, where the percentage of carbonic oxide in coal-gas was stated to be from 6 to 7 per cent. Mr. Carpenter thought, however, that statistics had been quoted to show that deaths had been more frequent since the introduction of water-gas and he was rather startled to hear of the two deaths at Bath on the day following the visit to which he referred.

Mr. GEORGE E. DAVIS remarked that he was pleased to find that Mr. Carey had gone into such minute details, as the process of introducing oxygen from a high-pressure bottle into a workman's lungs was not an operation to be thought too lightly of. As to the choice of the best respirator, experience had taught him that respiration should take place through both nostrils and mouth, and he did not think very highly of any apparatus which closed the nostrils. With reference to poisoning by carbonic oxide, members should bear in mind that water-gas was now being largely distributed by certain gas companies and in his opinion deaths by gas poisoning would now be more frequent. During the water-gas boom of several years ago the gas companies endeavoured to show how dangerous was the attempt to distribute water-gas; he would certainly say that a gas containing so large a proportion of carbonic oxide should not be used as an ordinary gas supply, except under proper regulations. The leakage from ordinary gas-taps was not a small figure, and if gas-works, from motives of economy, persisted in distributing a very poisonous mixture, which certainly was not intended in any of the Acts of Parliament under which their works were established, they should do so under special rules and regulations.

Mr. H. PORTER said he had been for some years connected with the manufacture of gun-cotton, and the decomposition of the gun-cotton in certain states of the atmosphere was a weekly or daily occurrence; the decomposition went on rapidly with evolution of dense brown fumes, and this necessitated the attendance of men to overturn the pots in which the gun-cotton was put to cool. He himself had been in such an atmosphere, and breathed without difficulty, for half an hour at a stretch, the only precaution he took being to fill his mouth with water and so compel himself to breathe merely through the nose. He would like to know if Mr. Carey had had experience in this direction.

Mr. T. A. REID observed that the question of treating people overcome by noxious gases was a public question, for there were many instances, outside the chemical trade, where noxious gases were produced, as, for instance, in the case of blast-furnaces, lime-kilns, water-gas plant and ordinary coal-gas. He had had experience with most of the types of apparatus exhibited, but he must say he had objection to the apparatus depending on the use of an absorbing medium for purifying the air before admission to the lungs. His experience was that in use it had a very tiring effect on the lungs, and for some purposes, of course, it was not applicable at all, as, for instance, in the case of lime-kiln and blast-furnace gases, waste gases from the ammonia-soda process, coal-gas, and producer gases. He was strongly in favour of the apparatus shown with air-pipe attached; this type was in daily use at the works of Messrs. Bowman, Thompson, and Co., Ltd., at Lostock Gralam, as a preventative, when cleaning out tanks, which were liable to contain such gases as had been mentioned.

Men equipped with this were able to work for 20 minutes at a spell, without any discomfort, in an atmosphere which would prove fatal in a few minutes to men not so equipped. He was of opinion, however, that it would be better to have the apparatus on a reel, so that, when not in use, the air could blow well through it. With regard to the use of oxygen, he considered the oxygen bottle to be an essential part of a works equipment if there was any liability at all of dangerous gases being met with. As Mr. Herman had mentioned, he had had numbers of cases of asphyxiation by noxious gases, but no fatal cases had occurred since the oxygen bottle had come into use.

Mr. A. SMITHAM described how he and two assistants were poisoned by working in an atmosphere containing only comparatively small proportions of carbonic oxide; one of his assistants was ill for a week, but the other and himself, beyond the intoxicating effects described by Mr. Herman, noticed no serious after-effects.

The CHAIRMAN conveyed the hearty thanks of the section to Mr. A. Carey and to Mr. Herman for their interesting and suggestive papers. The subject of Mr. Carey's paper was of the greatest practical importance and the line of work as carried out—that of prevention rather than of cure—was based on an exact knowledge of the conditions under which the poisonous gases referred to were met with. In regard to carbon monoxide poisoning he had had occasion recently to inquire into the extent to which it occurred in the United States in the use of plain or carburetted water-gas, and had been informed, on reliable authority, that the fatalities were not excessive. In comparing the poisonous effects of carburetted water-gas and ordinary coal-gas, it was desirable to bear in mind that the latter also was a powerful poison, and that in the case of an undetected escape, fatal results might follow from either. The absence of smell in ordinary water-gas could, of course, be overcome. He was very glad to see how fully Mr. Herman had appreciated Dr. Haldane's masterly work on carbon monoxide poisoning.

Mr. A. CAREY, in acknowledging the vote of thanks, referred to the several points raised in the discussion. In reply to Mr. Carpenter's question as to whether they had come across any satisfactory absorbent for the oxides of nitrogen, he said they had not; so that whenever they had reason to suspect the presence of the oxides of nitrogen they found it necessary to use the "safety pipe." He considered that the fact that some men were able to work at the cleaning of vitriol chambers or Guy Lussac towers without injury while others were seriously affected was largely due, not to any particular knowledge of how to breathe, but to the different powers possessed by the men of resisting the action of the gases. Mr. Herman had likened poisoning by carbon monoxide to alcoholic poisoning. There was not much doubt as to the varying power of men to resist alcohol, and he thought that the same idea was applicable to other gases than carbon monoxide. Mr. Porter had spoken of the oxides of nitrogen, and said that by filling the mouth with water and breathing through the nose it was possible to resist their effects, but he (Mr. Carey) failed to understand this; the damage done by the oxides of nitrogen was in the lungs, and the gases would get there through the nose as surely as through the mouth. Mr. Davis had said he disliked the respirators because they did not permit breathing through the nose, and that if a man had not his nose to warn him he might continue to use a respirator when the purifying material was exhausted. He thought Mr. Davis did not quite realise the object for which these respirators had been recommended, which was for rescue purposes, when a few minutes' exposure to the noxious atmosphere would be all that was required. The respirator, moreover, which he had already described, containing an absorption chamber of 50 cb. in. capacity, would last in an atmosphere containing 5 per cent. of H_2S by volume, about 80 minutes.

Mr. HERMAN questioned whether the odour imparted to water-gas would arouse a person from a sound sleep. It was during sleep in a closed room that danger from an escape of CO was most to be feared. Possibly the reason that there were not more deaths in America arose from the fact that the fittings were better looked after.

NOTE ON A SUBSTITUTE FOR TARTARIC ACID IN GASOGENES.

BY DOUGLAS HERMAN, F.I.C.

Abstract.

FOR one purpose for which it was commonly used, however, and that perhaps not the least important as regards quantity consumed, tartaric acid was by no means essential. He alluded to the preparation of carbonic acid, particularly in the domestic gasogene or seltzogene. Of course, in the manufacture on a large scale of aerated waters, sulphuric acid was used, but its employment in the ordinary gasogene was evidently out of the question. But although the difficulties attending its use for this purpose appeared insuperable when the acid existed as a liquid, they vanished entirely when the acid was supplied as a bisulphate in the solid form which he had the pleasure of bringing to the notice of the members that evening. The idea of employing a bisulphate for the liberation of carbonic acid from carbonates was not new, and he believed it had been applied in factories; but there were several practical difficulties in its application to gasogenes which had only recently been surmounted. In the particular form which he exhibited, however, the difficulties were not only overcome, but some advantages were obtained. Thus the bisulphate being cast in moulds of definite size, in order to pass easily into the gasogene, and the moulded blocks forming a package of regular size and shape, it was at once patent to the eye of the user that the correct charge was present, and the safety of the gasogene was assured. The solid blocks of bisulphate presented much less surface to the solvent action of the water than did small crystals of tartaric acid; hence the evolution of carbonic acid was more gradual and uniform, ensuring better aeration of the water without undue pressure.

Although the evolution of carbonic acid from the bisulphate charges was more gradual than from tartaric acid charges, yet, owing to the fact that in the former case it was practically uniform during the whole period, the aeration was complete quite as soon. The proportions of bisulphate and bicarbonate were so adjusted that the solution in the top globe was always faintly alkaline.

The advantages incidental to the form of packing were briefly reviewed, attention being called to the absolutely moisture-proof nature of the wrapping employed for the bisulphate. Mr. Herman also pointed out that sulphuric acid was still one of our staple manufactures, and it was to our advantage to substitute it wherever possible for a more expensive article, the greater part of the cost of which must of necessity be sent abroad.

Manchester Section.

ROOMS OF THE CHEMICAL CLUB, VICTORIA HOTEL.

Chairman: George E. Davis.*Vice-Chairman:* Peter Hart.*Committee:*

F. H. Bowman.	J. M. Irving.
R. Forbes Carpenter.	M. J. Langdon.
R. S. Dale.	J. Lewkowitsch.
R. Le Neve Foster.	E. Schunck.
B. W. Gerland.	W. Thomson.
H. Grimshaw.	D. Watson.
J. Grossmann.	

Hon. Local Secretary:

J. Carter Bell.

Bank House, The Cliff, Higher Broughton, Manchester.

SESSION 1896-97.

Jan. 5th, 1897.—

Mr. André B. Wahl. "A New Method for the Rapid Valuation of Zinc Dust."
Mr. W. Thomson, F.R.S.E. "The Last Suggested Scheme for Dealing with the Manchester Sewage Effluent."

Meeting held on Friday, December 4th, 1896.

THE PRESIDENT IN THE CHAIR.

CONTRIBUTIONS TO THE ANALYSIS OF FATS.

BY DR. J. LEWKOWITSCH.

VII. *The Gravimetric Determination of the Bromine Value.*

THE determination of the Hübl iodine number is one of the most useful tests in the analysis of fats, and if carried out in accordance with the directions of the author of this classic method leads to unmistakable results.

It is true that the theory of this process is not yet fully understood, and it is no doubt due to this that almost every chemist who uses this method introduces some insignificant modification, and, what is worse, rushes into print forthwith.

Latterly several experimenters have directed their attention to the bromine absorption value, which had been almost wholly superseded—and rightly so—by the Hübl method. The most notable of the papers dealing with this subject is that published by Hehner (*Analyst*, 1895, 50), and although he expressly states that he does not intend to propose a new method, but merely submits a study, we find in a later paper by the same author (Hehner, *ibid.*, 1896, 118) the positive statement that the action of bromine on unsaturated fatty substances is complete and quantitative.

This latter statement seemed hardly reconcilable with the well-established fact that hydrobromic acid is evolved when bromine acts on unsaturated fatty substances—a fact on which Hehner dwells at some length. For this reason it seemed to me desirable to examine Hehner's method more closely.

Some of the results obtained by closely following Hehner's directions are given in the subjoined table:—

Substance.	I. Bromine Value found by the Gravimetric Method.	II. Iodine Value calculated from I.	III. Hübl Iodine Value Experiment.	IV. Mean Hübl Iodine Value.
Olive oil	51.69	81.09	83.77	82
	50.80	80.62	..	..
Rape oil	62.63	96.40	..	100
Castor oil	39.09	62.04	..	84
Cotton-seed oil	48.51	79.39	..	108
Linseed oil	18.68	29.65	..	175
	16.4	16.5	..	..
Fish oil	18.92	30.02	..	127—150
	16.7	16.98	..	..
Oleic acid ("saponified")	36.10	57.30	80	..
	33.83	53.70	80	..
	12.43	67.34	80	..
	41.00	65.22	89	..
	41.43	65.75	89	..
	13.05	68.29	80	..
	14.51	70.63	80	..
	42.75	67.84	80	..
Mixed fatty acids from a household soap.	13.84	21.97	47.92	..
	13.45	21.35	47.92	..
Mixed fatty acid from a household soap.	25.50	40.46	54.86	..
	23.58	37.43	54.98	..

It is certainly very remarkable that in the case of olive oil and rape oil so close an agreement between the gravimetric bromine number and the Hübl iodine value is obtained. In all other cases the discrepancy is very great; in some cases even enormous. The drying of the brominated fatty substance at 125° C. until constant weight is obtained took in the case of, e.g., linseed oil and fish oil, a remarkably long time, considerable decreases in the weight being noticed after each drying.

The introduction of the gravimetric bromine process into fat analysis as a quantitative process must therefore be out of question.

Newcastle Section.

Chairman: F. S. Newall.

Vice-Chairman: G. T. France.

Committee:

A. Allhusen.

P. P. Bedson.

T. W. Hogg.

H. Louis.

T. W. Lovibond.

N. H. Martin.

W. Martyn.

John Morrison.

John Pattinson.

W. W. Proctor.

W. L. Rennoldson.

T. W. Stuart.

Hon. Local Secretary and Treasurer:

Saville Shaw, Durham College of Science, Newcastle-on-Tyne.

SESSION 1896-97.

Dates of Meetings.—Jan. 28th, Feb. 25th, March 25th, April 29th.

*Annual General Meeting, Tuesday, November 17th, 1896,
held at the Durham College of Science,
Newcastle-on-Tyne.*

MR. F. S. NEWALL IN THE CHAIR.

CHAIRMAN'S ADDRESS.

BEFORE beginning to read my address I should like to thank you most warmly for the honour you have conferred on me in electing me your chairman for the current session. I am deeply conscious of the responsibility of the position, following as I do in the footsteps of your past chairmen, who have been most intimately connected with the syndicate which practically controls the chemical trade of this district, and have had, therefore, a far wider field for the accumulation of that knowledge of general chemical matters which is so necessary for the Chairman of this Section.

One is met also by another great difficulty, namely, that, from a business point of view, chemical transactions cannot in many instances be made public. It is a selfish trade, for when a man has invented a good process, he does not wish to disclose it or to give the world the benefit of it.

These then I suppose are some of the reasons why Newcastle does not supply this Section of the Society of Chemical Industry with more papers upon chemical subjects. There is no doubt that pioneers of chemistry have certainly had their birth on Tyneside, and, in the present day, we have only to look round to see that talent is not wanting, but both talent and individual enterprise are warped and thwarted by amalgamations and unwieldy syndicates.

This want of activity is no new complaint and if you will allow me, I will quote from the Chairman's address of ten years ago:—

"It was a matter which had already been mentioned in the Committee's report and which is of such importance that he could but refer to it once more. He need scarcely say that he referred to the most striking feature in that report, viz., the great falling-off of the number of communications. The majority have been in the form of short notes merely, and one-third of the communications come from a foreign source. He would not emphasize this latter fact, for science recognised no nationality, but this, together with the small number of communications would appear to denote a want of activity, if not of interest, in the objects for which this Society was formed."

You see, therefore, that the difficulty which was then felt still exists and it is a lamentable conclusion that the impossibility of unfolding new processes and chemical inventions to the world, is one which cannot be easily overcome, and which of necessity very much limits our powers of conference.

There is, I think great scope for investigation in some processes of the past generation, and which though now disused and out of fashion, might be brought to life again by means of modern appliances.

It is upon such a subject that I propose to speak to you to-night, and I am very glad to have this opportunity of bringing it to your notice.

It is most difficult after the lapse of years to collect the details of an extinct process; books get lost, men who have worked at it get separated, or also become extinct, and the details of management are forgotten; and it is only my extreme desire that some account of the oxychloride of lead process of making white lead should be placed on record that has encouraged me to collect and set the following brief sketch before you to-night.

This process was invented by my grandfather, Mr. Hugh Lee Pattinson, and worked at the Washington Chemical Works from 1850 to 1871. Mr. Pattinson was born at Alston on Christmas Day 1796, where the lead industry was then of no mean importance, and it always seems to have had a fascination for him.

In 1833 he patented his process for desilverising lead, which has since been identified with his name, and upon which he read a paper before the British Association at their Newcastle meeting in 1838. After this process was perfected he turned his attention to the manufacture of white lead, and in 1848 invented the oxychloride of lead process. He was, at that time, carrying on the chemical works at Felling with Mr. John Lee, and had with him as assistant Mr. John Glover, who was extremely anxious to get a greater insight into the science of chemistry than he could do by merely working in the works, and persuaded Mr. Pattinson to allow him to work in the laboratory. Mr. Pattinson all this time was looking round for a suitable spot on which to build his white lead works, the great desideratum being an ample supply of good water. This he found at Washington coming straight from the limestone, and in 1846 he asked Mr. Glover to leave Felling and go to Washington to complete the white lead process.

Mr. Glover was then experimenting on his plan of denitrating sulphuric acid by means of the pyrites kiln gases, but he gave up the experiments, which were not continued until he completed them at Washington in 1857 by inventing the tower which bore his name and is universally adopted in chemical works of the present day.

You will see from this that the collection of the particulars of this process has been confined to very few individuals, and those who now remember its details are scattered far and wide, and it has been impossible to confer with them all.

Galena, in charges of about 6 tons, in the state in which it arrived from the lead mines, together with the necessary quantity of hydrochloric acid of 30° Tw., was put into a mill constructed of a wooden tub, 20 ft. diameter by 5 ft. deep, lined with lead and blocks of grey granite 9 in. square, which were set in asphalt. An agitator of strong oak beams, secured with copper bolts, carried round large blocks of granite, with which the galena and HCl were ground together, the result of the reaction being to produce lead chloride and H₂S, which was evolved in large quantities. Of this H₂S I will speak later on.

The free acid contained in the HCl used in these dissolvers was not by any means neutralised by the galena, but a considerable quantity remained, so that when, on testing, the acid was found to be about 10° Tw., the whole contents of the dissolver was run into a settling tank. Here the density of the PbCl₂ made it settle rapidly and the clear supernatant liquor was syphoned off. The PbCl₂ was washed with successive quantities of cold water to remove the last traces of free acid and salts of iron, which if not eliminated at this stage caused the resulting white lead to have a yellow tint.

It is hardly necessary to state the reason for using cold water instead of hot, which is of course on account of the slight solubility of PbCl₂ in cold, while it is freely soluble in hot water—it requires 135 lb. of water at 12° C. to dissolve 1 lb. of lead chloride and only 20 lb. of water at boiling point.

The removal of iron at this stage was one of the great difficulties of the process, finally overcome by using a peroxide, which caused the precipitation of ferric oxide in a manner well known and very commonly used. The results of many experiments showed that by dissolving lead chloride in boiling water, and adding at the same time small quantities of peroxide of lead, the liquid, after settlement, was perfectly free from iron and gave a pure white resulting product.

By the adoption of this process the number of washings with cold water could be reduced from 12 to 3 or 4, and thus a saving was made, as every washing carried away with it in solution an appreciable quantity of lead chloride. This plan was Mr. Glover's proposal, and in all probability he was the first, or among the first, to use peroxides for the removal of iron.

The chloride of lead was therefore washed from the settling tank with boiling water (and a quantity of from 4 to 5 lb. of peroxide of lead per ton of $PbCl_2$ added to remove the iron) into round vats, lined with lead, and fitted with agitators, the agitation being kept up until all the chloride was dissolved, when it was run into stock vats, 20 ft. diameter by 12 ft. deep, and allowed to settle. The heating to boiling point of the immense quantity of water required was a matter of considerable moment, and large haystack boilers were used, the water being passed from one to the other. We have now got the clear chloride of lead solution free from iron and all other impurities, and to precipitate it requires a large volume of lime water. The quantity of lime required to precipitate the lead having to be in the form of clear lime water will show you at once what immense quantities must be used for the purpose, as the solubility of lime in cold water is about 1 in 750. This lime water was prepared under cover in large brick tanks, about 100 ft. square and 8 ft. deep, and there were three of these.

One of the difficulties Mr. Pattinson had to contend with was getting an intimate mixture of these two solutions in the right proportions, for an excess of lime water made the lead yellow; and in order to maintain a constant head of liquor on the mixing pipes two stone tanks, about 4 ft. square by 12 ft. high, were used. These had gauge glasses fitted the entire height, and the man in charge had to keep an equal level in both tanks, into which chloride of lead and lime water were respectively run from the stock tanks. From the bottom of these tanks taps allowed the liquors to run to the mixing pipes, 6 in. diameter by 12 ft. long, along which a narrow slit ran the entire length. From these slits the liquors emerged in thin films, and were thus intimately mixed; passing on, it entered at the periphery of a circular tank with a central opening, forming a vortex action and completing the mixture. Hence they flowed into draining tanks, which settled and filtered the precipitate. As the clear filtrate passed away it was treated with a small quantity of bicarbonate of magnesia solution in order to precipitate any chloride of lead which might still remain in solution. It was found in practice that the oxychloride of lead, after being ground with oil to form paint, used to set hard in the casks, and to obviate this difficulty Mr. Pattinson added in the mixing tank a quantity of bicarbonate of magnesia, forming a basic carbonate of lead along with the oxychloride of lead having the formula $PbCl(OH)$.

The result was filtered from the tank, filled into earthenware dishes, and dried in the usual manner. It was of good colour—many considering it superior to Locke Blackett's white-lead, which I believe then stood highest in the market; and as for covering capacity, Mr. Pattinson used to claim for it that 60 lb. of oxychloride would go as far as 100 lb. of other paints. The quantity of white-lead made by this process averaged about 1,000 tons a year during the time the process was at work at Washington.

Such is a brief outline of the process, but I must ask you to let me take you back, to learn what happened to the by-products. The first of these was sulphuretted hydrogen, evolved on the decomposition of galena with HCl . This gas coming off in irregular quantities, was first taken in pipes to the pyrites kilns, and the products passed into the sulphuric acid chambers, but caused endless trouble, besides the danger occasioned by flashing back through the supply-pipes, producing explosions. To obviate this, a small gas-holder was made of gutta-percha. This was a most costly affair, and only lasted a very short time, for one day it suddenly exploded, and the fragments were too small to enable anyone to assign a cause for its dissolution. After this the gas was burnt under a boiler fire, and the products passed up the chimney. The undecomposed galena left in the settling-tank after the chloride of lead had been washed from it, contained all the silver originally in the ore, and many were the experiments made in smelting-

furnaces to recover this. Mr. Pattinson always wished to recover the silver in solution, and if he had done this, would have considered his process a complete success. He, however, was not spared long enough to complete his experiments, for he died in 1858. Mr. Glover, who had so ably assisted him, left Washington in 1861, and the question of extracting the silver and lead from the residuum remained unsolved.

In spite, however, of these advantages, the process was discontinued in 1874, and the works dismantled. A rapid fall in the price of white-lead, and the low prices realised for the residuum, which, as years went on, did not decrease in quantity, made it impossible to carry on the process at a profit.

The sources of loss in a process involving such large quantities of liquid are large, and although every possible care was taken, lead *did* get away undissolved, unprecipitated, and unfiltered.

If HCl could be spared in quantities, I have no doubt that this beautiful process could be economically worked with the modern disintegrators for grinding the lead ore before putting it among the acid, the perfected process for recovering sulphur from H_2S , and the excellent appliances we now possess for mixing and filtering solutions.

Mr. JOHN PATTINSON moved that a hearty vote of thanks be given to Mr. Newall for an address of exceeding interest.

Dr. BEDSON, in seconding the motion, congratulated the Section on having secured Mr. Newall as its chairman, and congratulated the chairman upon an address which was a distinct addition to chemical literature.

Mr. JOHN GLOVER, at the request of the chairman, spoke of the share which he had had in the working of the oxychloride of lead process, and also addressed a few words of advice to the younger members of the Section, urging them to add to their purely chemical knowledge a knowledge of mechanics and of constructive materials, pointing out that some such knowledge was essential to a man who had to carry out chemical reactions on a large scale.

He also spoke of the very great pleasure that it had been to him to receive the first medal of the Society, and that he regarded it not merely as a personal honour, but also as an honour bestowed upon the Newcastle Section of the Society.

Nottingham Section.

UNIVERSITY COLLEGE, NOTTINGHAM.

Chairman: F. J. R. Carulla.

Vice-Chairman: J. M. C. Paton.

Committee:

L. Archbutt.	F. E. Lott.
R. M. Caven.	T. Mason.
F. Clowes.	J. J. Sudborough.
H. Forth.	C. Taylor.
W. G. Johnston.	G. J. Ward.
J. F. Kempson.	

Treasurer: S. J. Pentecost.

Hon. Local Secretary:

J. T. Wood, 29, Musters Road, West Bridgeford, Nottingham.

SESSION 1896-97.

Dates of Meetings.—Jan. 27th (Burton), Feb. 24th (Nottingham), March 24th (Nottingham), April 28th (Derby), May 26th (Nottingham).

Meeting held on Wednesday, November 25th, 1896.

MR. F. J. R. CARULLA IN THE CHAIR.

CHAIRMAN'S ADDRESS.

The Commercial Position of Sulphate of Ammonia.

It is chiefly the farmer who has been kept in view when making comparisons between the price of sulphate of ammonia and that of its great rival, nitrate of soda. The last contains 16.47 per cent. of nitrogen, whilst in sulphate of

ammonia this reaches 21·21 per cent. It is obvious that, reckoning the unit of nitrogen as of equal value in both, the price of sulphate should exceed that of nitrate by more than a fourth, and this condition held good until not very long ago when a reversal occurred, the causes of which are not at all easy to fathom. It may safely be said that, had the synthetical manufacture of ammonia from the nitrogen of the air been accomplished on a commercial scale, the revolution experienced could hardly have been greater.

How industries can be influenced by methods other than those of a purely technical nature is well illustrated by the following extracts from a letter signed "Nitrogen," which appeared in the *Chemical Trade Journal* of the 15th of last August:—

"Some 16 or 18 years ago, when sulphate of ammonia sold at a very high price in relation to nitrate of soda, and when sulphate of ammonia alone was used as a manure for sugar beet, the nitrate of soda producers bethought themselves of a scheme whereby they could displace sulphate of ammonia, and induce the cultivators of beet to use nitrate of soda instead. They offered a prize of 1,000*l.* to the writer of the best essay upon the application of nitrate of soda for beet-growing in substitution of sulphate of ammonia. From that day to this, step by step, nitrate of soda has encroached upon the old preserves of sulphate of ammonia, until to-day we stand in the extraordinary position of being completely routed from a field that formerly was all our own. . . . The price of nitrate of soda to-day is, say, 8*l.* per ton. The price of sulphate of ammonia is to-day, say, 7*l.* 12*s.* 6*d.* per ton. . . . Now what does all this mean? . . . Assuming the export of nitrate of soda is one million tons per annum, then it means that the nitrate of soda producers are now receiving 2,087,500*l.* per annum more than they should receive. A fair return for 1,000*l.* prize once given! ! !"

It cannot be questioned that the literature that arose round this prize must have benefitted the nitrate of soda industry, but the effect in any case has been gradual, and we must remember that comparatively low prices were experienced in the sulphate market long before the prize-essay. In 1867, for example (I take the figures of Messrs. Bradbury and Hirsch), the average price of sulphate of ammonia was 11*l.* 10*s.*, from which figure it rose to 21*l.* in 1872, coming down to 17*l.* 2*s.* 6*d.* in 1874, rising again until 1878, when 20*l.* 5*s.* per ton was realised as an average for the year. This was about the time of the nitrate essay. It will thus be seen that severe fluctuations and low prices were not unknown before its advent. Hence the value of the suggestion that sulphate of ammonia makers should band together and offer a similar prize to sing the praises of their product is questionable. The money would be better spent in disseminating the literature we already possess amongst the farmers to teach them the value of nitrogenous manures generally, rather than make any attempt to fall foul of nitrate of soda. The Sulphate of Ammonia Manufacturers' Association, of which my worthy colleague of Manchester, Mr. Geo. E. Davis, is Hon. Sec., publishes an excellent pamphlet on the use of sulphate, that only wants distributing with a little energy to cause surprise to those apathetic manufacturers, who look with indifference on the association, forgetful of the motto: "United we stand, divided we fall."

It would appear from estimates made by M. Legrand, given in M. Truchot's recent book "L'Ammoniaque," that Belgium uses but $\frac{1}{10}$ th, Germany $\frac{1}{20}$ th, France $\frac{1}{10}$ th, and England $\frac{1}{10}$ th of the quantity of nitrogenous manures they might each consume with advantage. It may thus be seen how great is the field that lies unconquered at our very doors, and the instruction of the farmer is only needed in order to have a flourishing market for our sulphate with benefit to the whole community. The matter is so notorious that numerous references to it are to be found in the reports of Mr. A. E. Fletcher, late H.M. Chief Inspector under the Alkali & E. Works Regulation Acts.

Thus in the proceedings during the year 1889 (p. 12) he wrote: "Seeing that the larger proportion of this ammonia is produced in the gasworks scattered through the country, it appears surprising that the British farmer does not see it to be to his interest to buy that which may be had in his

own market town rather than to allow it to be carried away and shipped for the use of the farmer in Germany, who has to pay the carriage and other charges in addition to the price for which our farmers at home could purchase it."

With our present means of manufacture over-production should be impossible in the face of such figures as those given above, and yet the accumulation of stocks in the hands of the large makers, which, for instance, at the beginning of 1895 amounted to something like 16,000 tons according to Messrs. Bradbury and Hirsch, is a fact that would lead one to suppose production was in excess of demand. Sulphate of ammonia and nitrate of soda are evidently fighting for a restricted field that by combined efforts might be greatly enlarged to the benefit of both.

The accompanying table gives the production of sulphate of ammonia in the United Kingdom during the last 10 years, and the diagram represents the annual variations in the quantities obtained from the various sources. Each division represents 1,000 tons.

AMOUNT OF SULPHATE OF AMMONIA PRODUCED IN THE UNITED KINGDOM DURING THE LAST TEN YEARS.

The figures being taken from the Reports of Her Majesty's Chief Inspector under the Alkali Acts.

	1886.	1887.	1888.	1889.	1890.
	Tons.	Tons.	Tons.	Tons.	Tons.
Gasworks	82,480	85,022	92,896	100,711	102,138
Shale-works	18,080	21,098	22,072	23,953	24,760
Ironworks	3,950	5,068	5,280	6,145	5,064
Coke, &c. works	2,100	2,678	2,537	2,795	2,325
Total	106,610	113,866	122,785	133,604	134,257

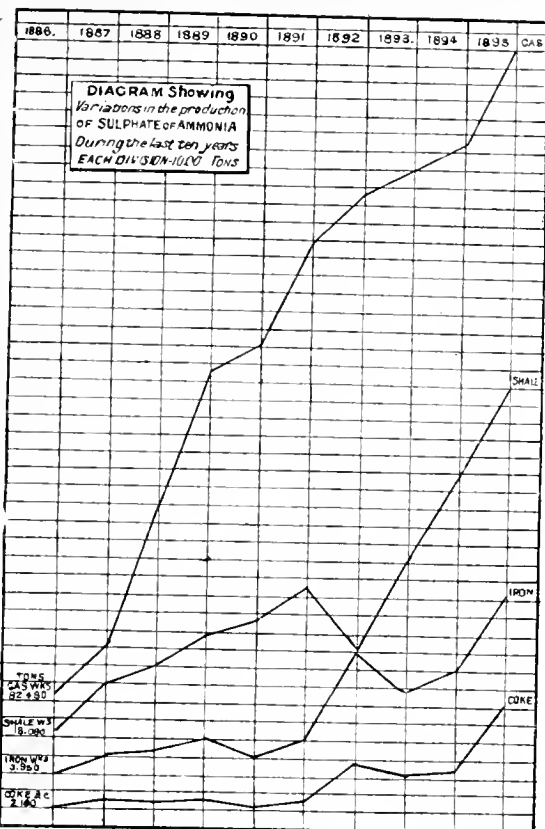
	1891.	1892.	1893.	1894.	1895.
	Tons.	Tons.	Tons.	Tons.	Tons.
Gasworks	107,950	110,748	112,179	113,634	119,615
Shale-works	26,500	23,705	28,485	32,801	38,335
Ironworks	6,290	11,000	8,833	10,075	14,588
Coke, &c. works	2,766	4,973	3,265	3,418	7,983
Total	143,506	149,826	152,762	160,048	179,651

A mere glance at the diagram will show how last year every branch of the industry contributed to the increased production, which rose from an average of barely 6,700 tons for each of the previous eight years, to the astonishing figure of 19,603 tons, an addition to the market supplies that largely explains the depression, already in an acute stage at the end of 1895, when sulphate touched 8*l.* 10*s.*, the lowest price then on record.

It may be that errors in the manipulation of stocks at the large gasworks have aggravated the situation. It is obvious, however, from the diagram that the annual increase in production from such works is only that naturally due to the spread of the gas industry. This increase has not been so great of recent years as it was in 1888 and 1889, years that show remarkable advance. Can the falling-off be due to the progress of the electric light? We cannot doubt that this must in some degree have affected the output of gas, and hence of sulphate.

The use of oil-gas and of the water-gases, in which latter category acetylene may be included, will also tend to prevent any large increase in the output of coal-gas. The Birmingham Corporation have, for instance, established works for the manufacture of water-gas to be enriched with "Russian solar distillate," a petroleum whose specific gravity is nearly 0·80, which will yield 2,000,000 cb. ft. of gas per day of 24 hours, or about a quarter or a fifth of the average output of the Windsor Street Works, while the further extension, for which room is provided, will bring up the capacity to a third of the present output.

That extensions of this character will exert a powerful check on the production of sulphate from gasworks is clear. Acetylene promises also to be soon a familiar feature in view of the establishment of a company at the Falls of Foyers for the manufacture of carbide of calcium.



That the increasing use of coal-gas for cooking and heating purposes will influence the position in the opposite direction is equally certain, and not only for the sake of the gas industry but in the interests of the public health we must all sincerely hope that this will prevail.

Turning now to the ironworks, which help to swell the output of sulphate, I cannot do better than read to you again from one of Mr. Fletcher's reports to give you some idea of what is being accomplished. "There are cases where more of the capital invested in an iron smelting work is devoted to the collection and treatment of the tar and ammonia than to the production of the iron itself. . . . In Scotland at present the apparatus for collecting the ammonia, tar, &c. from the gases of the iron blast furnaces has cost over 444,600*l*." (Alkali Act Report for 1891.)

You will have observed that practically the whole of the sulphate of ammonia from ironworks is obtained in Scotland, and we may suppose that this make is largely added to that portion of the product from the shale works that finds an outlet at Leith. Can it be that this plethora enables speculators to so easily squeeze prices at that port? The iron manufacturers, however, or at least some of them, care as little for low prices, as do those engaged in the English gas industry, and it has been suggested that the ammonia from the blast furnaces should be recovered as carbonate instead of sulphate. This would certainly save the cost of the sulphuric acid and utilise the carbonic anhydride which now goes to waste. As R. Warrington has, however, shown the prejudicial action that ammonium carbonate has on nitrification it may yet be questioned whether the adoption of the suggestion would relieve the situation for the ironmasters.

Modern developments may, however, make such progress as to render the farmer altogether independent either of sulphate or of nitrate. You will be able to read in the forthcoming number of our Journal a report of Dr. Voelcker's paper on "Nitragin," the name given to a bacteriological culture which is to do away with nitrogenous manures at least for leguminous plants.

Although as yet the inroad of the bacteriologist into the domain of the agricultural chemist extends only to the requirements of these plants, it is well to ask ourselves what, if by further developments, nitrogenous manures can be dispensed with altogether? Clearly the nitrate of soda industry would suffer more than sulphate of ammonia, not only because it is the favourite, but also because the trade in nitrate is the larger. Were we in the position of some 28 years ago when the Heaton (Steel) process was invented, and which promised to consume enormous quantities of nitrate of soda, hopes might be entertained that with lower prices its use might increase even if it became obsolete for agricultural purposes. No such hopes are now possible, for with the modern steel processes to compete against that of Heaton could only find employment for exceptional purposes however much it might be technically perfected. It is difficult to imagine in what direction the large quantities of nitrate of soda used in agriculture could be otherwise employed.

The ammonia interest, although also a sufferer, would not be in quite so bad a plight. In the first place the quantity to be reckoned with is much smaller, and secondly, the outlets for ammonia in one form or another are daily widening. Of course I am referring here to ammonia not in the form of sulphate. Already considerable quantities of ammoniacal liquor go into consumption in the ammonia-soda process, amounts that are not included in any of the figures above given. The quantity of ammonia to thus find employment will probably go on increasing until double the present amount is used. The ammonia-soda process last year overtook the Leblanc process as regards the quantity of salt decomposed in Great Britain.

The use of ammonia for refrigerating purposes is also extending.

America has occasionally absorbed a considerable quantity of sulphate from England to be reconverted into ammonia. This may have occurred exceptionally, but it can hardly be a visionary thing to hope that the development of South Africa under British rule may make demands upon us in this direction.

It is needless to dwell on the many purposes for which ammonia may find employment in the house. As the public become more alive to its value as a detergent the use for this purpose must largely grow in importance.

I refrain from mentioning other outlets for ammonia that will be obvious to you for the manufacture of compounds used in small quantities, and over the consumption of which we can exert no influence. Nitrate of ammonia, the offspring of the two great rivals we have been considering, and which has been used in the manufacture of explosives, may be given a passing notice. At one time there was promise of both sulphate and nitrate being largely used in the manufacture of this salt, but its hygroscopic character has stood in the way of progress.

From what has been said it may be seen that whilst there is yet a large virgin field for the employment of sulphate of ammonia in agriculture, many uses for ammonia are opening out, whilst the competition of nitrate of soda is only felt by sulphate. We have also seen that the increase in the production of ammonia is likely to suffer a check in the gas industry, but, on the other hand, blast furnaces and coke-ovens, as well as the shale-works, will probably pour it into the market in increasing quantities. The latter, however, are more subject to trade fluctuations than are the gasworks, so that we cannot help being impressed by the conviction that great variations will be seen in the sulphate of ammonia market in the future as in the past, that the present depression is only temporary, and that we can hopefully look forward to better times.

THE AMOUNT OF AIR CONTAINED IN WATER.

BY J. M. C. PATON.

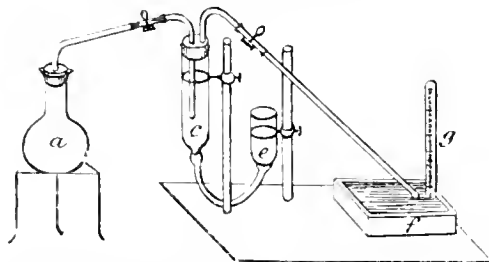
(This Journal, 1896, 419.)

DISCUSSION.

The CHAIRMAN hoped that other members had been more fortunate than he in his search for results of experiments to enable him to reply to the questions put by Mr. Paton

(p. 420). Mr. Caven had already given the chief points known on the subject of the gases dissolved in water, and indeed the note itself was a better reply to some of the questions than much that might be said. It might, however, be of interest in this connection to call attention to the

J. C. THRESH'S APPARATUS FOR COLLECTING THE GASES DISSOLVED IN WATER.



a, flask filled with the water to be examined; *c*, filled with mercury by raising *e*; *f*, mercury trough; *g*, receiver for the gases as they come from *a*.

form of apparatus designed by J. C. Thresh for collecting the gases dissolved in water whilst engaged in the analyses of the Buxton Thermal waters, which would be found illustrated in the *Journal of the Chemical Society*, Vol. XXXIX., p. 399.

Mr. G. J. WARD said he had no experimental evidence to offer. Possibly to look at the question from a purely theoretical point of view would be the best, because it seemed to him that the amount varied so much that it was difficult to get at it exactly by experiment. He understood that Mr. Caven showed that the amount dissolved by water of gases found in the ordinary atmosphere came altogether to 3.12 vols. per 100 vols. of water at a temperature of 0° C. and 760 mm. pressure. Assuming the vacuum of an air-pump to be equal to 76 mm. pressure, the equivalent of about 3 ins. of mercury, the result in such a case would be that the amount of gas dissolved in the water would be one-tenth of what it was originally, *i.e.* 2.8 vols. of gas would be given off leaving 0.32 in the water. But those 2.8 vols. of gas then given off would now be under a pressure of only one-tenth of what they were in the first instance, and the result would be that they would occupy 28 vols. per 100 vols. of water used. That was taking no account of temperature. He found Bunsen gave the following figures as to the effect of temperature:—The absorption coefficient of nitrogen at 0° C. is 0.02035, at 5° it is 0.01794, at 10° 0.01607, at 15° 0.01478, and at 20° 0.01403. In the case of oxygen the coefficients were—at 0° C. 0.01114, at 5° 0.009628, at 10° 0.008250, at 15° 0.00789, and at 20° 0.007838. Carbonic acid gas varied in the same way but to a larger extent, the coefficients being at 0° 1.7967, at 5° 1.4497, at 10° 1.1847, at 15° 1.0020, and at 20° 0.9014. That meant that if cold water, instead of being at a temperature of zero, be taken at 15° C., which was what they might take it to be on an average, the absorption coefficients came very nearly to three-quarters of what they were at 0°. Therefore the gas dissolved in the water would be about three-quarters of the amount given above, that was to say it would be 2.34 vols. per 100 vols. of water. The amount left in the water after the reduction of pressure to one-tenth would come to a little over 0.2 vols. per 100, and the other 2.1 vols. would be given off. At the reduced pressure this would become 21 or 22. In addition to that they had to consider the effect of temperature. The temperature of water which gave a vapour tension of 3 ins. of mercury was, roughly speaking, 45° C. That would cause an expansion approximately of one-sixth, bringing the 21 or 22 vols. to 24 or 25. All those figures were based on the assumption that the water in the first instance was pure water and thoroughly saturated. The next question to consider was whether the water was likely to be saturated. As to the rate of diffusion of gas in liquid, he was sorry to say he had not got any exact figures. The rate of diffusion of gas in a liquid was inversely in proportion to the square root of

the specific gravity of the gas. That would account for the fact that the oxygen and nitrogen in water more nearly approached the theoretical quantity than did carbonic acid gas, which would diffuse more slowly. The effect of different solids in solution was, for ordinary waters, very small. The absorption coefficients for solutions of sodium chloride and sodium sulphate were only slightly less than pure water, but certain solids, such as normal sodium carbonate and sodium phosphates, and some organic sodium solids, absorbed, probably chemically, more carbonic acid gas. Whether that gas would be given off on heating to temperature of the air-pump, he could not say, but in a similar case of ammonia, which was dissolved in nitrate of potassium, it was entirely given up on boiling; so he would be inclined to say that the same would be the result with carbonic acid gas. Buchanan measured the solubility of carbonic acid gas in solutions of calcium and magnesium sulphates, which would be similar to the water in those districts; but the results varied according to whether the solutions were freshly prepared or old, and the effects produced by these salts were very slight. It seemed to him that they could take it that pure drinking water, containing the solids which it would naturally contain, only,—the solids found in strata—and which had not been heated to any great temperature, in a natural stream gradually trickling down, must contain, if not quite so, very nearly the theoretical quantity of gas dissolved. As to the effect of sewage, perhaps somebody present, who had made analyses of drinking waters and determined the manner in which they would absorb oxygen, would give some information on the subject. He had made one small experiment which anybody could make. Take an ordinary glass of soda water and try the effect of sugar and salt, which were of about equal solubility. The sugar would cause effervescence immediately; the salt comparatively slowly.

Dr. CLOWES said that Mr. Paton had given an average statement which would apply to all classes of water approximately, and the statement being an average one, might be taken as a rule for working. He (Dr. Clowes) however thought that different samples of water would have to be dealt with separately was the only solution of the problem. As regards the effect of sewage on dissolved gases in water, he had many years ago occasion to examine into that question. Sewage did assist in removing free dissolved oxygen from the water, the oxygen, as soon as it was absorbed producing oxidation of certain matter in the sewage. Hence, waters which were contaminated with recent sewage to any considerable extent were free from dissolved oxygen, in fact the proportion of oxygen which was found in solution in water might serve to decide whether there had recently been sewage in it or not. If no dissolved oxygen was found the water was probably badly contaminated with sewage.

Mr. L. ARCHBUTT suggested to Mr. Paton that it was rather unfortunate to describe the gases dissolved in water as air, because as far as the oxygen and nitrogen alone were concerned the gases dissolved contained roughly one-third of oxygen. But the proportion of dissolved carbon dioxide was probably always greater than that contained in air, and often very much greater. The amount would depend upon the proportion of dissolved carbonates of lime and magnesia. The latter salt holds the carbonic acid very loosely, for he had proved by experiment that water containing magnesium carbonate dissolved in a solution of carbonic acid could have all the carbon dioxide in excess of that required to saturate the magnesia expelled at the ordinary temperature and pressure by merely passing through the water a current of air free from carbon dioxide. The greater part of the magnesium carbonate was precipitated, and at the end of this experiment the magnesia and carbonic acid remaining in solution were in the ratio $MgO:CO_2$. Therefore, in an air-pump and at the temperature of the condenser very likely a good deal of the carbon dioxide might be given up from such water which would not be re-dissolved from the air in the cooling apparatus.

Mr. PATON after dealing with other points said that when the source of water was an underground supply, the quantity of gases contained was frequently more than that which was theoretically to be expected. If the mixture was under

pressure a considerable time the water held gas longer after release. If they took natural aerated waters for drinking purposes, and artificial ones, they would find that the natural waters would hold gas longer. Apparently there was not much on record to throw light on the main question.

Yorkshire Section.

Chairman: Thos. Fairley.

Vice-Chairman: Christopher Rawson.

Committee:

H. E. Aykroyd.	W. Leach.
J. Cohen.	A. G. Perkin.
J. R. Denison.	F. W. Richardson.
N. Farrant.	A. Smithells.
T. Glendinning.	Geo. Ward.
A. Hess.	Thorp Whitaker.

Hon. Local Secretary and Treasurer:

H. R. Procter, Yorkshire College, Leeds.

SESSION 1896-97.

Jan. 28th, 1897.—Dr. S. G. Rawson. "On the Quantitative and Qualitative Separation of Ba, Sr, and Ca," and "On the Qualitative Separation of Bi, Sb, and As."

Meeting held on Monday, November 30th, 1896.

MR. T. FAIRLEY IN THE CHAIR.

NOTE ON AN EXACT METHOD FOR ESTIMATING THE INTENSITY OF THE X RAYS.

COMMUNICATED BY MR. F. W. BRANSON.

For comparing different sources of the X rays, the hand placed upon an ordinary fluorescent screen of barium platino-cyanide is a convenient test; but if an exact record is desired, a photographic process is necessary.

The following method, which I have devised, seems quite free from error:—

A quadrant of aluminium is taken, with millimetre steps (1—10). This is superimposed on a photographic plate, which is enclosed in a light-tight envelope, a vacuum tube is placed at a standard distance from the sensitive film, and an exposure of definite duration is given.

Development with a standard developer at a temperature of 60° F. for five minutes will reveal a number of steps on the negative, that number being exactly proportionate to the intensity of the X rays.

Comparative tests can thus be made with different vacuum tubes, or with the same tube under different conditions.

Mr. Branson then demonstrated the production and properties of the Röntgen rays by means of various apparatus, including the Wimshurst electrical machine, and exhibited a large number of photographs taken by these rays.

In answer to an inquiry as to whether any photographs had been taken by means of the Wimshurst machine, Mr. Branson stated that it was quite practicable, but that the time of exposure necessary was much greater than with a good induction coil, the minimum with the machine exhibited being about 20 minutes, whilst 1 minute sufficed with a coil which gave a 10-in. spark. This was accounted for by the great difference in intensity, which might be overcome by increasing the number of plates, and consequently the quantity of the discharge.

Mr. Branson considered that the use of the Wimshurst machine as a means of generating the X rays was capable of application to many commercial enterprises on account of its simplicity and adaptability to driving by mechanical means.

The use of the X rays in the examination of alloys was spoken of, and their application to the examination of food-stuffs, &c. for mineral impurities was perfectly feasible.

Mr. BROADBENT asked whether Mr. Branson had attempted to differentiate between the X rays, as it was supposed that they existed in two or three forms.

Mr. BRANSON, in reply, stated that the result of recent experiments had been, not to find two or three varieties merely, but a regular gradation of rays, as in the case of light.

SOME APPLICATIONS AND MODIFICATIONS OF THE MERCERISING PROCESS.

COMMUNICATED BY A. G. PERKIN, F.R.S.E.

PROFESSOR HUMMEL, who is unavoidably absent this evening, has asked me to bring before your notice some specimens of fabrics treated by somewhat novel processes, which are based upon the old and well-known method of "mercerisation." It appeared probable that these samples, which have been recently presented to the Dyeing Department of the Yorkshire College, would be of interest to the members of this Section.

The original process of Mercer consists in treating calico with a solution of strong caustic soda (40—50° Tw.) at the ordinary temperature, the material being by this means considerably strengthened, and also acquiring an increased attraction for colouring matters. As a process preliminary to dyeing, it has been but little utilised on account of the excessive contraction which the cotton undergoes (about $\frac{1}{2}$ th in length and breadth). Strange to say, this contraction, which in the early days was regarded as a defect, has proved to be a valuable feature, capable of useful application; thus in recent years it has been employed by printers for the imitation on calico of the "crêpons" introduced by the woollen manufacturers. For this purpose the cotton is printed with a solution of gum, usually in the form of stripes, and, after drying, passed through the caustic alkaline solution, with the result that the unprinted portions contract while those parts protected by the gum do not, and hence the latter assume the characteristic puckered or "crêpon" appearance.

More recently still, a French inventor has discovered that wool and silk, which are injuriously acted upon by caustic alkali at the ordinary temperature, are practically unattacked at 0° C. by this agent, though cotton, on the other hand, is still mercerised. By treating, therefore, mixed fabrics consisting of silk and cotton, or wool and cotton, with the caustic soda solution at this low temperature, the cotton is contracted while the wool and silk remain unaltered, and the local contraction thus produced causes the beautiful wave-like "crêpon" effects on the patterns now before you. Excellent imitations of "crêpon" work of a slightly different character are produced by mercerising in this way double cloths having a woollen face and gauze-like cotton back, interwoven at certain points in accordance with the pattern desired.

The most novel process here illustrated, which is the subject of a French patent, is based upon the contraction which silk is found to undergo when treated with dilute sulphuric acid. The following particulars, taken from the *Färber Zeitung* (VII., 139), are said to be employed:—They consist in steeping the material in sulphuric acid 75—80° Tw., at a temperature of 15—37° C., for 5—15 minutes, and though the silk thus suffers a loss of lustre, its strength is practically unaffected. By printing the silk with a wax resist, certain portions of the fabric may be protected from the action of the acid, and various ruffled "crêpon" effects are thus obtained, as seen in the samples submitted to your notice.

Finally, I have to bring before you a novel and somewhat ingenious adaptation of the process of mercerisation, which consists in the treatment of cotton with strong caustic soda solution, means being at the same time, however, employed to prevent the contraction of the material. Owing to the strain thus brought to bear upon the fibres during the mercerising process, and therefore while they are still in a plastic condition, they acquire such a high lustre as to give the material the appearance of silk.

Dyed and undyed samples of Lehner's artificial silk produced from collodion are also submitted to your inspection.

DISCUSSION.

The CHAIRMAN inquired whether artificial silk was made in this country.

Mr. J. W. PROCTER asked whether the sulphuric acid used in the process of mercerisation did not affect the durability of the silk fibres.

Mr. PERKIN, in reply, stated that artificial silk is not made in this country, but principally in France. The nature of the colouring matter of the silk is not stated. In some cases it has been introduced into the collodion mass before drawing into fibres. It had not been found that the sulphuric acid had any deleterious effect on the fibres.

NOTE ON THE DURABILITY OF PLATINUM-IRIDIUM VESSELS IN LABORATORY USE.

BY T. FAIRLEY.

Mr. FAIRLEY showed vessels of the alloy of platinum with 10 per cent. of iridium, which had been in everyday use for over 14 years. This alloy is much harder and more durable than pure platinum, and if carefully used does not crack, as has been recently stated by Mr. Blair, chief chemist in one of the United States Government laboratories. Even pure platinum vessels are sometimes injured by the sudden application of a powerful blow-pipe flame to the cold metal. The author also referred to the advantage of keeping platinum vessels thoroughly clean by carefully rubbing them after each heating with water-worn sand, free from any angular or gritty particles.

Some years ago Mr. Casamajor drew attention to this fact, and proved that vessels so treated lost much less in weight after repeated heatings than if they had not been cleaned at all. The action of gas or other flames containing carbon compounds tends to disintegrate the metal—by the formation and decomposition of carbon compounds of platinum—so that it becomes porous or even loosely coherent. The rounded sand acts as a burnisher, and mechanically restores the surface of the metal when rubbed on it.

The green flames given by certain burners in which an explosive mixture is burnt, act on platinum much less than other forms of Bunsen burner.

The author had also paid attention to the shape of platinum vessels in relation to durability. A shape more or less hemispherical appears to be the best in this respect. Sharp corners should be avoided.

DISCUSSION.

Mr. W. McD. MACKEY inquired as to the effect of fusions with strong alkalis on the platinum-iridium vessels.

Mr. FAIRLEY said that it was not so marked as in the case of platinum vessels, but undoubtedly a better substitute for such purposes would be platinum vessels coated with gold. The price of the alloy was about 2s. 6d. per oz. more than that of pure platinum, and as to the question of the comparative loss in weight, it had been found that the loss in the case of the vessels made of the alloy was about one-half that of vessels made of pure platinum.

Mr. Fairley also described a laboratory apparatus for supplying distilled water, heating drying-closet and steam bath, and supplying steam for distillations or other purposes.

The special points about the apparatus are the very efficient means used for minimising the loss of heat from the gas consumed, and a simple form of two-way tap, by which the steam may be directed as required.

The author hopes to describe this apparatus more fully later.

Scottish Section.

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W. I. Macadam.	R. T. Thomson.

Hon. Secretary and Treasurer:

Thomas Gray, Technical College, 204, George Street, Glasgow

SESSION 1896-97.

Dates of Meetings.—Glasgow: Jan. 26th, March 30th, April 27th.
 Edinburgh: Feb. 23rd.

Meeting held in Glasgow on Tuesday, Nov. 24th, 1896.

DR. JOHN CLARK IN THE CHAIR.

ESTIMATION OF NICKEL AND ZINC AS PHOSPHATE.

BY JOHN CLARK, PH.D.

IN 1883 I pointed out how cobalt could be conveniently separated from nickel as ammonio-phosphate of cobalt by a modification of Dirrell's process, and this method has been described by the late Professor Dittmar in his work on quantitative chemical analysis as the most elegant of all the known processes for the estimation of cobalt; and, according to Hope (this Journal, 1890, 375), it has been in daily use in a works for several years, and has given complete satisfaction both as to accuracy and the facility with which the separation can be made. Professor Dittmar also proved, by experiments, that this method was suitable as a supplement to the nitrite method for bringing the cobalt of the Fisher's salt into a weighable form.

After the removal of the cobalt as ammonio-phosphate, the nickel in the solution is either deposited by electrolysis, as recommended by Hope, or thrown down as sulphide with the object of getting rid of the phosphoric acid, and subsequently precipitating it as oxide with caustic soda; but, on account of the difficulty of removing the alkali, this latter method generally gives high results.

The nickel in the solution can be obtained as phosphate by protracted boiling, but this operation is so very troublesome, on account of the tendency to bumping and the difficulty of precipitating the whole of the nickel, that, so far as I am aware, no one has recommended this as a means of estimating nickel. I have found that this difficulty can be overcome by adding dilute HCl to the cold or moderately warm liquid till the solution is neutral to test paper, and stirring, when the nickel separates out as a pale green crystalline precipitate of ammonio-phosphate of nickel, which, when dried over sulphuric acid, has the composition $\text{NiNH}_4\text{PO}_4 + 6\text{H}_2\text{O}$. When dried at 100°C . it loses rather more than 5 atoms of water, and becomes yellow; but I have not been able to drive off the whole of the water at this temperature. When ignited, it is converted into pyrophosphate of nickel, which is brown in colour, and difficultly soluble in acid when ignited at a high temperature.

The ammonio-phosphate of nickel obtained in this way is slightly soluble in water, and, on this account, the filtrate contains a little nickel, but the amount seldom exceeds 3 mgrms. per 100 c.c. This can be precipitated as sulphide, and weighed either as oxide or sulphate, but the necessity of doing this can be obviated by the addition of alcohol, which brings down practically the whole of the nickel as ammonio-phosphate, and when the precipitate is washed with cold water containing alcohol, the filtrate gives only a faint indication of nickel.

To test the accuracy of this process, known quantities of pure nickel in the form of chloride were mixed with 10 times their weight of phosphate of ammonia and more than sufficient HCl to form a double salt; heated to boiling, excess of ammonia added, and cooled. To the ammoniacal liquid dilute HCl was then added from a burette till the blue colour disappeared and the liquid became green, when the HCl was added cautiously, stirring after each addition, till the liquid was practically neutral to test paper. The nickel begins to separate out while the liquid is still alkaline, and provided a sufficient quantity of phosphate of ammonia is present, the precipitation is complete before the liquid is quite neutral to test paper. About 20 per cent. of alcohol was then added, and the precipitate allowed to settle and stand for several hours, when it was filtered off, washed with cold water containing about 10 per cent. of alcohol, and dried. The precipitate was then removed from the filter, which was ignited first, the precipitate afterwards added, and weighed as pyrophosphate.

Ni taken.	Weight of Pyrophosphate.	Ni found.	Ni per Cent.
Grms.	Grms.	Grms.	Grms.
0.1000	0.2485	0.0098	99.80
0.1517	0.3780	0.1510	99.54
0.3076	0.7700	0.5080	100.13

The process which I have described is not suitable for the estimation of nickel in presence of cobalt or zinc, but it can be made available for the estimation of nickel in presence of cobalt by a simple modification.

New Method of separating Nickel and Cobalt.

In separating nickel and cobalt by Dirvell's process, the cobalt is precipitated as ammonio-phosphate, and the nickel is left in solution, provided the cobalt exists in the cobaltous state, but when the cobalt is in a higher state of oxidation no cobalt separates out as ammonio-phosphate, and this fact can be utilised for the precipitation of nickel in presence of cobalt.

For this purpose the solution of nickel and cobalt, in the form of chlorides, is mixed with 10 times as much phosphate of ammonia as the combined metals, and heated for a few minutes with HCl and a considerable excess of bromine. The solution is then supersaturated with ammonia, while free bromine is still present, and heated with some peroxide of hydrogen to ensure the complete oxidation of the cobalt. The ammoniacal liquid is then cooled, neutralised with dilute HCl, as already described, and stirred, when the nickel will be precipitated as ammonio-phosphate, and the cobalt will remain in solution. About 20 per cent. of alcohol is added, to complete the precipitation of the nickel, and after standing for several hours, the precipitate is filtered off, washed with dilute alcohol, dried, ignited, and weighed as pyrophosphate. When the proportion of cobalt is small, the nickel precipitate should be quite free from cobalt; but when there is any considerable quantity present, a little cobalt salt is apt to separate out on standing, and may not be completely removed by washing. In such cases it is advisable to redissolve the nickel precipitate in HCl before ignition, and reprecipitate it after oxidation and addition of some phosphate of ammonia, when the nickel should be obtained quite pure. The cobalt in the filtrate is precipitated as sulphide, and converted into phosphate.

This process is specially suitable for the separation of nickel from small quantities of cobalt. It is generally admitted that it is impossible to separate cobalt and nickel by the nitrite method when there is only 1 part of cobalt to 50 or 100 of nickel; and, according to Herrenschildt and Capelle (Zeit. Anal. Chem. 32, 607), the cyanide method, when carried out as directed by Fresenius, leaves something to be desired. By the method which I have described, there is no difficulty in detecting and estimating a minute quantity of cobalt, even when it is accompanied by 200 times its weight of nickel, and after the separation of the nickel, the presence of 1 mgrm. of cobalt communicates a decided rose tint to 200 c.c. solution.

Examples.	Ni taken.	Co taken.	Weight of $\text{Ni}_2\text{P}_2\text{O}_7$.	Weight of $\text{Co}_2\text{P}_2\text{O}_7$.	Ni found.	Co found.
	Grm.	Grm.	Grm.	Grm.	Grm.	Grm.
1	0.500	0.0050	1.2410	0.0120	0.4965	0.0048
2	0.500	0.0025	1.2425	0.0075	0.4970	0.0039

In each case a trace of nickel was found in the filtrate from the cobalt phosphate.

Probably the best existing method for the detection and separation of a minute quantity of cobalt in presence of a considerable quantity of nickel without concentration with hypochlorite, as recommended by Fleitmann (Zeit. Anal. Chem. 14, 76), is the nitroso- β -naphthol process of Ilinski and Knorre (Zeit. Anal. Chem. 24, 595); and the experiments which I have made seem to indicate that the method which I have described is at least quite as delicate.

Ilinski and Knorre recommend that the nickel should be estimated by difference or by evaporating the filtrate to dryness, igniting, dissolving in nitric acid, and precipitating with KHO; but, in my opinion, the nickel in the filtrate can be much more conveniently estimated as phosphate, and when oxidised with bromine and peroxide of hydrogen any cobalt not precipitated by the nitroso- β -naphthol will be found in the filtrate from the nickel, and can be precipitated as sulphide.

Estimation of Zinc as Phosphate.

In 1871, Hugo Tamm (Chem. News, XXIV., 148) introduced a method of estimating zinc depending on the precipitation of the metal as ammonio-phosphate. For this purpose he supersaturated the zinc solution with ammonia, then rendered it slightly acid with HCl, and to the hot liquid added phosphate of soda, which brought down the zinc as a voluminous precipitate of phosphate of zinc, which, when kept for a few minutes near the boiling point, combines with phosphate of ammonia and comes down as a dense white precipitate, which, when dried at 100° C., has the composition ZnNH_4PO_4 , and is converted into pyrophosphate by ignition. According to Tamm, the defects of the process are: that the phosphate of zinc is not quite insoluble, and that it adheres firmly to the side of the flask in which the precipitation takes place; and he further points out that as some of the zinc is volatilised on ignition, it is better to weigh the precipitate as ammonio-phosphate. The defects referred to by Tamm can be overcome by the method which I have described for nickel. The ammoniacal zinc solution, containing sufficient chloride of ammonium to form a double salt, is mixed with 10 parts of phosphate of ammonia for each part of metal, and to the cold, or moderately warm liquid dilute HCl is added from a burette, till the solution is neutral to litmus paper. The zinc comes down at first as a flocculent precipitate, which becomes crystalline on stirring as the liquid is neutralised.

The precipitate, which is easily removed from the sides of the vessel, after standing for several hours, is thrown upon a filter and washed with cold water till it is completely free from salts of ammonia. When dried over sulphuric acid or in a water-bath, the precipitate has the composition ZnNH_4PO_4 , and can be weighed without ignition; but it is not necessary to collect it on a weighed filter, as there is no loss of zinc when the precipitate is removed from the filter and ignited apart from the paper.

Examples.	Zn taken.	$\text{Zn}_2\text{P}_2\text{O}_7$ found.	Zn found.
	Grm.	Grm.	Grm.
1	0.226	0.527	0.2253
2	0.113	0.263	0.1124

In applying this method to zinc ores the iron, alumina, and manganese are removed by means of ammoniacal peroxide of hydrogen, and to the hot alkaline liquid, solution of carbonate of ammonia is added to precipitate the lime. The whole of the lime is not removed in this way, but

when the phosphate of ammonia is added, the small quantity remaining is precipitated as phosphate and is quite free from zinc.

When the percentage of lime in the ore is small the addition of carbonate of ammonia may be dispensed with, but when phosphate of ammonia is added to an ammoniacal zinc solution containing a considerable quantity of lime, a portion of the zinc is carried down along with the phosphate of lime. After getting rid of the lime the solution is set aside to allow the magnesia to separate out as ammonio-phosphate, and the zinc is precipitated in the filtrate by neutralising with dilute HCl, as already described.

This process is not suitable for the estimation of zinc in presence of nickel, cobalt, or copper, but it is a convenient and accurate method of estimating zinc in an ammoniacal solution, without the necessity of separating the zinc as sulphide.

DETERMINATION OF ALUMINA AND OXIDE OF IRON IN MINERAL PHOSPHATES, MANURES, SULPHATE OF ALUMINA, ALUM, &c.

BY R. T. THOMSON, F.R.C.

THE determination of alumina and oxide of iron by precipitation as phosphate is one of those methods of analysis which have been dealt with by various chemists, but there still remains an element of unsatisfactoriness about all the published processes. This is due to the fact that all the conditions which may tend to cause inaccuracy are not taken into account, and while one condition of obtaining correct results is carefully elaborated, another and perhaps equally important one is altogether neglected. In a paper which I read to this Society nearly 11 years ago, I endeavoured to bring out these points, and the present paper is simply a continuation, or the second part, of the former one, giving the result of experience gained since then.

Taking, in the first instance, the estimation of alumina and oxide of iron in mineral phosphates and manures, we must view the matter from two standpoints. The first of these is how to obtain the precipitated phosphates of alumina and iron free from phosphate of calcium, and the second is how to obtain and keep the precipitate in the perfectly normal state.

As usually practised the direct estimation of alumina and oxide of iron in the solution of mineral phosphates is carried out by precipitation (after preliminary neutralisation) in a hot solution with acetate of ammonia containing a considerable excess of free acetic acid. Anyone who has carried out this process with careful observation, will have noticed in many cases the crystalline precipitate of the less acid phosphate of calcium which is formed when the mixture is heated to only 60° C., as directed by Gladding in his recent paper on this subject. To get rid of all the lime, Gladding recommends a second and even a third reprecipitation of the phosphates of alumina and iron, and certainly not less than that is required in the circumstances to obtain anything like a pure precipitate. From the result of experiments I have made, it is evident that the acetate of ammonia is the agent which makes the decomposition of the di-acid phosphate of calcium take place with greater facility than would otherwise be the case. This is made plain by the fact that when a solution of phosphate of calcium in hydrochloric acid is made neutral to methyl orange or lacmoid, it shows little tendency to decomposition at 60° C., although when brought nearer the boiling point there is very considerable decomposition. At lower temperatures than 60° C. the acetate of ammonia causes precipitation in the di-acid phosphate of calcium solutions, and even in the cold there is often such precipitation, especially in presence of the phosphate of iron and alumina. In the neutralised solution, however, there is no tendency to decomposition in the cold, or even up to a temperature of 50° C., and I have therefore come to the conclusion that the neutralisation method I proposed formerly, has very decided advantages over the acetate of ammonia process, although this question was left unsettled in the first part of this paper (see this Journal for 1886, page 152). This latter

process consists in adding ammonia to the cold solution of the mineral phosphate or manure until it is neutral or only faintly acid to lacmoid paper, when the whole of the aluminium and iron phosphates will be precipitated, and all the phosphate of calcium will remain in solution. Of course it is necessary to agitate well after each addition of ammonia in order to redissolve any phosphate of calcium precipitated locally, but even with ordinary care I have found that no lime is precipitated. It may be interesting to note that slight traces of free phosphoric acid left in solution do not hold any weighable quantity of alumina or iron in solution, and this has been conclusively proved by experiments which were made to find the amount of standard alkali consumed between the point at which the slightest trace of permanent precipitate of phosphate of iron and alumina was formed, and that at which the solution was found to be neutral to methyl orange or lacmoid paper. From these results I have calculated that, under the conditions of the method of analysis, 1 part by weight of aluminium phosphate requires 3 parts by weight of phosphoric acid (H_3PO_4) to keep it in solution, and that 1 part of ferric phosphate requires no less than 12 parts of phosphoric acid for the same purpose. It will thus be apparent that traces of this acid left free, can have practically no effect on the determination of alumina, but more especially on that of iron, while the freedom of the precipitate from phosphate of calcium will be thus insured.

We come now to the second point which must be attended to in the endeavour to secure correct results, namely, how to obtain and keep the phosphates of iron and aluminium in the normal condition. In my former paper I showed that at least 1.5 times the proportion of phosphoric acid theoretically required, must be present, in order to precipitate alumina and oxide of iron as normal phosphates; otherwise, the precipitates are more or less basic, and their composition cannot be depended on. But although this may be attended to, as Gladding for instance does, the end thus accomplished is destroyed by his washing with dilute acetate of ammonia, which indeed keeps the precipitate in a suitable gelatinous condition, but decomposes it by dissolving out some of the phosphoric acid in combination with the alumina or oxide of iron, and thus rendering the precipitate basic. That this decomposition took place with dilute acetate of ammonia, and also with cold and hot water, I showed in Part I. of this paper and in a contribution to the *Chemical News* (vol. 54, page 252) on the Estimation of Aluminium in Iron and Steel. These facts as regards water-washing of ferric phosphate have, I am glad to find, been corroborated by Mr. R. M. Caven (this Journal for 1896, page 17), who discovered them quite independently. I have found that, even with moderate washing, alumina may be 8 per cent. and oxide of iron 5 per cent. too low, calculating on 100 per cent. of these substances present. Now this attending to the keeping of the precipitates in the normal condition is altogether omitted in descriptions of methods of analysis for the determination of alumina and oxide of iron in mineral phosphates and manures, and of aluminium in iron and steel. The plan I formerly gave for this object is entirely successful, and consists (after a slight alteration) in washing with a 1 per cent. solution of nitrate of ammonium containing 0.2 gm. of di-acid phosphate of ammonium ($NH_4H_2PO_4$) per litre. Of course part at least of the phosphoric acid in this will remain in the precipitate, but from further experiments it appears quite clearly that it cannot interfere materially with the weight of the phosphates, especially when it is considered that part of the phosphoric acid must go to supply what the water would otherwise carry away. A phosphate of alumina precipitate, when washed and drained, retains about 35 times, and a phosphate of iron precipitate holds about 30 times its own weight of water or the nitrate and phosphate of ammonia solution, but all the phosphate of ammonia in the latter cannot raise the percentage of alumina more than 0.13 per cent., or the oxide of iron more than 0.36 per cent., calculating on 100 per cent. of these oxides. It may just be further noted that washing with water alone, or water containing 0.2 gm. per litre of phosphate of ammonia, brings the precipitate into a slimy condition, which is avoided by the addition of a per cent.

or so of a neutral salt of ammonia. That nitrate of ammonia is best is obvious, while the acetate is decidedly objectionable, for reasons referred to in dealing with the precipitation of the phosphates of alumina and iron in order to free them from lime.

In the above remarks I have confined my attention to the removal of phosphate of calcium from the phosphate of alumina and iron precipitate, but there is often fluoride of calcium present in mineral phosphate, and this dissolves in hydrochloric acid, and is precipitated, partially at least, by both the acetate of ammonia and the neutralisation methods. The possible interference of fluoride of calcium was suggested to me by Dr. Clark when I wrote the first part of this paper, in which it was proposed that the fluorine might be got rid of by a preliminary treatment with sulphuric acid. This, however, would form a large quantity of comparatively insoluble sulphate of calcium, which should be avoided if at all possible. Since then I have found that evaporation of the hydrochloric acid solution of the phosphate to dryness with nitric acid, has the desired effect of removing all the fluorine, and thus this interfering agent is easily eliminated.

We have now seen how the determination of alumina and oxide of iron is beset with difficulties, but these can be dealt with in detail as already described, and, bearing these in mind, a fairly accurate method may now be described. From 3 to 5 grms. of the sample are dissolved in hydrochloric acid, filtered, 20 c.c. or so of nitric acid added, and the mixture evaporated to dryness, by which the fluorides are removed. The reason for not adding the nitric acid to the unfiltered solution, is with the object of keeping out iron existing as pyrites, which, as Mr. Shepherd has shown, is left unaffected when mineral phosphates are made into superphosphate, and they should therefore be stated separately from the oxide of iron. The dry residue is now dissolved in hydrochloric acid, diluted with cold water to about 200 c.c., and neutralised with ammonia, adding a little methyl orange to the solution to serve as a rough guide as to when the neutral point is nearly reached, then finishing off carefully with delicate blue litmus paper as indicator, and leaving the mixture to the faintly acid side. The phosphates of alumina and iron thus precipitated are now washed with a 1 per cent. solution of nitrate of ammonia, containing 0.2 grm. of di-acid ammonium phosphate per litre, until no lime is detected by oxalate of ammonium in the washings. The precipitate is now dried, ignited thoroughly, weighed, dissolved in hydrochloric acid, the iron estimated by the bichromate process, and the alumina and oxide of iron deduced from the weight of the mixed phosphate precipitate and the proportion of iron found. If it is thought advisable, the precipitate may be dissolved before ignition, some phosphate of ammonium added to supply the requisite excess of phosphoric acid, and the precipitation, &c. carried out precisely as described. It should be mentioned that the solution of di-acid ammonium phosphate used for washing should be made exactly neutral to methyl orange with dilute solution of phosphoric acid, as the article as purchased usually contains a little of the mono-acid phosphate, which would of course cause a slight precipitation of phosphate of calcium during the washing of the precipitate.

The above process may be applied with advantage to the estimation of alumina in sulphate of alumina and alum, as lime, magnesia, and other bases are not carried down with the same ease as when alumina is precipitated simply with ammonia.

I may just add that the neutralisation process serves for the perfect separation of alumina and oxide of iron from cobalt and nickel, zinc and manganese, as well as lime and magnesia; all of these metals remaining completely in solution under the circumstances.

DISCUSSION.

The CHAIRMAN referred to the disadvantages attendant on the estimation of iron and alumina as phosphate, as usually carried out, and expressed his pleasure at the satisfactory manner in which the author had succeeded in preventing the formation of basic phosphates, and in insuring the absence of phosphate and fluoride of calcium from the precipitate.

GOLD MILLING AT BALLARAT.

HAMILTON M. WINGATE, B.Sc., F.C.S., M.A.M.E.

GOLD was first discovered at Ballarat in August 1851, and, during the 20 years following, mining of the precious metal was almost exclusively confined to the shallow and deep leads formed by the denudation of the surrounding Silurian rocks, which had concentrated the gold into these ancient river beds and creeks.

In the year 1856 this field alone produced gold to the value of 3,750,000*l.*, and up to the present time the total yield of the Ballarat district has been upwards of 65,000,000*l.*

When the alluvial leads were becoming exhausted, attention was turned to the quartz veins which abound, and at the present day mining in the immediate vicinity of Ballarat is almost entirely confined to them. The quartz reefs are low grade; 6.16 dwt. per ton was the average of last year's returns for the Ballarat district, and owing to their poorness and the unsystematic methods of working, but few are remunerative.

The reefs consist essentially of free-milling quartz with but little mineral, which consists principally of iron pyrites, with a small percentage of galena, and sometimes, but rarely, a little zinc blende, and these for the most part are not intimately associated with the gold. The gold is of high quality, and often very coarse.

In America and South Africa statistics of the cost of milling, &c. are carefully kept; but in Victoria, on the other hand, it is almost impossible to get accurate information, and what is published is only approximate, so this induces me to lay before the Society the following statistics, which are the results of the past quarter's milling, ending September 30th, 1896, at the Grey Horse Gold Mine, which is typical of the district, and which were taken by me during a temporary residence at Ballarat, and under my personal supervision.

At this mine the quartz is mostly of a friable nature, intermixed with chlorite and other slate, containing about 2 per cent. of pyrites, and carrying 4 to 7 dwt. of gold per ton.

The ore, on being delivered at the mill, is tipped over "grizzlies," spaced so that all pieces under 1½ ins. fall into the ore bins, while the larger pieces are broken to the required size by two Blake-Marsden rock crushers.

The mill contains 40 head of stamps, each having a falling weight of 915 lb., and dropping 6 ins. 90 times per minute, which are fed automatically.

The discharge is low—about 2 ins. Owing to the coarseness of the gold, the screens adopted have 144 round punched holes per sq. in. The diameter of these holes is 0.048 in. The screens overhang at an angle of 11°.

No inside plates are used, but mercury is fed into the mortar boxes every two hours.

Outside the mortars the crushed ore is discharged on to a lip plate, and then passes over three copper plates 5 ft. wide, each 2 ft. long. They weigh 5 lb. per sq. ft. The lip plate and first plate yield the most gold; little is got on the second, the third serving to catch any loose mercury which always carries with it in small quantities.

After passing over the copper plates, the tailings are allowed to escape, not being sufficiently rich to attempt further treatment, their gold contents then only averaging 23 grains per ton, and but 37.6 grains of mercury per ton is lost.

The plates are dressed with a weak solution of cyanide of potassium and mercury every eight hours, and skimmed daily, and the whole mill is cleaned up every four weeks.

During the quarter, 5,480 tons of ore were crushed for a total yield of 1,342 oz. of gold, being an average of 4.89 dwt. of gold per ton.

The gold caught in the mortar boxes amounted to 70 per cent. of the total, while the plates yielded the remaining 30 per cent. The amalgam of the mortar boxes yielded 65 per cent. of gold, that of the plates 33 per cent.

The gold averages 982 fineness, the mint value being 4*l.* 3*s.* 5½*d.* per oz.

The mill is supplied with power from two Babcock and Wilcox water boilers, which drive a compound condensing

engine, and wood is used for fuel. The whole building is fitted with incandescent electric lights.

The following are the tabulated statistics of cost of milling for quarter :—

Cost of Milling at the "Gray Horse Mine," Ballarat, 40 Head of Stamps.		Quarter ending Sept. 30th, 1896.	
Tons crushed		5,480	
Labour	s. d.	0 8 810	
Firewood		0 6 611	
Shoes and dies		0 1 770	
Screens		0 0 377	
Mercury		0 0 013	
Stores and various expenses		0 1 314	
Total cost per ton of ore of 2,240 lb. ..		1 6 895	

The crushing capacity of the mill during this period was 3 tons per stamp per 24 hours.

The tons are of 2,240 lb., as in Australia; the short ton of 2,000 lb. adopted in America and South Africa is not used.

Owing to insufficiency of ore during the quarter, the mill was only run for 16 hours per day, which of course increased the cost of milling, owing to watchmen having to be provided, loss of time, waste of fuel, &c.

I may add that during this time the cost of mining and transport to mill, exclusive of development work, amounted to 8s. 10 35d. per ton.

The temperature of the water in the supply dam averaged 44° F., it being winter, and this is rather low for obtaining good amalgamation.

The following is the result of sizing and assaying a sample of the tailings taken as they left the tables during ore crushing. The yield of this crushing was 7.07 dwt. per ton; the assay of the tailings was 23 grains per ton, which shows the extraction to have been 88 per cent. of the total gold.

Sieve Mesh.		Proportion of Sample.	Assay in Grains.	Proportion of Total Gold.
Through.	On.			
..	40	Per Cent.	Per Ton.	Per Cent.
..	40	10.65	24	11.11
40	60	17.02	26	19.99
60	100	19.00	20	16.52
100	..	50.05	24	52.22
Loss		3.28	..	0.16
Total		100.00	..	100.00

This result showed that the bulk of the gold in the tailings was in an excessively fine state of division, and that the tailings were unadapted for profitable concentration.

Concentration was tried with canvas strakes, and a sample of concentrates thus obtained assayed 1.14 oz. of gold to the ton, and contained 65 per cent. of iron pyrites, the remaining 35 per cent. being silica.

The following results of sizing and assaying these concentrates may be of interest, from the fact it discloses that nearly 40 per cent. of the gold saved in them passed the 100-mesh sieve.

Sieve Mesh.		Proportion of Sample.	Assay in Oz.	Proportion of Total Gold.
Through.	On.			
..	50	Per Cent.	Per Ton.	Per Cent.
..	50	10.77	0.80	7.55
50	40	8.35	1.10	8.05
10	50	10.25	1.00	8.99
50	60	17.80	1.05	16.33
60	80	6.05	0.80	4.21
80	100	27.10	0.60	11.42
100	..	18.15	2.50	39.80
Loss		1.23	..	0.66
Total		100.00	..	100.00

In the Ballarat East Mines the pyrites is very low grade, and only rough concentration is attempted, and that by hand. In the Western mines the mineral carries more gold, and there percussion tables are used, besides blanket strakes, &c. Fine vanners were erected on one mine, but have been discarded.

The milling of the ore on this field as a general rule is very faulty. Hand feeding is still in vogue, and the consequent irregularity in the quantity of ore delivered into the mortar boxes and the uneven distribution seriously affect both the amalgamation and the crushing capacity of the mill.

In construction, the mortar boxes are simply designed as crushing machines. Inside, amalgamation is nowhere attempted, though it appears to me to be especially suitable for this district.

In many mills mercury is not fed into the mortar boxes, while mercury riffles, and in some cases simply iron riffle tables, take the place of the usual copper plates.

Where concentration is carried on, the resulting mineral is sold to the local chlorination works. Treatment of the tailings in bulk by means of the cyanide process has, as yet, been unsuccessful, owing to their small gold contents and the unsuitable condition of the gold.

DISCUSSION.

The CHAIRMAN commented on the fact that the cyanide process could not be successfully applied to the tailings, and remarked that this was possibly due to the presence of copper pyrites, which would interfere with the economical extraction of a small quantity of gold by this process.

MR. ALFRED JAMES expressed his pleasure at hearing such a paper at one of their meetings. Although it was outside the usual type of paper read before the Society, yet it must be remembered that the subject dealt with was not nearly so foreign to the object and aims of the Society as might at first sight appear to be the case. There was, in reality, quite a considerable number of the members of the Society of Chemical Industry who were professionally employed on gold mills and reduction plant, as any member would realise if he looked through the monthly list of changes of address published in the Journal.

He had been particularly interested in hearing of the latest returns from Ballarat, as that district was scarcely regarded as an exponent of the best up-to-date milling practice. He remembered, when visiting the district some time since, remarking to a manager on the entire absence of rock breakers, automatic feeders, and other labour-saving appliances, and being met with the rejoinder that the shareholders' sons were most deserving young men, and he would back them against any rock breaker or ore feeder in existence. He noted that such a prejudice was now becoming a thing of the past, and that at the mill under review Blake-Marsden crushers were in regular use, and he expected that Fine vanners would also be adopted as soon as "the deserving young men" had become more accustomed to the machine.

With regard to the Chairman's remarks on the amount of gold still left in the tailings, he might add that this matter had been engaging the special attention of the Department of Mines of the colony, and he had received an official report on the subject. He suggested that the reason for the non-adoption of the cyanide process was the extremely low value of the tailings and the fact that the coarse crushing prevalent throughout the district did not permit the fine gold locked up in a grain of coarse sand to be sufficiently exposed to the solvent powers of the cyanide solution, but that the increased local attention now being paid to the subject might be reasonably expected to overcome this difficulty and lead to the adoption of this Glasgow process.

New York Section.

Chairman: Charles F. Chandler.

Vice-Chairman:

Committee:

M. Alsberg.

T. Lynton Briggs.

G. T. Bruckmann.

Virgil Coblenz.

H. Endemann.

W. F. Fuerst.

Jas. Hartford.

E. G. Love.

Thos. J. Parker.

Win. Jay Scheffelin.

R. C. Schupphaus.

J. H. Wainwright.

D. Wesson.

Hon. Treasurer: R. C. Woodcock.

Hon. Local Secretary:

H. Schweitzer, 77, William Street, New York, U.S.A.

Meeting held on Friday, November 20th, 1896.

MR. R. C. WOODCOCK IN THE CHAIR.

THE DEATH OF MR. A. H. MASON.

MR. WOODCOCK said that owing to the unavoidable absence of the Chairman he had somewhat suddenly been called upon to take his place, and equally suddenly had heard of the lamented death of the previous Chairman of the Section, Mr. Alfred H. Mason. He thought that a few words reviewing Mr. Mason's connection with that branch of the Society would not be amiss. They might remember that they were called together in May 1894 by Mr. McGeorge to meet at the Ashland House, when he brought forward a suggestion that, as there were so many members belonging to the Society in America, they might form an American Section. At the meeting among others was Mr. Mason, and from that moment he devoted much time and energy to the Section, and helped in every way possible. Even those who were not connected with him on the Committee could not fail to appreciate the admirable way he filled the chair, and the interest that he took in every detail connected with the subjects brought before them: but he was certain that at the Committee meetings there was no man who was more energetic, who was more willing to take on the onerous duties—and they were onerous at the commencement of this Section of the Society—before they had any regular monthly meetings at all. Mr. Mason was always the first to help; and indeed it was owing to his energy throughout that they had become the successful branch of the Society which they undoubtedly were that day. He was sure that they all felt very deeply the loss that they had sustained by his sudden death; and, furthermore, that it would be the wish of all that a resolution should be passed expressing the deep regret and sympathy that they felt for his family in their bereavement.

MR. JAS. HARTFORD said that it was with profound regret he rose to move that the Secretary be requested to write a letter to Mrs. Mason, and convey to her the sincere regrets of the Section. To him Mr. Mason was an old friend, and his death was a sudden blow. He had no idea that Mr. Mason was even seriously ill; and the Society met with a very serious loss in his death, because nobody could take a greater interest than he did in his work. At all times he had the thoughts of the Society in his mind, and he spared no time or trouble to make the meetings and every thing connected with them very successful.

DR. H. ENDEMANN seconded the resolution, which was put and carried unanimously.

THE ANALYSIS OF ASPHALT.

BY H. ENDEMANN, Ph.D.

THE greater activity existing in the cities throughout the United States with regard to asphalt paving has also been

the cause of a greater activity amongst chemists, with the object in view to aid the practical man in the selection of raw material by so-called chemical analyses. New methods of analysis have been proposed, and in addition thereto the results of such have been discussed, and even have been the foundation for theoretical speculations of more than doubtful utility. Altogether our experimental work on asphalt is not extended enough for theorising. Theorising upon insufficient knowledge can only hurt the cause of scientific investigation, for the reason that it causes prejudice. I refer here especially to such views as were expressed by Messrs. Sabin and Mabery in the Journal of the American Chemical Society for 1896, pages 279—283.

The original investigations and analyses of asphalt, which were made in the early part of this century, had shown that the bituminous part thereof consisted of two radically different substances or classes of substances: the first a volatile and distillable portion consisting of hydrocarbons, and the second a non-distillable compound containing, besides carbon and hydrogen, over 14 per cent. of oxygen.

These substances had been called by Boussingault respectively petroleum and asphaltene, the latter name being reserved for the substance containing oxygen and occurring in asphalts in largest quantity.

If we look at our modern literature on this subject, we again meet the same names "petroleum and asphaltene," but find that the separation of these substances is undertaken by new methods; and as far as the analytical results are concerned we find the ratio of petroleum to asphaltene reversed, inasmuch as the petroleum is the predominant portion. I have not been able to find any valid reason why the products of such separation should be given the names of substances analysed minutely and to a certain extent characterised and classified. The new methods referred to have either originated with Mr. Clifford Richardson, formerly in the employ of the Government at Washington and now with the Barber Asphalt Paving Co., or they have been adopted by him for his extensive investigations. They are described in Sadler's Handbook on Industrial Organic Chemistry, 1895, page 42, as also by many or most writers upon this subject in unchanged or slightly modified form (L. A. Linton), and consist mainly in a successive extraction of the material by petroleum ether and subsequently such other solvents as spirits of turpentine, chloroform, and bisulphide of carbon; the substance extracted by petroleum ether being called petroleum.

These new methods have nothing to recommend them to the chemist except ease of execution, though conscientious chemists must find it hard to account for some anomalies, of which, as far as I could see, none of the investigators and method-promoters speak.

Asphalt may be looked upon as a solution of asphaltene in petroleum. If we add to such mixture petroleum ether the petroleum proper dissolves, but with it a goodly portion of asphaltene, which is easily soluble in a concentrated solution of petroleum in petroleum ether. After allowing this first solution to run off through a filter, fresh petroleum ether is poured on the asphalt, and this treatment continued as long as the solution appears coloured. But if these fractional extracts be mixed, a precipitate invariably forms, for the reason that asphaltene is less soluble in a dilute solution of petroleum in petroleum ether. That this is really the cause of the precipitate can be verified. Treat asphalt with some petroleum ether, then filter, and add to the clear solution petroleum ether. A precipitate will form, which is brought upon a filter and tested with petroleum ether for solubility. It shows the characteristics of asphaltene. There will then be chemists who, during an analysis, will look upon this turbidity as a separation due to change of temperature or spontaneous evaporation of the volatile petroleum ether, and thus will count the precipitate with the petroleum. Others will think that the filter was at fault, allowing suspended matter to pass through, and will refilter, counting the precipitate with the asphaltene. Who shall in such cases decide in the absence of specific instructions? for the method is an arbitrary one, and instructions must be therefore more specific. The actual knowledge of the facts

stated above was the cause that I had such precipitates re-filtered and counted as asphaltene, at the peril of obtaining results differing from those obtained by others or so-called authorities.

Analyses made by others as well as myself by these methods showed so little of a relation to the usefulness or applicability of the asphalts, that for a long while I considered chemical analysis of asphalts merely as a costly toy, *i.e.*, as something entirely useless, but for which people are willing to pay.

I had to admit and do admit that the analysis as carried out by these later methods suffices to make identity or non-identity of two samples probable or highly probable; it also is adapted to watch the supply of a single mine or the refining of asphalt from the same source; but it does not admit of basing any conclusions upon the results, if we work on asphalts from different sources.

I will illustrate this by considering refined asphalts from different sources. If asphalts are refined, they are melted at a high temperature, either in order to allow of subsidence of coarser mineral impurities, or simply to obtain a more uniform product, or also to allow of the escape of the most volatile petroleums, whose presence is not useful for paving, because on exposure they will soon be lost by evaporation, and leave a more brittle compound behind. The temperature generally applied is about 450° F.

One would think, now, that the resulting asphalts, aside of the mineral constituents, should show a certain similarity, if such asphalts were analysed as are acknowledged to give satisfactory pavements after their composition is rectified in the usual manner, or that the additions could be added directly from the results of the analyses. This, however, is not so.

Three analyses of Trinidad land asphalt, Trinidad lake asphalt, and Mexican asphalts, all refined, had given on analysis by the extraction method the following results:—

	Trinidad.		Mexican.
	Land.	Lake.	
Soluble in petroleum ether, called petroleum.	24.97	31.86	87.12
Asphaltene	33.37	28.12	10.19
Insoluble and ash	41.33	40.01	2.69
Ash	34.13	30.08	0.27
Organic	7.20	6.33	2.42

If, for instance, for the manufacture of an asphalt cement from land asphalt we use for 100 of the refined asphalt 20 of residuum oil for the production of the asphalt cement used for the paving mixture, and we count the residuum oil all as petroleum, while the refined Mexican asphalt were used without any addition, the proportions of petroleum to asphaltene in these would appear as follows:—

	Trinidad Land Asphalt Cement.	Proportion.	Mexican refined.	Proportion.
Petroleum	44.97	1½	87.12	8½
Asphaltene	33.37	1	10.19	1

If we consider the composition of asphalt cement from Trinidad lake asphalt, where less residuum oil is used, we get about the same proportions as in the Trinidad land asphalt. If the analyses were correct, one would have to argue that the substances composing these asphalts must differ completely, notwithstanding the fact that in other properties there is such great resemblance. Hence, various tests were made to ascertain, if possible, properties wherein the products of one analysis differed from those of another. So it was found that the petroleum obtained by petroleum

ether, when dissolved in carbon tetrachloride, absorbed iodine. The iodine numbers were found as follows:—

	Trinidad.		Mexican.
	Land.	Lake.	
Iodine absorbed in 20 hours.	20.32	19.04	21.90

The action was in all cases accompanied by a precipitation. There was no hydroiodic acid formed, hence there was addition and not substitution.

Bromine acted alike at first, but later much hydrobromic acid was formed, showing that addition was followed by substitution. Hence there was great similarity in these products. The iodine number for asphaltene was found very much greater. To avoid coming back to this subject again, I wish to add here that the iodine numbers above given pertain to the asphaltene in the petroleum as it is obtained by petroleum ether extraction.

The question whether asphaltene is not soluble even in dilute solutions of petroleum in petroleum ether, had not been touched as yet, and, if so, how much asphaltene will go into such solution, required investigation. To get an approximate idea I took extracted petroleum obtained from refined asphalts and removed the easily volatile portion first by heating in an air-bath at 220° C. for two hours. The residue was then powdered and extracted by petroleum ether, and the residue from such extraction was weighed:—

	Grams.
Petroleum by extraction method weighed	1.916
Volatile at 220° within two hours	0.037
Residue from petroleum ether extract	0.859
In petroleum ether extract by difference	0.420

Since this latter extract is known to contain both petroleum and asphaltene, its quantity is to be divided. For want of anything better I divided it in the proportion of volatile petroleum to insoluble asphaltene obtained. Thus we find that the petroleum obtained by extraction with petroleum ether contains:—

	Per Cent.
Petroleum volatilised	33.27
Petroleum in extract calculated	9.36
Total	42.63
Asphaltene as insoluble residue	44.83
Asphaltene in extract calculated	12.54
Total	57.37

According to this, what has been called petroleum in the extraction analysis contains only about 43 per cent. petroleum proper.

The above analyses, if calculated upon this approximate determination, would become:—

	Trinidad.		Mexican.
	Lake.	Land.	
Petroleum	13.70	10.74	37.45
Asphaltene	16.28	47.70	59.85

I believe no one accustomed to the figures generally reported for these three excellent asphalts would recognise them in this shape. It should be borne in mind that these tests were all made on refined asphalts, *i.e.*, such as had been kept in the melted state for some time, whereby the more volatile substances had been lost; that, therefore, they possessed a similarity not to be expected in crude asphalts, where such an averaging as to results would certainly lead us considerably more astray than might be possible in these cases.

If we look back upon Boussingault's original investigations on the asphalt of Pechelbrunn we meet at once some

difficulty, inasmuch as his statements are not all verified by the publication. The pure bitumen of this asphalt had given on analysis—

	Per Cent.
Carbon.....	85.90
Hydrogen.....	11.25
Oxygen.....	2.85

From this he had obtained, by distillation, petroleum with—

	Per Cent.
Carbon.....	87.15
Hydrogen.....	12.28

and, after prolonged heating as residue, asphaltene with—

	Per Cent.
Carbon.....	74.23
Hydrogen.....	9.90
Oxygen.....	15.87

If the asphaltene were not the product of an oxidising process—by no means improbable,—this asphalt must contain less than 20 per cent. of asphaltene, which is in contradiction to his other statement, that asphaltene is the predominant constituent of asphalt bitumen. In the hope of understanding the questions involved better, the following experiments were made.

Mexican refined asphalt was extracted repeatedly with warm petroleum ether, the residue taken up in chloroform, and, after evaporation of the latter, dried and analysed.

0.190 so-called asphaltene gave
0.0031 ashes, hence

0.1569 organic, which yielded

0.4815 CO₂ × 0.1196 H₂O.

	Per Cent.
Carbon.....	84.20
Hydrogen.....	8.52
Oxygen.....	7.28

Examination of some of the material showed that it was not free from petroleum, giving, by further treatment with petroleum ether, solutions which left a sticky residue.

The quantity of oxygen in this asphaltene is only about half of what Boussingault gave in his publication, but the quantity of extract with petroleum ether was not so much as to make it at all possible by further extraction to enhance the quantity of oxygen to such figures as should be expected from Boussingault's statement.

There are now two possibilities: either asphaltene from Bechelbroun asphalt has a different composition from asphaltene from Mexican asphalt, or the Boussingault asphaltene is an oxidised asphaltene as nature provides it.

The first of these questions I have, so far, not been able to decide, for the reason that I have no Bechelbroun asphalt in my possession. But, comparing asphaltenes from other asphalts with the first, it might be possible to ascertain whether asphaltenes of such entirely different composition exist, and, if not, experiment might decide if asphaltene is capable of further oxidation, *i.e.*, accumulation of oxygen.

In order to ascertain similarity or dissimilarity of matter in asphalts from other sources, I analysed asphaltene obtained from refined Trinidad lake asphalt after purifying the same by repeated extraction with hot petroleum ether, dissolving it then in chloroform, filtering, and evaporating to dryness. The extraction with petroleum ether had been carried to the end in this case, *i.e.*, until but traces were taken up by petroleum ether.

The material thus obtained contained 9.27 per cent. of ashes, mainly sesquioxide of iron. This latter must have been in combination with asphaltene, from the fact that it is soluble in chloroform, 0.0884 grm. of this substance giving 0.0082 ashes gave 0.6708 water × 0.2492 CO₂.

For calculation we have to calculate from above data the actual quantity of organic substance taken. The ashes, consisting of Fe₂O₃, contain 0.0057 Fe, which will have to be subtracted from the quantity of material weighed off for analysis, while an equivalent quantity of hydrogen will have

to be added = 0.0002 grm. Thus we find that the organic matter really used for analysis weighed 0.0829 grm. We have therefore in this case—

C.....	81.97
H.....	9.49
O.....	8.54

I take occasion to here point out the fact, generally overlooked, that refined asphalts always give an asphaltene rich in mineral matter, which is soluble in chloroform and other similar solvents. In analysing refined asphalts or asphalt pavements it is therefore not safe to call the loss of a sample in weight, when it is washed with chloroform, either asphaltene or bitumen.

To get to these substances, incineration of the asphaltene thus obtained is required in order to determine the quantity of inorganic matter contained therein. While the results of elementary analyses of asphaltene make it quite probable that the quantity of oxygen contained in asphaltene is not so high as given by Boussingault, it was left for me to show yet, that asphaltene is really able to acquire more oxygen by exposure to air. The Mexican asphalt, which I had examined, was found to contain so little of impurities, that I concluded, for the purpose of obtaining further light on the question desired to elucidate, to operate directly on this.

Two portions of refined Mexican asphalt were heated in an air-bath, side by side, to a temperature ranging between 225° and 250° C. The one sample was thus heated in the open air of the bath, while the other was enclosed in a tube through which a current of carbon dioxide gas was passed.

The heating was continued for 29 hours, with intermissions to allow the weighing of the samples. In both cases the boats containing the samples lost in weight rapidly at first, then slower, and finally the boat heated in air gained in weight considerably; the surface of this lost its smooth appearance and became apparently covered with a skin similar to that observed on hot milk. The sample dried in carbonic acid gas kept its smooth surface. The following is the record:—

0.2567 heated in air to 225°—250° for 29 hours weighed 0.1987.

0.2745 heated in CO₂ to 225°—250° for 29 hours weighed 0.2018.

Heated in air, 77.3 per cent. were left.

Heated in CO₂, 73.5 per cent. were left.

In order to now ascertain whether the greater weight of sample heated in air was due to absorbed oxygen or to insufficient loss of petroleum, elementary analyses of the residuums were made:—

1. Asphalt heated in air.....	0.1987
Gave ashes.....	0.0063
Organic.....	0.1924
Per Cent.	
Gave 0.5675 CO ₂	80.44 C
0.1152 H ₂ O.....	8.35 H
	11.18 O
2.—Asphalt heated in CO ₂	0.2018
Gave ashes.....	0.0028
Organic.....	0.1990
Per Cent.	
Gave 0.6000 CO ₂	82.21 C
0.1637 H ₂ O.....	9.18 H
	8.31 O

Thus it was ascertained that asphaltene is able to take up oxygen, and it becomes now probable that what Boussingault called asphaltene, and which was obtained by him by heating asphaltic bitumen for 50 hours in air, was a substance really not pre-formed in asphalt, but produced during the process.

As a check on the above an elementary analysis of untreated, refined Mexican asphalt was made:—

0.1451 grm. of this gave

Ashes 0.0032 grm.

Leaving 0.1419 grm. organic, which yielded

0.4332 CO ₂	Per Cent. 83.26 C
0.1377 H ₂ O.....	10.78 H
	5.96 O

Mexican asphalt was found to yield (heated in CO_2)—

	Per Cent.
Petroleum	26.8
Asphaltene	73.2
100 asphaltene thus obtained contained	Per Cent.
73.2 " would contain	8.31 O
Oxygen found	6.08 O
	5.96

These 73.2 per cent. asphaltene require—

	Per Cent.
C	60.18
H	6.94
O	6.08

The whole asphalt contained—

	Per Cent.
C	83.26
H	10.78

now deducting the above from these figures leaves for petroleum—

	Proportion
C 23.08 : 12 = 1.92	1 of $\text{C}_{13}\text{H}_{18}\text{O}$
H 3.84 : 1 = 3.84	2 of $\text{C}_{13}\text{H}_{20}$

The asphaltene would be approximately $\text{C}_{13}\text{H}_{18}\text{O}$, or a multiple.

While the formula for asphaltene is verified by direct analyses, that of petroleum is deduced from a mixture, and may require verification. Petroleum also includes a series of compounds, while asphaltene appears as a single body. It differs from the substance called asphaltene by Boussingault by containing less oxygen. The largest quantity of oxygen which up to this time I had been able to accumulate in asphaltene was 11.18 per cent., as the result of 29 hours' heating in air, but without stirring or other means to aid oxidation.

The fact that air-stirred paving mixtures give with chloroform an extract which contains considerable lime, made it probable that oxidation might be accelerated by the addition of lime. In fact, I found that thus the limit of 11.18 per cent. O could be exceeded.

By heating asphalt (Mexican) in air with lime, only 19.6 per cent. could be driven off. Analysis of the resulting substance proved that it was not petroleum remaining, but oxygen absorbed by asphaltene, which had brought about this result.

It was then tried to free the lime compound from lime by boiling with hydrochloric acid for a long time, but this proved impracticable owing to the utter insolubility of the lime compound. After a day's treatment still 6 per cent. of lime remained.

Inasmuch as there was a considerable difficulty of obtaining either the free acid or even the neutral lime salt in this manner pure enough for analysis, a combustion was made of a chloroform extract, which, however, contained also some lime. Calculated for the free compound, I found C, 78.75 per cent.

Owing to the difficulties encountered in this direction, I again oxidised the Mexican asphaltene without lime, but care was taken to carry the oxidation further than done heretofore. At first the skin was removed frequently, and after all had become solid the mass was brought into a mortar and finely pulverised, then brought back into the air-bath, and this repeated until the mass even at 230° C. was perfectly dry. The substance which then remained was black, insoluble in chloroform, but soluble in soda. From the solution in soda it is precipitated by acids as a brown precipitate.

The asphaltene according to these tests has therefore disappeared, and an acid body has formed which I will call asphaltic acid, and which, as far as oxygen is concerned, resembles Boussingault's asphaltene:—

1. 0.1531 gave 0.0898 H_2O and 0.4352 CO_2
2. 0.157 gave 0.0907 H_2O and 0.4466 CO_2

this body containing therefore:—

	1.	2.	Calculated for $\text{C}_{20}\text{H}_{20}\text{O}_4$
Carbon	77.53	77.58	77.61
Hydrogen	6.51	6.41	6.46
Oxygen	15.96	16.01	15.93

The existence of this body makes the formula for asphaltene $\text{C}_{20}\text{H}_{20}\text{O}_4$ probable. According to my observations the petroleues have not shared in the reactions, but behaved like inert bodies throughout. Whether the organic substance adhering to the mineral part of many asphalts, which is insoluble in the ordinary solvents, is asphaltic acid or a salt thereof, has, so far, not yet been determined.

Great stress is laid by some writers upon the fact that, using spirits of turpentine for dissolving asphaltene, only a partial extraction of the bitumen is obtained, and that chloroform will then dissolve another part; and from this it is argued that what is called asphaltene consists really of two different substances.

If we extract petroleum with petroleum ether we obtain a dissolved mixture of petroleum and asphaltene, but the residue is by no means free from petroleum. It requires heat and many extractions to remove all the petroleum, and the analysis prescribes the use of cold petroleum ether. Hence we operate upon a mixture of petroleum and asphaltene again. Of such mixture the hot spirits of turpentine dissolve the petroleum and so much asphaltene as is soluble in a solution of petroleum in spirits of turpentine. But the solvent fails as soon as all petroleum is gone.

This is easily illustrated by extracting asphalt with hot spirits of turpentine under addition of a little petroleum. There remains under these circumstances nothing upon the filter for chloroform to dissolve.

Inasmuch as I have shown in this paper the shortcomings of the ordinary methods of analysis, I should not close it without recommendations as to a rational method of analysis based upon my investigations, though the method is really self-evident from the nature of the results obtained.

Analysis.—For refined asphalts I propose the following manipulations:—

Five grms. of refined asphalt are treated with chloroform, and the residue is collected on a weighed filter and treated in the ordinary manner, as, for instance, described by Linton. The chloroform solution is then distilled from a weighed flask, and residue in flask dried at 120° for half an hour. In order to get this residue into a flask as small as possible, it is proposed to feed the chloroform solution gradually into the flask through a stop-cock funnel while the distillation proceeds.

About 0.2 to 0.3 gm. of the residue—or more if greater accuracy is aimed at—are then brought into a porcelain boat and heated in a current of CO_2 for 12 hours at a temperature of 250° C. To aid volatilisation the asphalt should be spread over as large a surface as possible.

Loss, petroleum; residue, asphaltene and ash.

Of the latter an elementary analysis can be made, if desired.

The drying tube for the reception of the boat is closed at the end by an asbestos stopper. The narrow vertical end of tube connects with a cylinder containing liquid CO_2 . The current is regulated by means of a H_2SO_4 wash-bottle. In the case of such asphalts as contain very much mineral matter, more than 5 grms. should be taken. Crude and rich asphalts should be refined on a small scale and in strict imitation to the process as conducted on a large scale.

The loss noted during this operation should be called water and light petroleues. The residue is then analysed as above. Not less than 200 grms. should be taken for this process. If, during refining, much mineral matter should subside, the ratio thus removed should be determined by separate determinations of the mineral matter in the crude and refined, and calculated under proper considera-

tion of the concentration of the material during the process, if it be not desirable to keep up the uniformity of the mixture by stirring. The vessel for refining should be a casserole with straight, perpendicular sides, about twice as deep as wide, and should be filled to about half. The end temperature for the refining process may range from (350°—450° F.) 175° C. to 235° C., according to the application for the asphalt in view. After ascertaining loss during the process, some of the material is poured out and cooled quickly.

It appears from this investigation that asphalt is mainly asphaltene, which is a solid body, and which is softened by the presence of a lesser quality of petroleum, somewhat like turpentine, which is rosier softened by spirits of turpentine (17 to 19 per cent.). Whether asphaltic acid is present or not in natural asphalts is possible, but I look upon its presence as a deterioration, and in refined asphalt mainly due to faulty treatment.

In conclusion I will here put side by side the results of the analysis of Mexican refined asphalt by the old and by the method which I have described above:—

	Old Method.	Proposed Method.
Petroleum.....	87.12	26.51
Asphaltene.....	10.19	70.80
Inorganic.....	0.27	0.27
Organic, not bituminous.....	2.42	2.42

According to my method the ratio of petroleum to asphaltene in this asphalt is 1:2.7. The ratio in Trinidad asphalts with 60 per cent. bitumen ranges from 1:5 to 1:7. If we desire to make of our Mexican refined asphalt a hard asphalt with proportion of 1:7, we learn that we must reduce this Mexican asphalt by 16 per cent. by evaporation. On the other hand, if we desire to soften asphalts with ratio 1:5 or 1:7 to ratio 1:2.7, we know that we will have to add residuum oil in proportions of 8 to 12 for 100—60 per cent. asphalt.

In practice we use, however, more residuum oil, for the reason that these oils are not quite so heavy as the petroleums of refined asphalts, hence are more apt to disappear during the manufacture of the asphalt cement, especially if air-current stirring is resorted to. Such simple ratios, which at the same time are practically true, cannot be deduced from the old-style analysis.

It would naturally be a drawback for my proposed method of analysis if it were either difficult as to manipulation or if it would require a considerable time for execution. I take, therefore, occasion to state that the time is not more than that required for the old method, and that in fact it requires less manipulation, and certainly so as regards the amount of available information.

The examinations as to the composition of asphaltene have so far only included the Mexican asphalt and the Trinidad asphalts, and in these cases it has been found that the asphaltene in all of these was identical. Whether the asphaltene of other asphalts may have a composition different from the one here described remains to be seen. At present I am not able to make positive statement as to this. I have, however, very little doubt but that the asphaltenes will be found either identical or isomeric compounds of the one described. Boussingault's figures for his mistaken asphaltene are really nearer my own for asphaltic acid than appears on the face of the records. Even 35 years ago chemists were frequently satisfied with analyses giving the carbon $\frac{1}{2}$ per cent. less, and the hydrogen $\frac{1}{2}$ per cent. higher than calculation demanded. The analyses of Boussingault were made over 60 years ago.

I have been asked whether it would not be possible to recalculate the many analyses of especially crude asphalts made during the last years to avoid the loss of so much labour. To this I have to answer that it is not possible, for the reason that the higher petroleums, when dissolved in petroleum ether, exert a greater dissolving influence upon asphaltene than the lower.

However, as regards refined paving asphalts, an approximation is possible, and may be reached by dividing the petroleum found according to old-style analysis by $3\frac{1}{2}$. This will give us real petroleum. The difference between this figure and the original is to be added to the asphaltene.

I hereby take occasion to thank my assistant, Mr. John W. Paisley, for the help which I have derived from his industry in the course of this investigation.

DISCUSSION.

The CHAIRMAN said that very little had been written on the subject of asphalt, and the information, so far as he was aware, that had been published was very unreliable and meagre. It was particularly interesting to see the enormous change in the composition of asphalt that Dr. Endemann's method of analysis gave compared to the former ones. He hoped that Dr. Endemann would continue his investigations, and favour them with his further researches on other specimens. He remembered inquiring what became of a lot of old asphalt piled up in front of his place of business, and he was informed it was impossible to work it over again. It might have been from want of knowledge in using the stuff, and he would like to ask Dr. Endemann why it was impossible to use this asphalt over a second time after it has once been laid down.

Another interesting point was the fact that the chloroform extract should take out so much mineral matter. Most chemists would hardly be prepared to find such a great deal of mineral matter in a chloroform extract. He should be glad to hear from Dr. Endemann as to the quantity of mineral matter that he had found in it. He presumed it was in organic combination.

Dr. H. SCHWEITZER said that since acetone and ethyl ether had also been recommended for the extraction of petroleum in the old scheme of asphalt analysis, he would like to ask Dr. Endemann whether he noticed the same difficulties experienced with petroleum ether when working with these other solvents, and whether petroleum also remained undissolved and mixed with asphaltene in the insoluble residue; and further, whether he thought that the mineral matter in the chloroform solution was present in the shape of a lime salt of the substance called by him asphaltic acid.

Dr. H. ENDEMANN said in reply that there was a lime salt of asphaltic acid, but he found it to be insoluble in chloroform. He had shown that if you dissolved in these asphalts one substance, you might get a certain portion of another in a solution. While the lime salt had never been obtained in solution by itself, its solubility in chloroform was due perhaps to the presence of a certain quantity of asphaltene.

As to the re-working of the asphalt, this of course would depend entirely upon the cause of the difficulty. If the difficulty had resulted from exposing the asphalt to too high a temperature the asphalt would be lost. He did not think there would be an easy way, applicable on a manufacturing scale, of reducing the asphaltic acid again to asphaltene.

As far as the other solvents were concerned he had made no experiments, but concluded that, inasmuch as it was not claimed for these other solvents that there was any remarkable difference in the results, they probably did act in the same way. For instance, if they had said we prefer acetone or we prefer alcohol for the extraction of the petroleum, because the results would be entirely different from the others, then he thought it might be worth while to examine; but since they did not claim that the relation between petroleum and asphaltene, if separated by any modified method, produced entirely different results from those of the method here investigated, he expected that the same difficulty would exist in these proposed methods.

Dr. SCHWEITZER said that, according to Sadtler, acetone was a much better solvent than petroleum ether, and he (the speaker) came to the same conclusion from his analyses of asphalts. He once extracted the petroleum with acetone, which he had always used because it is so much easier to work with. He extracted the sample of asphalt cold and when the acetone was perfectly colourless. To see how it

would work he heated the acetone; he did not notice any further solution.

Dr. ENDEMAUN said that if the acetone extract were coloured, it was a sign that it took up brown asphaltene, because petroleums have been described by all the original investigators as light yellow oils. The best information on the original literature of asphalts was to be found in Dumas' Applied Chemistry, in the 7th volume, where elementary analyses as well as other so-called analyses were compiled. For instance, in many cases destructive distillation of asphalt, giving quantities of gas, water, oil, and coke obtained, was called an analysis. Such were many analyses met with in works written in the early part of the century. Amongst the analyses he found those of Boussingault.

Mr. F. J. SCHMIDT asked if Dr. Endemaun had any experience with so-called gilsonite.

Dr. ENDEMAUN said he had not. He intended to take other asphalts by-and-by, and test them to see how the asphaltene of those other substances compared with the asphaltene which he had been able to obtain from the Trinidad and the Mexican asphalts. He had taken the matter up only about two months before, and had not gone so very deeply into it, except as regarded those asphalts which were now on the market and generally applied for paving. For these he had elaborated his method of analysis and given his reasons for the proposed changes.

ON CRUDE AND REFINED CARBONATE OF POTASH.

By C. F. A. MUSEL.

THE U.S. Tariff Act of 1894 has on the free list a paragraph which reads and is punctuated as follows:—"Potash, crude, carbonate of, or 'black salts.' Caustic of potash, &c., &c."

The importers' claim, at the time this matter was brought to the attention of the U.S. laboratory, was that all carbonate of potash imported should be entitled to free entry under this paragraph. The examiners who handled this article claimed that certain grades of carbonate of potash were dutiable, and to support their claim forwarded to us a number of samples, with the request that we state whether, in our opinion, they were crude or refined.

Any chemist I think will recognise the difficulty which presented itself, rendered more important as several million dollars' worth of goods were involved; and it was only after the examination of a large number of samples that the idea of distinguishing between crude and refined carbonate as hereafter set forth occurred to me.

As the matter has turned out, the importers' protest was sustained by the U.S. Board of General Appraisers, thus losing interest for us; but I believe the collector has appealed from this decision, and it may be reversed by the Court.

It is my understanding that the question to be decided is the distinction between crude and refined carbonate of potash, potash, or potassium carbonate, as I believe these various terms may be used interchangeably.

In my opinion, from a chemical standpoint, it is impossible to say that because a certain sample contains a relatively high percentage of potassium carbonate it is refined, and that another sample containing a much lower percentage of potassium carbonate is for that reason crude. It is doubtless the case that any sample containing, as have the majority of samples examined by me up to date, over 90 per cent. of potassium carbonate, may very safely be termed refined or perhaps, more conservatively, partly refined.

They are not by any means chemically pure, but they certainly are not crude. Carbonate of potash, designated in chemistry by the formula K_2CO_3 plus one or more molecules of water, may be prepared in a number of different ways and from a number of different materials.

There is, I believe, but one process at the present time which is of any commercial importance or significance. In this process the potassium carbonate is prepared from potassium chloride or sulphate—enormous deposits of which exist at Stassfurt, Germany—by a process analogous in every respect to the well-known Leblanc soda process.

It will be readily seen that a number of intermediate products may be put on the market varying from the very crudest first product to the highest grade of refined carbonate of potash. It becomes almost impossible, therefore, to say what is refined carbonate of potash.

We may, however, state, I think, in a negative way, that a sample is *not crude*; as, in my opinion (from the definition of the word *crude*), any product obtained from this by any process of refining whatever is certainly partially refined.

I have made no mention of the other processes which were formerly, and may still be, used to some extent. Without entering into such processes in detail, I will say that from whatever source the potassium sulphate or chloride is obtained and whatever process is used, carbonate of lime or limestone must be employed to convert the alkaline sulphate to the corresponding alkaline carbonate.

For this reason, lime in some form is always a constituent of crude potash, and crude potash also almost invariably contains a certain percentage of caustic potash.

It is my opinion, therefore, based on these facts, that all the samples I have examined, with the exception of the few reported as crude, are *partly refined* and the majority *highly refined*, or constituting what should be justly termed refined carbonate of potash.

DISCUSSION.

The CHAIRMAN said that the words as used the Government appeared to be for the purpose of fixing whether or no there should be any duty on this material; and if such were the case he supposed the word "refined," as applied to it, did not imply any particular percentage.

Dr. SNEDECOR, head chemist of U.S. laboratories, said that the appraisers had decided that they must regard refined carbonate of potash as dutiable. The contention of the importer was that all carbonate of potash, whether refined or crude, was free under the clause of the free list, which really made no distinction. According to the wording of the paragraph it would seem that carbonate of potash, if even chemically pure, was free, but the appraisers did not take that view of the matter. It was held that refined carbonate of potash should be dutiable under a general clause. It was put under the general paragraph providing for chemical salts with a duty of 25 per cent., because it was held that it could not be placed on the free list, since the free list did not mention refined carbonate of potash; but the free list did mention carbonate of potash, black salts, and several other things. If he was correctly informed, the case had been recently decided in favour of the importers, and was now on appeal before the Courts. It was really a commercial and a legal question rather than a chemical one, and the drawing of any distinction between the crude and refined article was a difficult point. He would not be prepared to say that because carbonate of potash contained 95 per cent. of carbonate that it was necessarily a refined article. It would be impracticable to draw any line of percentage in purity. It would be a question of process of manufacture—the amount of manipulation gone through. He thought that originally crude carbonate of potash was "black salts." They were mentioned in one of the previous tariffs, were prepared mostly in Canada, and thence imported into the States. Black salts would be crude carbonate of potash. Any advance beyond that state would possibly involve more or less of a refining process. In regard to asphalt, the law permitted asphalt to be considered as crude, although it has been melted, and much of the water evaporated, and much of the foreign impurities removed. It still remained crude asphalt.

Mr. E. HARTLEY said that the legal question involved was this. There had been a provision in the tariff for a number of years for potash on the free list, which read as follows:—"Potash, crude, carbonate of, or black salts," and caustic potash; and now that was amended in the last tariff so as to include caustic potash in sticks or rolls, all placed on the same footing. The question was, What was the interpretation? If crude carbonate of potash be synonymous with black salts, why was caustic potash in the high refined condition of sticks or rolls put upon the free list? It seemed also that the manufacture from black salts into potash directly was not now a matter of much

importance. Nearly all carbonate of potash came to the States, and was made by the Leblanc process from potassium chloride. The tariff was inadequate and out of date. The only proper course to take was to place all these products that were either inferior or equivalent to caustic potash in advancement on the free list.

Mr. C. F. A. MEISEL explained that the question was at present *sub judice*, and if the Courts decided the interpretation of that paragraph unfavourably to the importers' claim, the question would arise as to the distinction between crude and refined carbonate of potash. The opinion he wished to elicit, therefore, was as to whether it would be just to term any carbonate of potash that contained lime a crude carbonate of potash. There was an easy method of determining whether carbonate of potash contained lime or not. The test was simple and quick, and a distinction could easily be drawn between the importation that contained lime and the importation which did not. If the Courts finally decided that all forms of potash were free, the question would have no significance; but should they decide that they were not all to be free, it would become of considerable importance to have some quick and simple test to determine the difference.

Dr. H. ENDEMANN thought that the mere presence of a small quantity of carbonate of lime would be of very doubtful utility in that case.

Dr. SHERER asked where in that case they would put raw sugar, which had gone through a good many processes of manufacture and yet was a crude product. Could they still regard carbonate of potash as a crude article after it had gone through certain processes of manufacture?

Dr. ENDEMANN said that raw sugar implied manufactured sugar, and the mention of raw sugar in the tariff must include the permission to use all such processes as were necessary for the separation of this sugar from the liquid or juice, without, however, any additional steps. It was possible to have a raw product yet implying manufacture. The statute could not mean that cane or saccharine juice was raw sugar.

Dr. H. SCHWEITZER understood it to be the commercial usage which settled questions of this kind. If the imported article did the work of " K_2CO_3 ," then it was refined, no matter whether it contained 20 per cent. or 95 per cent. of " K_2CO_3 ." But if it contained impurities and had to undergo some process of refining before it was applied as " K_2CO_3 ," then it would be the "crude" product whatever percentage it contained.

Mr. MEISEL stated that the great bulk of potash imported contained over 95 per cent. of potassium carbonate.

Dr. M. ALSBERG said that if any process, more than the crudest manipulation, applied to any material, raised the material from the class of crude products, black salt would be a refined product. It was manufactured from wood ashes by means of caustic lime, and underwent a thorough process of lixiviation, evaporation, and manipulation. He had bought ashes which contained a higher percentage of alkali than the carbonate would call for. In other words, the process of causticisation had gone a great deal further than intended. If any process, which was more than the crudest manipulation, applied to any material, raised the material from the class of crude products, black salts would be condemned.

Mr. E. H. GANE said that this question might best be settled from the standpoint of the retail druggist. When a salesman sent in his order to his wholesale firm, if he wanted a refined article, all products which did not answer the test of the U.S. Pharmacopoeia were considered crude products.

Mr. E. A. SCHROEDER thought that imported carbonate of potash should be considered crude so long as it required any further refining on the part of the U.S. Moist bicarbonate of sodium, manufactured by the ammonia process, was imported as a crude article, whereas the substance only required drying to refine it. He thought that whether it was a refined article or not depended entirely upon the percentage of carbonate of potash present.

Dr. ALSBERG said that under those circumstances a crude potash did not exist. It was all refined.

Mr. C. F. A. MEISEL said in reply:—Take any process of manufacture. The object was the conversion of the

material from the form in which it existed in nature to the desired form. In the manufacture of carbonate of potash, the sulphate as a first step was converted into carbonate; that carbonate was impure, from being worked with other substances. Nevertheless they had accomplished the conversion of the natural salt into the salt desired. In practice the article went through without being taken out of the furnace.

It was a continuous process, but could be divided into a number of steps, and any article after the first step in the process was at least partly refined. Perhaps the only crude potash was the first material, which does not come on the market.

Dr. H. SCHWEITZER then read his paper, "Precaution in Reducing the Tinctorial Strength of Aniline Colours," in which he reported the formation of water insoluble substances in aniline colours to which cane sugar and bisulphate of sodium had been mixed for reducing purposes. The cane sugar had been decomposed by the action of the acid salt, and insoluble carbonaceous matter had been formed.

Meeting held on Friday, October 23rd, 1896.

DR. C. T. CHANDLER IN THE CHAIR.

THE MANUFACTURE OF ALKALI BY THE AMMONIA PROCESS, AND THE ALKALI TRADE OF THE UNITED STATES.

By J. A. BRADBURN.

THE history of the ammonia-soda process is well known to all who are directly interested in the manufacture of alkali, and more or less known to those in whose business soda is used; moreover, during the last three or four years a few works have been built in the United States to work this process. There is, however, still a large quantity of alkali products imported, so that there is yet plenty of room here for the growth of the manufacture of heavy chemicals. A history of this process has been given by L. Mond (*this Journal*, 1885, 52) and by A. Scheurer-Kestner (*Ibid.*, 1887, 322). The profitability of this industry is shown by the large dividends distributed by the largest ammonia-soda concern in England, and by the largest similar concern in the United States.

The following table, supplied by the Bureau of Statistics, Washington, D.C., gives the quantities and values of alkali products imported into the United States for the years given:—

Bleaching Powder.		Sal Soda.		Soda Ash.	
Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Lbs.	Dols.	Lbs.	Dols.	Lbs.	Dols.
1885 94,698,380	1,153,337	26,039,782	203,179	260,932,988	3,065,979
1886 98,016,208	1,354,019	30,687,608	197,249	279,331,320	3,229,050
1887 103,097,817	1,554,168	25,681,496	194,597	263,274,392	2,857,930
1888 101,699,978	1,672,130	25,048,475	154,111	267,896,710	2,681,793
1889 104,152,723	1,659,472	23,703,047	147,257	286,103,275	2,752,865
1890 89,111,312	1,385,080	31,680,469	257,147	290,141,652	2,245,001
1891 111,156,006	1,481,470	28,548,379	252,051	320,009,298	1,122,700
1892 116,796,147	1,840,056	22,509,306	226,522	329,880,894	1,282,416
1893 120,786,233	2,212,606	22,777,488	238,923	388,841,970	1,890,788
1894 81,610,063	1,507,076	17,483,813	126,756	252,573,836	2,490,628
1895 100,256,774	1,644,835	28,760,028	167,267	300,599,257	2,997,169

The figures for bicarbonate of soda are not obtainable in suitable form. The quantity of soda ash (ammonia process) made at Syracuse, N.Y., since 1885, is approximately as follows:—

	Tons.		Tons.
1884, about	11,800	1890, about	67,000
1885 "	15,000	1891 "	72,500
1886 "	31,200	1892 "	81,100
1887 "	35,000	1893 "	98,000
1888 "	50,500	1894 "	105,000
1889 "	52,370	1895 "	107,000

The above represent the total soda capacity of the works. Part of the soda made is transformed into caustic soda (80 tons daily) and into bicarbonate (20 tons daily). Ammonia soda is also made by the Michigan Alkali Co., at Wyandotte, Mich., and by the Mathieson Alkali Co., at Saltville, Va.

The location for an ammonia soda works is a matter requiring careful consideration. The salt and limestone should be near at hand, on the land belonging to the works, if possible; suitable waste places should be near by to receive the lime waste, and there should be available an abundant supply of water of a low temperature for cooling purposes. To be within a reasonable distance of cities using coal-gas is also desirable, so that ammonia may be obtained at cheap rates. At the present time (1894) a good location is in the neighbourhood of Cleveland, Ohio, or near Detroit, Michigan. The works of the Michigan Alkali Co. were the first to be located in the Detroit district, the next being the works of Church and Co. at Trenton; these are being followed by the Solvay Process Co. of Syracuse, N.Y., who propose to place near Detroit a branch works.

There is an abundance of salt, limestone, and cooling water, and also room for the disposal of the lime waste, at the above places in Michigan.

In the Detroit district salt is reached at about 1,400 ft., at Cleveland it is considerably lower, about 2,200 ft. The following (from the Geological Survey of Ohio, "Economic Geology," Vols. V. and VI.) gives the record of a well drilled just outside of the city of Cleveland. The well-head is about 780 feet above tide:—

	Total Depth.	
	Ft.	Ft.
Drift, sand, clay, and gravel.....	40	40
Shale, changing colour.....	1,310	1,350
Limestone, solid.....	310	1,660
Sand, with first salt water vein.....	40	1,700
Limestone.....	290	1,990
Rock salt and shale.....	164	2,154
Shale.....	15	2,169
Limestone.....	81	2,250
Rock salt.....	50	2,300
Shale, bluish.....	40	2,340
Sand.....	10	2,350
Shale.....	18	2,368
Limestone.....	22	2,400
Rock salt.....	20	2,420
Shale.....	10	2,430
Limestone.....	40	2,470
Rock salt.....	5	2,475
Shale.....	8	2,483
Limestone.....	167	2,650
Oil sand.....	8	2,658
Limestone.....	22	2,680
Oil sand.....	6	2,686
Limestone.....	64	2,750

The 40 ft. of sand, unlike most of such entries in the drillers' record in Western Ohio, is the genuine article. The rock salt, 164 ft. in thickness, extending from 1,990 to 2,154 ft., is not a clear uninterrupted deposit, but is broken by both shales and limestone. An analysis of this seam gave the following (N. W. Lord, Chemist, Geol. Survey):—

	Per Cent.
Salt.....	71.24
Sulphuric acid.....	1.80
Lime.....	2.75
Magnesia.....	0.12
Insoluble residue.....	17.92

The bed of "shale," 15 ft., reported by the driller immediately below the rock salt, proves, on examination, to be anhydrite or sulphate of lime. The 40 ft. of bluish shale, reported from 2,300 to 2,340, is also anhydrite. The 50 ft. of rock salt directly overlying it has the following constitution (N. W. Lord):—

	Per Cent.
Salt.....	83.00
Sulphuric acid.....	0.10
Lime.....	1.68
Magnesia.....	0.15
Insoluble residue.....	13.03

The limestone, 167 ft., that extends from 2,483 to 2,650 ft., is a nearly pure dolomite.

The United Salt Co., at Cleveland, manufacture a fine grade of salt for dairy and table purposes; their wells are about 2,200 ft. deep. The limestone found in this part of the country tends in general to run into dolomite, but there is no difficulty in getting a limestone suitable for the ammonia-soda process. In the autumn of the year of the World's Fair 1893 the writer of this paper examined a number of places along the lake shore from Cleveland to Detroit, and also in Western New York, where there is also plenty of salt and limestone, for sites suitable for an ammonia-soda works.

The district around Sandusky, in Erie and Ottawa counties, Ohio, including the small peninsula named Marblehead, jutting out into Lake Erie, and a group of small islands, of which Kelley's Island is the largest on the United States side, constitutes the most important lime-producing region in Ohio. The carbonate of lime ranges from 70 per cent. to 94 per cent., the magnesia from 8 per cent. to 27 per cent., and the insoluble matters from 1 per cent. to 5 per cent. This district is about 50 miles by water west of Cleveland. Kelley's Island furnishes limestone for fluxing purposes. The average composition of limestone received by Cleveland furnaces is given as—

	Per Cent.
Carbonate of lime.....	86.10
Carbonate of magnesia.....	11.49

Prof. Lord gives the following in vol. VI., "Economic Geology of Ohio":—

KELLEY'S ISLAND QUARRIES.

	Ft.
1. Extra cap.....	4
2. Cap rock.....	9
3. Building stone courses.....	6
4. Bottom rock.....	9

Flint underlyine.

	1.	2.	3.	4.
Carbonate of lime.....	97.28	87.10	89.16	77.22
Carbonate of magnesia..	2.00	10.96	9.48	20.19
Alumina and iron oxide..	0.27	0.15	0.20	0.14
Silicious matters.....	0.85	1.49	1.05	1.65

The writer of this paper collected, three years ago several samples of stone from Marblehead. An average sample of the lot contained—

	Per Cent.
Calcium carbonate.....	82.8
Magnesium carbonate.....	12.5

There are several kilns working at Marblehead; one lime works there had 16 kilns using crude oil as fuel; this was in the autumn of 1893. In the early spring of 1895 crude oil rose to a price nearly three times what it was in 1893 and 1894. The western part of New York State is underlain with a fine bed of salt; there is also limestone here of good quality, particularly in the neighbourhood of Leroy, where lime is manufactured. There are a few places in this locality very suitable for the ammonia-soda industry; this part of the State is also intersected by several important railroads. Most of the salt manufacturing towns of Western New York are in the district drained by the Genesee River, and are mainly in the counties of Livingston, Wyoming, and Genesee. New York State produced in 1895, 6,795,000 barrels of salt, 280 lb. to the barrel. There are rock salt mines at Retsof and Livonia in Livingston county, and at Leroy in Genesee county. At Livonia the mine is about 1,100 ft. deep, and the salt 55 ft. thick. The Retsof mine is about 1,140 ft. deep. The brine wells range from about 650 ft. at Leroy in the north, in Genesee county, to 2,400 ft. at Castile, in Wyoming county south. The rock salt has a slightly greyish appearance, due to particles of carbonaceous matter. East of this district, at Watkins, in Schuyler county, and at Ithaca, in Tompkins county, salt has been discovered at 2,250 ft., and it is

claimed that the bed of salt is over 200 ft. thick. A salt works was erected on the lake shore near Watkins, in Schuyler county, in 1894.

The limestone around Leroy and a few other places in this district runs up to 98 per cent. of calcium carbonate. In the summer of 1892 the writer took a number of samples from a quarry near Leroy. An average of these gave—

	Per Cent.
Silicious and insoluble matters.....	3.72
Iron oxide and alumina.....	0.14
Magnesium carbonate.....	3.00
Calcium carbonate.....	92.55

A sample from a large stone being put into a building gave—

	Per Cent.
Silicious and insoluble matters.....	3.45
Iron oxide and alumina.....	0.70
Magnesium carbonate.....	1.86
Calcium carbonate.....	94.20

Two samples of stone from the shaft of the Lehigh Rock Salt Mining Co., about four miles south of Leroy, gave—

	Near Top of Shaft.	Half-way Down.
	Per Cent.	Per Cent.
Silicious and insoluble matters.....	3.05	26.40
Iron oxide and alumina.....	0.25	6.00
Magnesium carbonate.....	0.84	25.20
Calcium carbonate.....	95.82	42.30

At the town of Avon, in Livingston county, there is a bridge over the Genesee River; the pillars supporting the bridge are built of blocks of limestone quarried near Leroy. From the face of one of the pillars the writer chipped off about 40 pieces; an average of these gave—

	Per Cent.
Silicious and insoluble matters.....	3.85
Iron oxide and alumina.....	1.06
Manganese carbonate.....	5.72
Calcium carbonate.....	89.20

The limestone quarried in this district is, as a rule, specular, crystalline and greyish in colour. The presence of a large quantity of magnesia is readily detected, for the specular character is replaced by a dull, close, and very fine grain, and the colour is of a creamy-white shade.

The works of the largest manufacturers of soda by the ammonia process in the United States are at Syracuse, N.Y. They are situated on the south-west side of Onondaga Lake, into which the lime waste liquors from the works run. Complaints are often made about the waste lime running into the lake.

A long stretch of the lake shore is covered with the white mud. The limestone is brought to the works on a cable road from quarries belonging to the company, about three miles west of the works. Rock-salt has not been found at Syracuse; the weak brine obtained there is supposed to result from water which has percolated through saline strata south of the city. As coming from the wells at Syracuse, it contains about 18 per cent. of salt. The ammonia-soda works there were commenced in the early part of 1884, and from then up to 1889 this weak brine was used, being brought to saturation by the addition of bought salt, made by evaporating similar weak brine. During that time soda products brought higher prices than now. Then the crude bicarbonate of soda, as dug out of the filters, simply dried in a current of hot CO₂, and then ground and packed in kegs and barrels, was sold for the price of refined bicarbonate and brought between 40 and 50 dols. per ton. Since 1889 these works have had saturated, or nearly saturated, brine brought by pipe-line from a point about 20 miles south of Syracuse, where rock-salt was discovered at about 1,200 feet. This district is considerably higher above the sea level than is Syracuse. At the wells it is about 400 feet higher, and a small lake situated 3 miles

from the wells is 400 feet higher still. Advantage is taken of these differences of elevation to force the water, first down to the salt and then to the city of Syracuse, thus avoiding pumping expenses. Along the Ohio River, at places in Ohio, West Virginia, Illinois, and Kentucky, a weak brine (about 8 per cent.) is found in boring for gas and oil. An attempt has been made to start a small ammonia-soda works at Brandenburg, Ky., on the Ohio River, about 30 miles west of Louisville. The weak brine is concentrated by burning the gas obtained from the well furnishing the brine; the concentrated brine is then used in the soda works. The output of this small works at the time of a visit of the writer (in January 1895) was about 5 tons per day; the total soda output at Syracuse, N.Y., at that time was equal to 320 tons of soda ash per day, part of this, as already mentioned, being converted to caustic and to bicarbonate; the Wyandotte, Mich., works were then producing about 30 tons. The Mathieson Alkali Co. have works at Saltville, Va.; this place has good natural resources in raw materials, but it lies somewhat away from the points of consumption.

The works of the Solvay Process Co. in the United States, those of Brunner, Mond, and Co. in England, and those of Solvay and Co. on the continent of Europe are the ones producing the largest quantity of soda by the ammonia process, and are to a certain extent allied with each other; but the plant or apparatus for any particular operation is not always the same in each of the works of these companies.

Outside of the essentially chemical part of the apparatus come boilers. In the United States high-pressure water-tube boilers are extensively used.

In England, Lancashire boilers of the Galloway type are mainly used. One of these boilers in an ammonia-soda works there takes about 6½ long tons of slack per day, evaporating about 53 cb. m. of water. Liquor pumps for milk of lime, vat liquor, filter liquor, brine, &c.; these are all of the plunger type, with outside packing. In some works the liquor pumps are actuated by belt, all the pumps being worked from a special shaft and power engine placed for this purpose alone; in others, each pump has its own steam cylinder, and is worked independently. There are also vacuum pumps for filters and maintenance of vacuum on the distiller-absorber-vat system. Power engines, high speed, for running the calciners and mills. Gas producers to supply gas for a densifying furnace.

The limekilns are standing in line. Each kiln is set on four standards, so that a hand wagon can run on a track underneath; the wagon or ear is filled by turning or shaking the grate-bars; the burnt and cooled lime then falls into the wagon. The limestone is burnt with coke as fuel. The gas is taken from each kiln at a point 4 ft. from the top; the gas pipe from each kiln leads down to a common collector pipe running alongside the row of kilns and taking the gas to a washer, through which it passes before going to the compressor. The gas-washer is in some works a vessel built up of cast-iron rings. Between each ring and the one above it is fixed a plate having a central tunnel covered with a hood, filled with small holes to break up the gas into many small streams. A shallow bed of water rests on each plate, and is of a depth sufficient to just cover the small holes of the hood. (See Lunge "Sulphuric Acid and Alkali," Vol. III. (Second Edition), pp. 12 and 46.)

Each compartment of the washer has an overflow pipe which connects it with the next compartment below, so that a stream of water can enter at the top and flow through each compartment to the bottom. In place of this washer, some English works use a coke-scrubber. The gas, after being washed, passes on to the compressor, but on its way there it is mixed with richer gas coming from the calcination of the bicarbonate of soda.

The milk of lime is made in wrought-iron tanks, called dissolvers, having a coned bottom. Above the cone is a sloping grate on which the lime rests. A stirrer revolves below the grate to circulate the water among the pieces of lime. The shaft of the stirrer passes up through the grate, and is turned by suitable gear fixed above the tank. After the milk of lime has been run out, the unburnt stone on the grate is removed by opening a door placed

on the side of the tank at the bottom of the slope. The coned bottom of the tank collects the gritty matters and small pieces of unburnt stone which have fallen through the grate: these are taken out by removing a sliding cover at the bottom of the cone.

The milk of lime, on leaving the dissolver, goes through a sieve, and is then pumped to a large reservoir tank in the main building.

The compressors maintain a suction on both the kilns and on the bicarbonate calciners: the resistance to the passage of the gas through the washers should be as small as possible. Several types of the blowing engine or compressor have been used and are now being used in the ammonia-soda industry. In the matter of valves the simple thick rubber flap valve was early used and is in use still; the poppet valve Ingersoll Sergeant New York compressor has been used; the slide valve of the Bueckhardt (Switzerland) type is in use on the continent of Europe, in England, and in the United States, and very recently the Riedler gas compressor has been adopted. In England the rubber flap valve and the Bueckhardt slide valve compressors are working in the same factory, and in the United States the slide valve and the Riedler compressors are at work in the same factory.

The compressor pumps the gas against a pressure equal to about 54 ins. of mercury, consequently the compressed gas is very hot, notwithstanding the water-jacket on the gas cylinder. This pressure is about 27 lb. per square inch and the theoretical temperature at this pressure (the initial temperature being 60° F.) is several degrees above the boiling point of water, but the water-jacket on the cylinder, and further cooling in gas traps bring down the temperature of the gas entering the precipitating tower to about 30° C.

The ammonia brine as it is first made contains only 38—40 grms. of CO_2 per litre; to raise it to the 70 grms. test it is treated with gas in a separate tower before it is submitted to the precipitating operation; for this work two other compressors are required, and in addition it is necessary to have an extra compressor, standing clean and ready to start at once should any of the others break down. In place of the above compressors three single Riedler compressors, 30 ins. by 36 ins. gas cylinders, may be used, or one duplex and one single.

We have thus far considered the carbonic acid gas, its generation in the kiln, and the engine for handling it; we will now consider the liquor (brine) and note the treatment it undergoes in its passage through the works. A good brine, suitable for use in the ammonia-soda process, should contain about 300 grms. of NaCl per litre, and as little as possible of lime and magnesia. Of these, the magnesia is the more troublesome. The following may be regarded as a good and suitable brine:—

NaCl	298.00 grms. per litre.
CaSO_4	4.00 " "
CaCl_2	1.00 " "
MgCl_2	0.50 " "

In Cheshire, where most of the English ammonia-soda works are located, the brine contains, on the average, more magnesium chloride and less calcium chloride than the brines of Central and Western New York. They compare approximately as follows:—

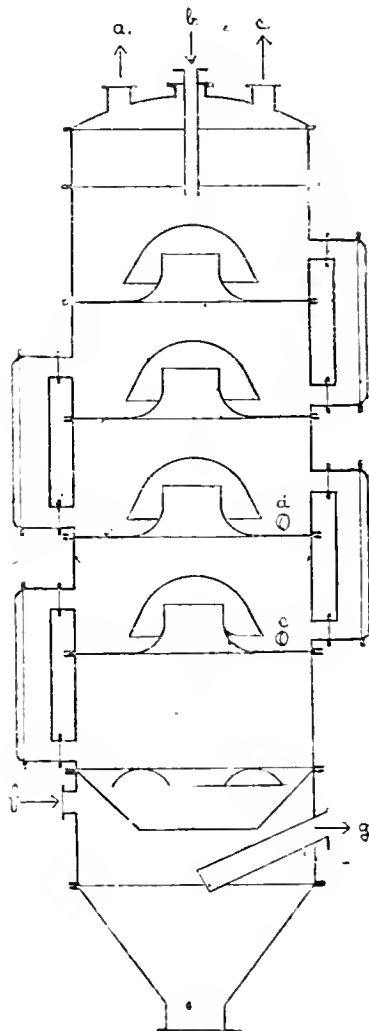
	Grms. per Litre.	
	Cheshire.	New York.
NaCl	295.00	298.00
CaSO_4	5.00	4.10
CaCl_2	0.93	2.35
MgCl_2	2.60	0.65

Many brines contain also small quantities of iron and calcium bicarbonate. Some brines obtained in Michigan contain sulphuretted hydrogen. The lime salts can be readily precipitated by ammonium carbonate, which is formed or introduced into the brine during the treatment it undergoes in the works; ammonium chloride is also formed in the brine at certain stages. This prevents the magnesia from being completely precipitated, whereas it does not

affect the precipitation of the lime. This unprecipitated magnesia separates out later, when the vat liquor is being cooled, and is apt to fill up the tubes of the cooler.

The fresh brine, on entering the works, goes into a vessel termed a tower washer—so called because in it are washed the unabsorbed gases from the towers. (See Lunge, "Sulphuric Acid and Alkali," Vol. III. (Second Edition), p. 33.) There are two tower washers, one working and the other standing clean, ready to be put into run if anything should happen to stop the first. The tower washer is built up of five cast-iron rings or cylinders. Between each pair of rings is a plate having one large central hole covered by a second plate or hood having many small holes, and having also many teeth or projections around the rim. The small holes and teeth serve to break up the gas into small bubbles as it rises through the liquor. The tower washer has thus five compartments, which are connected with each other by outside overflow

Fig 1.



ABSORBER.

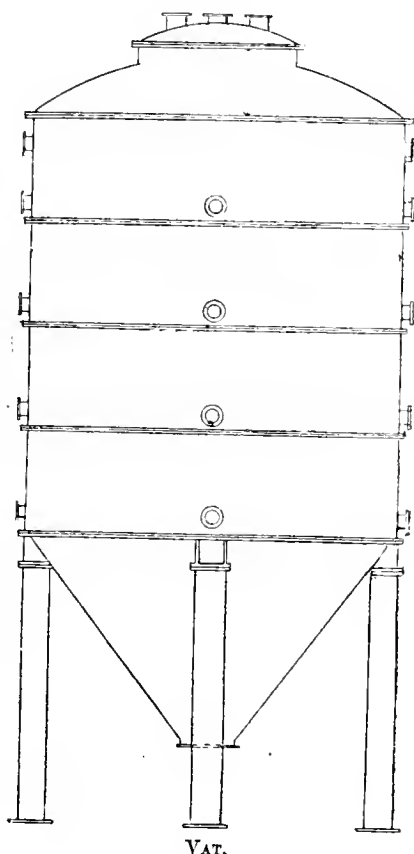
- a. Vacuum outlet.
- b. Inlet for fresh brine.
- c. Pressure outlet to tower washer.
- d. Inlet for liquor from tower washer.
- e. " cold vat liquor (for cooling).
- f. " ammonia gas.
- g. Outlet for liquor to vats.

pipes. The brine travels down from one compartment to the next below, and as the outlet of each compartment is about 15 inches above the bottom plate, there is in each a layer of brine of about this depth resting on each lower plate. Each compartment has a nozzle placed level with the lower plate, so that when desired the liquor can be run out. The idea seen in all the apparatus for treating liquids with gases or gases with liquids in the ammonia-soda process is to arrange the liquid in several superimposed layers and to cause the gas to bubble through one layer before going to the next; in this way the richest or strongest gas meets first the liquid richest or strongest in what has to be taken from the gas passing through it. The fresh unused liquid is thus kept at the top of the vessel, to wash out or absorb what has escaped the lower layers, owing to these being more or less saturated with the substance it is desired to wash out or absorb. This idea or principle is what forms the distinguishing feature of the old Coffey's still, and the apparatus of Adam, for distilling alcoholic liquors.

In the tower washer the lime is more or less precipitated from the brine by the ammonia and ammonium carbonate carried in by the unabsorbed gases from the towers, but the precipitate remains in the liquor, and goes with it until it reaches the vats, where the precipitate is settled out. The waste tower-gas, after passing through the tower washer, goes into the atmosphere. The liquor leaving the bottom of the tower washer now goes to the absorber.

The absorber is a vessel of cast-iron rings formed into compartments like the tower washer. (See Fig. 1.) The gases drawn off by the vacuum pump are sent to a small scrubber, down which runs the raw brine just coming to the works, or, in place of this, to a small washer supplied with water, which, when strong enough, is sent along with other liquor to a distiller. The compartments of the absorber are provided with large manholes, and the overflow pipes have swinging covers to facilitate cleaning.

Fig. 2.



The fresh brine enters at the top to act as a scrubbing liquid. The curves of the plates and hoods in the absorber are reproductions of those in the distiller—a vessel to be described later.

The ammoniated brine, is run out continuously from near the bottom, going to a series of three or more vats, where it is settled and stored. The settling is necessary in order to get rid of the precipitated lime and magnesia of the brine, and thus prevent these from getting into the soda ash. If unsettled liquor is sent to the tower where the bicarbonate of soda is formed, the sediment is collected along with the bicarbonate, and on calcining the latter we get an ash containing lime and traces of iron, this last giving to the ash a yellowish tint. A small quantity of ammonium sulphide helps to prevent the liquor from taking up iron from the sides of the vessels and pipes.

The vats are built up of four cast-iron rings. Each vat rests on four iron pipe pillars taking hold of the vat at the top of the cone. Each of the four rings forming the body of the vat is provided with nozzles for pipe connections; and I may say here that all the vessels and apparatus used in the ammonia-soda process should be well provided with facilities for making connections with each other. Another point that is apt to be overlooked is that a gas or vapour is a material substance, and therefore requires room or space for its existence. The increased production of ammonia-process soda in Europe, England, and the United States during the last few years has been largely attained by a recognition of the above, the openings and passages in the several apparatus having been made larger, the apparatus otherwise being of about the same dimensions as before, thus enabling larger volumes of gas and liquor to pass through in a given time. The mud of carbonates of lime and magnesia settled in the cones of the vats is drawn out in charges every two or three hours, and treated to obtain the ammonia. In a large works in England the mud is sent to the distiller, whereas in a works at Syracuse, N.Y., the mud was drawn into a closed tank provided with a stirrer, raw brine was then run in, and the whole well mixed. After settling again, the clear liquor was run out to go to the absorber, and the operation repeated until the mud was free from ammonia. The method by distillation, however, is more direct, and altogether the handiest way of dealing with it. The absorber vats and distiller are the vessels included in a vacuum circuit, the object being to facilitate the working of the distiller. The atmosphere above the liquor in the vats is of course saturated with ammonia, and in the emptying and filling of the vats is alternately drawn in and driven out, but the tops of the vats being connected with the absorber, this ammonia is all retained. In place of this absorber two separate vessels have been used; these were simple wrought-iron tanks, having no internal hoods nor plates, the liquor in each being one undivided mass. One tank was called the absorber and the other the vat washer; they were placed so that liquor from the tower washer could flow naturally into the vat washer, and from this to the absorber, and from here to the vats. The ammonia gas from the distiller passed down a pipe to the bottom of the absorber, bubbled up through the mass of liquor, then up through the vat washer, and then passed into the tower washer. It will be seen that the present absorber is a combination of the old vat washer and old absorber, but whereas these were simple tanks, the present absorber has a number of compartments. Mr. H. Schreih has described an absorber similar to this some years ago. See the *Chemiker Zeitung*, 1890, page 490.

We now come to the tower where the settled vat liquor is treated with carbonic acid gas. The tower and the distiller constitute a sort of dual backbone around which the other apparatus clings. The tower is built up of cast-iron rings and plates. The tower plates are composite or double plates, that is, each bottom plate and its cover or perforated plate form one casting. The cooling of the liquor in the tower has for a long time been effected by trickling water down the outside of the tower; but some works use cooling pipes and tubes running into and through the tower, seeking to cool the tower liquor by a more efficient way than by outside cooling (see the *Chemical News*, Oct. 25th, 1878, and this *Journal*, 1882, p. 110).

of lime and iron, but when the total matters insoluble in water are over 0.5 per cent. of the soda ash, we know that the vat-liquor was not settled well enough. Other devices have been and are being tried to provide continuous and more or less automatic filtering. Some 16 years ago there was in a salt works at Northwich, England, a small experimental plant for making salt. The apparatus consisted essentially of an iron cylinder closed at the ends, having hollow trunnions and heated by steam inside. The cylinder revolved in a tank of brine, so that the lower part dipped in the brine, and thus accumulated a layer of salt on the outside, and a fixed scraper, against which the cylinder came, took off the salt. The idea running through the above has been embodied in a filter which is being tried in several ammonia-soda works. A cylinder closed

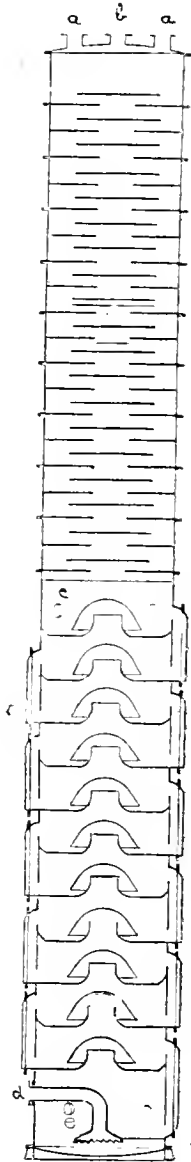
at both ends, having its shell formed as a grid or grating covered with filter cloth, forms the filter bed; it revolved in a tank containing tower liquor, dipping into the liquor at its lower part. A vacuum is maintained inside the cylinder by a connection through the axis, and a suction pipe dipping down to near the bottom takes away the clear filtered liquor. In this way a thin layer of bicarbonate is taken up on the outside of the cylinder, is washed and dried, and taken off as in the experimental salt plant. Centrifugal machines have also of late years been again brought into use. These will turn out bicarbonate containing only 10 per cent. and less of moisture, against 24 per cent. to 25 per cent. from the filters; but against the drier bicarbonate got from their use we have a greater expense in keeping them in running order and a rather large labour account.

The filter liquor reservoirs, where the clear liquor and washings from the filters are collected, are either large cisterns built of stone and brick in the ground, or ordinary iron tanks resting on the ground floor. The former method is in use in the United States and the latter in England. In these reservoirs are put other strong ammonia liquors, such as concentrated gas water, testing about 16 per cent. of NH_3 . This strong ammonia liquor is bought to supply the working loss of ammonia, and is stored in separate special tanks, a certain quantity being drawn therefrom and put into the filter liquor reservoirs as required. The working loss of ammonia runs from $\frac{1}{2}$ per cent. to 2 per cent. of ammonium sulphate on the soda ash made. The underground reservoirs, built of stone or brick, are lined inside with Portland cement, and covered with brick arches resting on I beams. There are other such cisterns for holding other ammonia liquors. The filter liquor reservoirs above ground are ordinary wrought-iron covered tanks holding about 40 M.

All liquor coming from the filter liquor reservoirs is called filter liquor, no matter where it originally came from. For good distillation, this liquor ought to be kept regular in test.

We now come to the distiller, in which the filter liquor is treated, to obtain again, in an active form, the ammonia which has enabled us to convert common salt into bicarbonate of soda, and has itself become ammonium chloride. Filter liquor contains, beside ammonium chloride, the excess of ammonium carbonates, the filter washings, more or less concentrated ammonia gas water, a small quantity of ammonium sulphate, and all the common salt which has not been converted into soda. In some works it also contains a strong liquor resulting from cooling the ammonia gas coming from the distiller. About 18 years ago stills were used in the ammonia-soda process to work up the filter liquor. A charge of liquor was run into a still, then a charge of lime, and when the ammonia was boiled off, the waste liquor was run out and another charge treated in the same way. They were used in sets of four, three working and one empty, the steam and ammonia of one passing through the other two and then up a heater-tower to heat the incoming liquor; but now, with the distiller, the operation goes on continuously, filter liquor and milk of lime going in, ammonia gas coming from the top, and waste liquor from the bottom. The distiller is a tall vessel; the lower half is built up of wrought-iron plates, divided into 12 compartments by means of horizontal cast-iron plates, each having a large central hole or tunnel covered by a hood of umbrella shape; the upper half is built up of cast-iron rings, also divided into compartments by cast-iron plates, which act as dash-plates to break up the liquor in its descent. The upper half is called the heater; its function is to heat the filter liquor, and so drive off the ammonium carbonates before it reaches the lower half, where it meets the milk of lime, which is pumped into the top wrought-iron compartment. On meeting the milk of lime, the fixed ammonia salts are decomposed and the ammonia set free. During the course of the liquor down the remaining compartments the ammonia is driven out by steam forced in at the bottom compartment. The ammonia gas coming from the top of the distiller has a temperature of about 80° to 85° C. This is too hot to allow it to go to the absorber direct; moreover, it contains a quantity of steam which would dilute the brine. It is therefore first passed through a condenser, where it is cooled. This

Fig. 3.

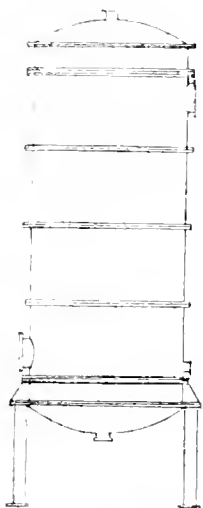


DISTILLER.

- a. Gas outlet. b. Liquor inlet.
c. Milk of lime inlet. d. Steam inlet.
e. Waste liquor outlet.

strong liquor in some works goes down to the filter liquor reservoirs. In some works this condensate is run back into the heater at a point about half-way down the heater.

Fig. 4.



COOLER OR CONDENSER.

The distiller condenser is a vessel built up of cast-iron rings; through these are placed about 150 tubes; a water chamber is fitted at the top and bottom. The cooling water enters at the bottom, rises up through the tubes, and flows away at the top. The distiller will run from 30 to 70 days, depending on the quality of the lime used. The heater part is seldom cleaned, as no lime goes into it except what may splash into it from the upper wrought-iron compartment, and there is very little deposit from the filter liquor itself; but the lower half is cleaned about as often as stated.

The scale formed in the lower half is sometimes 3 ins. thick; in the upper wrought-iron compartments the scale is soft and contains much calcium carbonate, while in the lower ones it is hard and is mostly calcium sulphate; this sulphuric acid comes from the calcium sulphate originally in the brine. The distiller is cleaned by chipping off the scale; one or, where required, two men go into each compartment and take off the scale with chipping hammers. The scale in a distiller has been softened and more or less removed by boiling or distilling in it ammonia liquors without using lime. From one or more of a number of possible causes, it sometimes happens that the liquor arriving at the bottom of the distiller is not "sweet," that is, not free from ammonia. If this arises from a deficiency of lime, a quantity of milk of lime is allowed to go into the bottom compartment (this compartment has a branch from the lime pipe), the exit liquor pipe from the distiller is closed, and an attempt is made to work off the ammonia before this compartment, which is purposely made larger than the others, can fill up. If this cannot be done, and the quantity of ammonia present is small, it is better to let it go than to deal further with it; but if the liquor is strong, and the trouble is only a strong spot, as it were, in the line of liquor travelling down the distiller, the liquor can be run from the lower compartment into a spare tank and worked up afterwards. Of course, a distiller will get strong, even with plenty of lime present, if the supply of steam becomes lessened. Anything more than a temporary irregularity has to be dealt with according to the trouble existing.

Beside the distillation of filter liquor as just described there is a miscellaneous liquor called "weak liquor." This is mainly composed of the liquor got by condensing, scrubbing, or washing the gas coming from the calcination of the bicarbonate, and the leakages and drippings from strong liquor tanks. This liquor is worked up without lime

in a small special distiller. The condensate from the bicarbonate calcination contains a little soda, and this decomposes any fixed ammonia salts which may get into the liquor. The weak liquor distiller will work up also the weak ammonia water from gasworks, containing about 2 to 3 per cent. of ammonia. The ammonia-gas from the weak liquor distiller is either made to follow the same path as the ammonia from the large distiller, or it is condensed to a strong liquor, and this run into the filter liquor reservoirs, so that it ultimately goes into the absorber, whichever way is adopted.

The liquor and lime going to a distiller are so adjusted that the exit liquor shall have a small excess of lime. The waste liquor is a solution of calcium chloride and sodium chloride mainly; it contains also the excess of caustic lime, calcium carbonate (representing both unburnt stone and any CO_2 not driven off in the heater), calcium sulphate (representing that contained in the lime and the sulphate in the brine), and the miscellaneous impurities of the limestone.

The waste liquor varies considerably in composition even in the same works, and necessarily does so in liquors from works in different localities using different qualities of limestone.

Efforts are made in some works to settle the waste liquor and return the lime mud to be mixed with fresh milk of lime going to the distillers; particularly is this the case in England, where the limestone used (Buxton) contains less impurities than the limestone of Central New York. Where the lime mud is used over again, a milk of lime testing about 280 grms. CaO per litre is reduced by the admixture to about 180. The waste liquor is run on to waste land, and if objections are raised against it finding its own way to rivers or watercourses, large shallow ponds are made by making banks with the settled mud to inclose the liquor, the ponds being made of such a size that the liquor run in at one end will run out at the other end nearly clear or free from sediment.

We have now followed the brine along all its course through the works.

Stock of Ammonia.—This is expressed in kilos. of ammonium sulphate. Per ton of ash made per day there should be provided ammonia equal to 2,000 kilos. of ammonium sulphate; of this about 1,250 kilos. are in use in the working liquors, while 750 are in the form of reserve liquor, consisting usually of ammonia water from gasworks concentrated until it contains about 16 per cent. of NH_3 .

We will now return to the washed bicarbonate left in the filters. It is dug out with shovels and sent to the calciners. The apparatus for drying and calcining the damp bicarbonate into finished ash is not the same even in affiliated works. The largest ammonia-soda works in the United States follows the lead of the Solvay ammonia-soda works on the continent of Europe, whereas the largest of the English works, although affiliated with these, uses different apparatus, conducts its own experimental work in regard thereto, and generally carries on the manufacture after its own methods. The old Solvay calciner (see U.S. Pat. No. 136,463, March 4, 1873), shaped like a saucer, is in use in the United States; it is being replaced as circumstances permit by the calciner described in U.S. Pat. No. 386,664, July 24, 1888. This last, however, as used is a cast-iron cylinder about 60 ft. long by about 5 ft. in diameter; it is supported at the ends and at the middle on roller bearings, and revolved by gear fixed at the middle. A furnace chamber is built around each half of the calciner, the two chambers being connected by underground flues. The middle roller bearings and gear are thus situated between the two furnace chambers; the fire gases pass through the whole length, heating the shell of the calciner on the outside. Producer gas is used as fuel. Provision is made in the bearings of the calciner at one end for the expansion or extension of the shell by the heat. A heavy chain lying along the length of the cylinder propels the ash forward as the calciner revolves. The old Solvay calciner has not been used in England for many years; there the Thelen machine calciner is mainly used. A description of the original Thelen dryer can be found in German in *Die Chemische Industrie*, 1878, page 7. For drying

ammonia-process bicarbonate it is built of cast-iron half-cylinders, bolted together; a shaft having a number of arms fixed along its length, fitted with propelling blades, is fixed longitudinally through the pan and given a rocking motion of a quarter of a revolution by a worm and wheel. The pan rests on brick walls and is heated underneath by gas or coal fires. Both in the new Solvay calciner and in the Thelen machine the bicarbonate is fed in at the fire end and is received at the back end into a conveyor, from which it is taken by an elevator to a cooling conveyor placed near the roof. This cooling conveyor is a revolving shell, having an inside screw fastened on the shell; this method avoids having a shaft turning in the hot ash and so avoids dust; it also has greater cooling surface than the ordinary conveyor. When cooled, it goes to the milling and packing plant. Only a small proportion of the ash from these calciners need go through the mill, because it is not so lumpy as heavy fired, that is direct fired ash. By referring to the analysis of the bicarbonate it will be seen that there is considerable water and ammonia, and also, of course, carbonic acid gas, coming from the operation of drying and calcining this. These gases leave the calciners at a point near the charging hole at the fire end, and are either passed at once through a condenser (similar to the distiller gas condenser) standing near the calciner, each calciner having a condenser; or a number of calciners have their gas pipes arranged to lead into a common trunk pipe, which carries all the gases and vapours to a series of three or four condensers. In the condensers the steam and most of the ammonia are removed. The gas, CO_2 , with a little ammonia, pass through a washer similar to the kiln gas washer, or, in place of this, up a coke tower, in which the remaining ammonia is taken out. The carbonic acid gas then passes to the kiln gas pipe, where, the two, mixing go to the compressor as has been described. The condensed steam and the water of the washer go to the weak-liquor distiller. The gas contains about 60 to 80 per cent. CO_2 , depending on the care exercised in preventing air being drawn into the calciner. Soda ash, made in vessels heated on the outside, as in the above calciners, is light-weight ash. This ash, if packed and shaken into a glass jar holding 1,000 c.c., will have a weight of 900 to 1,000 grms. for this volume, whereas this ash, when subjected to fire playing direct upon it until near the point of fusion, cooled, and ground to the same condition as the other, will weigh 1,350 grms. for 1,000 c.c. For densifying ash a Maetear or similar furnace is employed.

When densified ash is wanted the calcination in the Thelen or other calciner need not be pushed so far as to fully convert the NaHCO_3 into Na_2CO_3 , because this will be completed by the further heating in the Maetear.

Soda ash made in England for the American trade is almost entirely dense ash, and is packed in casks holding about 15 long cwt. Soda ash made in the United States is mostly light ash, and is packed in barrels holding about one-fifth of the above; it is also packed and sold in bags. All the above refers to full-test 58 per cent. ash; when 48 per cent. is wanted either common salt or salt cake, or both, is added in sufficient quantity to reduce the test. Caustic ash is made by adding strong caustic liquor to ordinary 58 per cent. ash, or to 48 per cent. ash and calcining again. These 48 per cent. and caustic ashes are really imitation Leblanc ashes. The following figures show the chief constituents of full-test, 58 per cent., and the two kinds of 48 per cent. :—

	58 per Cent.	48 per Cent.	48 per Cent.
Na_2CO_3	98.00	81.10	81.10
NaCl	1.20	17.60	12.86
Na_2SO_4	0.12	0.20	5.12
Impurities	0.10	0.12	0.75

The impurities are chiefly calcium carbonate, magnesium carbonate, and iron oxide. These are kept out of the 58 per cent. by good setting of vat liquor; the larger quantity in the 48 per cent. ash arises from the impure salt and salt-cake.

The market price of soda ash in the United States and in the United Kingdom is based on a supposition that the ash quoted is 48 per cent. This is a relief of the trade in the old Leblanc days. When New York or Boston papers quote ammonia alkali 58 per cent., 95 c. and 1.00 dol., this means (taking, for example, the first mentioned price) that the real price is $\frac{95 \text{ c.} \times 58}{48}$ per 100 lb., that is, 1.14 dols. for 100 lb. of 58 per cent.

The United States stands at the front in the manufacture of iron and of mechanical appliances, and holds an eminent position in textile industries, but in the alkali trade there is ample room for growth, which ought to be stimulated by the possession of first-class raw materials, and a home market calling every year for large imports.

OPENING OF THE DAVY-FARADAY LABORATORY.

WE are indebted to the *Pharmaceutical Journal* for the following account of the formal opening of the new Davy-Faraday Laboratory of the Royal Institution, by H.R.H. the Prince of Wales, which took place in the lecture theatre of the Royal Institution on Tuesday afternoon, Dec. 22.

Dr. Ludwig Mond commenced the proceedings by reminding the Chairman that under the auspices of his august father, whose enlightened mind had fully realised that the pursuit of pure science is the most potent factor in the promotion of the intellectual and material progress of nations or of humanity at large, a movement was set on foot fifty years ago to found an institute in connection with the Royal Institution for the pursuit of pure chemistry. It was intended that the proposed institute should not only give practical and systematic instruction to students, but also provide a place where research work could be conducted by fully qualified investigators. This project was approved by Faraday and Brande, the then professors, but the idea had to be abandoned because sufficient accommodation could not be found within the precincts of the Royal Institution. The first part of the scheme, however, was carried out a few years later by the foundation of the Royal College of Chemistry. The second part, that of providing a place where original work could be carried on by a number of independent investigators, has been waiting until now for its realisation. On learning these facts the speaker determined to found in London a Research Laboratory in purely scientific chemistry and in physical chemistry, that borderland between chemistry and physics from which in his opinion we may hope to learn more about the real nature of things than from any other branch of natural science. He had also come to the conclusion that such a laboratory would derive the greatest advantage if it could be associated with the Royal Institution of Great Britain, which has during its long existence made the promotion of research in those sciences one of its main objects, and the laboratories of which have been productive and are still productive of such marvellous results at the hands of the eminent professors elected by the Institution. The commodious house immediately adjoining the Royal Institution was therefore acquired, and a scheme submitted to the managers, which they readily accepted with unanimity. Work was immediately commenced to alter the building so as to make it suitable for its new purpose, and, thanks to the advice which has been freely extended by scientific men all over the world, and the active co-operation of Lord Rayleigh and Prof. Dewar, Mr. Flockhart, the architect, and Mr. Robert Mond, to whom has been left the selection of the apparatus and the equipment of the place generally, the laboratory which His Royal Highness was asked to inaugurate would stand favourable comparison with any other laboratory in or out of England as to the completeness and convenience of its appliances. It is provided with the best instruments made at the present day, and is unique of its kind, being the only public laboratory in the world solely devoted to research in pure science. In order to ensure its continued usefulness, the Laboratory has been endowed so as to cover the cost of maintenance of the fabric and all necessary current expenses, and it has been named the Davy-Faraday Research Laboratory, in perpetual

memory of those two great pioneers of science. Lord Rayleigh and Prof. Dewar have consented to undertake the duties of directors of the Laboratory without emolument, and an experienced superintendent has been appointed in the person of Dr. Scott, nothing being now wanting for its success but a number of investigators, competent and ardent, to continue the great work of this century, the unravelling of the secrets of Nature. As soon as His Royal Highness declared the building open, persons of either sex or any nationality would be welcome within its walls if they could satisfy the Laboratory Committee that they were fully qualified to undertake scientific research in pure and physical chemistry, preference being naturally given to those who have already published original work. In establishing the Davy-Faraday Laboratory, the speaker had, at the same time, been able to enlarge the old laboratories of the Royal Institution, and also to make additions to its library and reception rooms, which he hoped would prove a convenience to its members.

The Prince of Wales then replied, saying it afforded him much satisfaction to assist at the opening of the beautifully arranged and well equipped Research Laboratory which this country owes to Dr. Mond's generosity, and he congratulated the members of the Royal Institution of Great Britain upon this most important accession to its resources. The Royal Institution has always enjoyed a world-wide reputation, thanks to the marvellous work of the succession of illustrious men whose researches have very largely contributed to secure and maintain for this country a foremost position in science and its applications. The identification of the Laboratory with the names of two of the most eminent former Professors of the Royal Institution, Sir Humphry Davy and Michael Faraday, was a graceful act on the part of Dr. Mond; and most gratifying evidence of the great faith entertained by Lord Rayleigh and Prof. Dewar of the benefit to the promotion of science which this wisely applied munificence is destined to realise, was afforded by the fact that they have undertaken the important duties of directors of the new Laboratory without any remuneration.

THE "WILLIAM GOSSAGE" LABORATORIES, UNIVERSITY COLLEGE, LIVERPOOL.

On December 12th the new chemical laboratories of the Liverpool University College were opened by the Earl of Derby, when an address was delivered by Prof. W. Ramsay.

The first portions of the chemical laboratories of the College, which were completed in 1886, have for the past three years been insufficient for the increasing number of students and especially for the development of the more advanced work required. A large laboratory for senior students and additions to the research laboratory were especially necessary—a want which has now been fulfilled chiefly by the liberality of Mr. F. H. Gossage and Mr. T. Sutton Timmis. Some time ago these gentlemen undertook to build and fit up a farther section of the building, including the largest of the main laboratories and other rooms, at a cost of 7,000*l.* These laboratories they have presented to the College as a memorial of the late Mr. William Gossage.

Other portions of the buildings have been erected by subscription, amongst the donors being Sir John T. Brunner, M.P., 1,000*l.*; Mr. E. K. Muspratt, 1,000*l.*; and Messrs. Lever Brothers, 1,000*l.* The new buildings complete the Brownlow Street frontage, and include a large laboratory 60 ft. by 32 ft., with benches fitted up for 44 advanced students, an adjacent room provided with a new form of heated sand-bath and other appliances for the service of the main laboratory, and, in the basement, an additional lecture room to seat 70 or 80, a preparation room, and a gas-analysis room. These five rooms, which are lined with ivory-glazed bricks, constitute the "William Gossage" laboratories. The other new buildings are a metallurgical laboratory with furnaces and other equipment, an addition to the research laboratory, a store for apparatus and chemicals, a dynamo room, electric accumulator room, and a heating chamber. In his address Prof. Ramsay contrasted the opportunities of studying chemistry to-day and in Faraday's time, rather regretting that students now have only to go to the apparatus shop round the corner for

what they want. It would be better for them, he said, if they had to rough it a bit, for as an engineer should be able to make his own tools, so should a chemist. Starting from crude material, he should be able to produce pure chemicals; starting with glass tubes, he should be able to extemporise a blow-pipe, and make the most complicated apparatus. He should be a reasonably good gasfitter and turner; he should be able to solder a joint, and he should be able to turn to account nearly every apparently useless article.

Prof. Campbell Browne reviewed the development of the chemical department of the College, and pointed out the suitability of associating the gift with the name of William Gossage, whose career as a chemist and as an inventor he sketched.

The Earl of Derby afterwards spoke; then Mr. Sutton Timmis (on behalf of Mr. F. H. Gossage, who was unfortunately prevented by illness from being present) presented the Earl with a silver casket containing the key of the building. Lord Derby, followed by the rest of the assembly, then proceeded to the laboratory, unlocked the door, and formally took possession of the building on behalf of University College.

OPENING OF NEW LABORATORIES AT PERTH.

On December 24th Sir Robert Pullar opened the new laboratories at Sharp's Institution, Perth, which have cost over 6,000*l.* The extensions, which were designed by Mr. Murray Robertson, of Dundee, comprise new chemical and physical departments, and a re-arranged art department. The chemical laboratory affords bench accommodation for 30 students, and the lecture-room will seat 40. The physical laboratory can accommodate 24 students working at a time. To this a dark room for galvanometric and photometric work is attached. The whole is well furnished with modern apparatus.

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I.—PLANT, APPARATUS, AND MACHINERY.

Refrigerating Apparatus (for Liquefying Air and Separating Gaseous Mixtures). C. Linde. The Engineer, 1896, Nov. 13 and Nov. 20, 485—486 and 509.

AFTER a discussion of critical temperatures (containing a useful table and diagram), the author gives an account of previous methods and apparatus for liquefying gases. All

* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to Sir Henry Reader Luck, Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

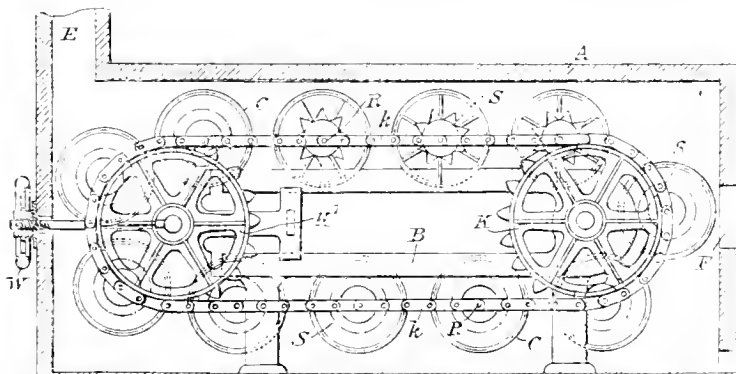
mechanical processes for reducing temperature are based upon the expenditure of "internal" or "external" work. Refrigerating machines are often classified as "evaporative machines" and "cold air machines." In the former it is mainly the equivalent of the internal work—latent heat—that is abstracted; in the latter it is mainly the equivalent of the external work. The action of Linde's machine consists in eliminating heat from the gas to be liquefied, exclusively by expenditure of internal work until reduction below the critical point and condensation have been effected. In the liquefaction of air, its constituents (considering nitrogen and oxygen only) pass simultaneously into the liquid state, although the boiling point of nitrogen is not inconsiderably below that of oxygen. On the other hand, in subsequent evaporation the more volatile nitrogen separates first. A "separator" is described by which more or less pure oxygen is obtained by the liquefaction and evaporation of air.

The first successful experiments with Linde's refrigerator were made in May 1895, using the compressor of a carbonic acid cold-vapour engine as an air compressor. After equilibrium was established, about 3 litres of liquid air were obtained per hour. The liquid was of bluish colour, perfectly clear, and it contained 70 per cent. of oxygen. With a Whitehead compressor and improved apparatus the period of temperature decrease was reduced 15 to 5 hours, whilst in a third series of experiments with a Brotherhood compressor it was reduced to 2 hours. 0.9 litre of liquid air was produced per hour, and was found to contain about 40 per cent. of oxygen.—D. E. J.

PATENTS.

Material for Filtering Water, Sewage Effluents, Saccharine Juices, Alcoholic Liquors, Illuminating Gas, and other Liquids and Fluids, and for Use in the Manufacture of Steel: Impts. in and connected with the Manufacture of. G. MacDonald, London. Eng. Pat. 19,352, Oct. 23, 1895.

A porous magnetic oxide of iron is made by heating iron ore, pyrites, waste from aniline works, &c., in small lumps, and in presence of vapours of cheap hydrocarbon oil, until the material is freely attracted by a magnet. By continuing the reduction beyond this state, a magnetic carbide is formed useful for steel-making as well as for filtering. The inventor calls this "steel oxide."—L. A.



opening E, through which the material, in the form of a syrup, or in a semi-fluid condition, is introduced for the purpose of being dried, and a second opening F, through which hot air is introduced by a fan. The material to be dried is fed on to the outer surface of the cylinders C, to which it adheres, and when dry, falls on to the floor of the chamber A, whence it can be removed by suitable means.

—R. B. P.

Separating [by Filtration] Insoluble Substances from Liquids, Impts. in the Method of and Apparatus for. W. E. Heys, Manchester. From J. Hundhausen, Hamm, Westphalia. Eng. Pat. 22,920, Nov. 30, 1895.

This apparatus consists of a flat tank provided with a perforated false bottom, over which a band of filtering

Air-Pump [Torricellian], An Improved, especially useful for Exhausting or Diminishing the Pressure in Vacuum-Pans, Stills, and other Vessels. J. A. Wanklyn and W. J. Cooper, New Malden, Surrey. Eng. Pat. 20,658, Nov. 1, 1895.

An upright cylinder is provided in its upper portion with, first, a comparatively wide aperture, surmounted by a funnel-shaped reservoir containing water, glycerin, oil, mercury, &c., and having a stopper; and second, with a narrow pipe having two branches, each provided with a good stopcock, one leading to the vacuum-pan or still, the other being an air-vent. Below, the cylinder is provided with an outlet, also having a stopcock. In use, the stopcocks on the outlet and tube leading to the vacuum-pan are closed: the others are open. The cylinder then fills with liquid from the reservoir, the air escaping through the vent. On reversing the valves, the liquid flows away from the cylinder, thereby creating a vacuum, by means of which the still becomes exhausted.—R. S.

Preparing Solutions of Definite Strengths, Apparatus for. R. P. Roberts, Camberwell, London. Eng. Pat. 22,470, Nov. 25, 1895.

A vessel, as a bottle, has marked thereon a scale or scales graduated, by trial, according to the increased bulk of the liquid due to the added solid, the zero of the scale being a measure of the liquid, and the graduations thereof indicating the levels to which the liquid will rise for each addition of solid, so as to make a solution of any definite strength. The invention is described in connection with making up solutions of hypo. for the use of photographers.—R. S.

Drying Semi-fluid [Syrups, Slurry, &c.] and like Materials: Impts. in the Method of and Apparatus for. W. E. Heys, Manchester. From J. Hundhausen, Hamm, Westphalia. Eng. Pat. 22,918, Nov. 30, 1895.

The apparatus consists of a series of cylinders C, mounted on spindles R, which are carried by a flat-link chain k at each end. Each spindle carries a star wheel S, the teeth of which touch the frame B, and, as the cylinders are carried along by the chains, cause them to rotate. The chains pass over sprocket wheels K K', K being driven by the gearing shown at S, whilst K' is fitted with a tightening gear W. The whole is surrounded by a casing A, with an

cloth or like material travels. The liquid passes through the filtering band and false bottom, being assisted by suction applied underneath, and the insoluble material is deposited on the travelling band. The latter passes over a drum outside the flat tank and discharges the material deposited on it into a transverse trough fitted with an archimedean screw, which in turn transfers the insoluble material into a suitable receptacle, or into a conveyor.—R. B. P.

Drying Sensitive Substances [Starches, &c.]: Impts. in the Method of and Apparatus for. W. E. Heys, Manchester. From J. Hundhausen, Hamm, Westphalia. Eng. Pat. 22,924, Nov. 30, 1895.

The apparatus consists of one or more rotating chambers hexagonal in cross-section. Each chamber consists of

a central tube carrying arms which support longitudinal wooden strips. To these are attached cloth walls forming an inner and outer polygon, between which the material to be dried passes from one end to the other of the chamber. If more than one chamber is used, the material passes successively through each. At the same time a current of air is caused to flow along the chambers, which carries off evaporated moisture, and an internal stirring device may be fitted. One or more of these chambers are surrounded by an outer casing, which also contains suitably placed steam pipes for supplying the necessary heat. Steam may also be passed through the central tubes. Modified constructions are also described.—R. B. P.

Plastic Material from Asbestos, An Improved Process for the Manufacture of a Mouldable Mass or Objects and Articles from Asbestos Fibre or other Fibrous Material or Fibrous Produce. L. Grote, Landsberg-on-the-Lech, Germany. Eng. Pat. 24,163, Dec. 17, 1895.

The fibrous material (asbestos, &c.) is steeped in a hot solution of "soluble glass," glue, and formaldehyde. The material is then immersed in solution of a salt of alumina, baryta, strontia, and finally the parchment-like material is reduced to powder and subsequently worked up with one-third of its weight of soluble glass solution, and one-sixth of its weight of lead oxide (litharge).

Sheets of the material pasted together and subjected to hydraulic pressure become perfectly hard, and may be worked by means of a saw, plane, file, or lathe. The objects, such as vats, buckets, &c., produced by moulding, are said to be acid-proof, waterproof, and fireproof.—V. C.

Separating Substances of Different Sizes or Specific Gravities, Impts. in Apparatus for. W. Johnson and H. Walker, Leeds. Eng. Pat. 16,616, July 27, 1896.

The material to be sized, is fed from a hopper on to a sieve, which retains the largest particles and delivers them into a chute. The material passing through the sieve falls into a closed chamber, in the side of which is an opening leading to a fan, preferably of the Blackman type. As the material falling down from the sieve passes this opening, all the finest particles are sucked away by the fan and deposited in a second chamber.—R. B. P.

Uniform Temperature in Laboratory Ovens, Incubators, Drying Rooms, and the like, An Improved Method of and Apparatus for maintaining. W. R. Lake, Southampton Buildings, Middlesex. From A. Schwabe, Berlin, Germany. Eng. Pat. 19,764, Sept. 7, 1896.

The method consists in submitting the chambers to the heating action of a liquid, the temperature of which is maintained constant by causing hot gases to pass around the sides of the chamber, and regulating the admission of these hot gases by a float balanced in the fluid. In the example shown, the chamber to be heated is surrounded by a fluid jacket, and the latter by a space for hot gases from a burner which is capable of raising the temperature higher than required. When the temperature of the fluid rises to the point for which the apparatus is set, the float sinks, and allows a ball or cup, filled with shot or other weights, and connected to it by a chain, to descend more or less upon the burner. Should the temperature fall the float and cup rise.—R. S.

II.—FUEL, GAS, AND LIGHT.

Hard Coal, Upper Silesian. Bremme. Zeits. d. Ver. d. Ing. 1896, 1185.

UPPER SILESIA is richer in coal than any other district of similar size on the Continent, the seams worked ranging from 3 to 7 metres and occasionally 9 to 12 metres in thickness. The coal is very pure, with a low content of ash, and with less than 1 per cent. (average) of sulphur. Most of the coal now won is close-burning long-flame coal, altogether unsuitable for coke-making, and only a little cherry-coal—the nearest approach to bituminous coal—is met with. The bituminous character of the coal decreases from the sole up to the hanging wall, and from west to east of the Zabrze-

Myslowitz deposit. The best coal for coking is that obtained from the extreme west of the field—at the Königin Luise Colliery, lowest seam, and now and again fairly good coal for this purpose is met with in the upper seams where the cover rock is impervious to water and air.

Despite all endeavours to obtain good coke from mixed upper and lower seam coal, the product is not nearly so well suited for smelting work as that obtained from other districts, and it is considered that this defect can only be surmounted by employing the lower coal alone for the manufacture of coke.—C. S.

Coal-Dust, Firing with; and Coal-Grinding Processes. Zarniko and Tropfe. Proc. Inst. Civil Eng. 126, (iv.), 66—64. From Gesundheits-Ingenieur, 1896, 210.

TESTS of the Wegener, Frieleberg, and Schwartzkopf systems of firing with powdered coal were undertaken at the Moabit Infirmary, Berlin, and the last-named apparatus gave an effective value of 80 per cent., with a perfect consumption of smoke. In a sugar manufactory at Algermissen a saving of 22 per cent. of fuel has been effected as compared with the usual combustion on fire-bars, whilst in a cupola at Vienna the saving amounted to 45 per cent.

—W. G. M.

Petroleum Consumption in Germany. J. für Gasbeleuchtung, 39, [47], 775.

THE consumption of petroleum in Germany increases steadily in the face of the competition offered by gas and electricity, 811,058 tons having been imported in 1895, as against 785,192 tons in 1894, and 556,887 (average) in 1886—1890. The increase per head of population in the period between 1891 and 1895 averages 3·21 kilos. per annum over the figures for 1886—1890, viz., 14·82 against 11·61 kilos. The home production is small but growing—1,309 tons in 1880; 5,665 tons, 1885; 11,513 tons, 1890; and 15,620 tons, 1895 (quinquennial averages). The largest share of the import trade is still in the hands of the United States, the quantity sent over in 1895 being 749,258 tons, as against 55,078 tons of Russian origin.—C. S.

Gas Engines, Combustion of Lighting Gas in. F. Haber and A. Weber. Proc. Inst. Civil Eng. 126, (iv.), 51—56. From Habilitationsschrift für Chem. Techn. Hochschule, Karlsruhe, Nov. 1895.

TRIALS were made with two Otto engines, one being a 4 H.P. old-type motor with slide-valve and flame ignition, in which the governor acted by cutting off the gas supply, whilst the other was a modern 2 H.P. engine with lift valves and tube-ignition, the speed being regulated by diminishing the amount of gas. The gases were drawn off and examined chemically under varying conditions of work. The following conclusions are drawn:—That the combustion was perfect at full power in both engines, but less so at half power, CO, H, and CH₄ being then found in the products. The lubricating oil plays a small part in the combustion phenomena, and the water-jacket temperature has no influence. The explosive mixture on ignition burns in a few hundredths of a second, so that a low cylinder temperature cannot affect it; the gases being violently agitated when explosion occurs, are at a uniform temperature, which is that of the inner wall surface. An explosive mixture diluted to the limit of inflammability must have a low combustion temperature—so low that combustion is imperfect owing to some parts not being raised to their ignition temperature. If the flame spread so slowly that combustion may be followed by the eye, it is imperfect, and, in a gas engine, were the mixture uniform, the progress of the flame would be so slow that the engine would not work. The authors confirm Slaby's statement that the explosions in the cylinder are short and sharp because the mixture is imperfect, and contains strongly-, weakly-, and non-explosive particles. The last-named probably yield the combustible residuum as follows:—The suction-stroke begins when the compression-space is full of exhaust products, which expand into the space behind the receding piston, whilst the admission valves successively rise, so that air and gas enter.

These three strata become partly mixed during the compression stroke, but there is, even at the end, a strongly-explosive mixture near the ignition channel, and a weak mixture next to the piston. The less rich the mixture of gas and air, the further removed from the piston-surface is the limit of violent explosion, and the thicker the weakly- or non-explosive layers. Particles of lighting gas at high pressure and speed may possibly penetrate this layer, and, escaping ignition, would account for the presence of CH_4 and H in the exhaust. The presence of CO points to more complicated phenomena. The combustible residue in the exhaust of the lift-valve engine was thus probably due to the use of a small charge. In the slide-valve motor it may perhaps be explained by the weakness of the first explosion after miss-fires, as shown by the indicator diagrams. In the valve-engine, when running at half-power with the cock fully open, the first explosion of each series also often missed fire. Both engines showed the presence of combustible gases in the exhaust whenever the explosions were intentionally caused to be weak, and the two phenomena appear therefore to be intimately connected.—W. G. M.

Acetylene, The Explosion of, with less than its own Volume of Oxygen W. A. Bone and J. C. Cain. *Proc. Chem. Soc.* 1896, [169], 176—177.

CONTINUING their earlier experiments (*Proc. Chem. Soc.* 142, 170), the authors have exploded mixtures of acetylene with from 29 to 95 per cent. of its own volume of oxygen in a leaden coil some 5 m. long, having an internal diameter of 13 mm. The coil was closed at each end by a steel tap, and at one end a stout glass firing piece, into which two platinum wires were fused, was fixed between the steel tap and the end of the coil. The other end of the coil was connected with a mercury manometer, so that the pressure change inside the coil after an explosion could be determined.

The coil was immersed in a bucket of cold water, which served to rapidly cool the gases in the coil after an explosion. The coil was filled with the explosion mixture at the ordinary atmospheric pressure, by displacement; the mixture was then fired by an electric spark passed across the wires at the firing piece. After the products of the explosion had cooled down to the temperature of the water surrounding the coil, the tap nearest the manometer was opened, and the pressure of the gases inside the coil was read off. In all cases a considerable increase in pressure, varying from 360 to 370 mm. of mercury, according to the mixture exploded, occurred.

Samples of the products of explosion were collected and analysed; they were found to consist chiefly of CO and H_2 , but small quantities of acetylene and carbon dioxide were also present; methane was not present in "any appreciable quantity."

From these and the earlier experiments, the authors state that it is evident that when the electric arc is passed between carbon terminals in an atmosphere of hydrogen, acetylene and methane are both produced. Further, that the rate of formation of these two gases is fairly rapid during the first 15 minutes of the experiment, after which the rate falls, and finally, after about half an hour, a state of equilibrium between the hydrogen, acetylene, and methane is attained. This equilibrium depends, to some extent, on the voltage employed.

These results led to the inference that methane and acetylene would both be decomposed by the electric arc, and that if the arc is passed long enough a similar state of equilibrium would be arrived at. This conclusion was fully borne out by subsequent experiments, in which pure acetylene or methane was subjected to the action of the electric arc passed between carbon terminals in the same apparatus as that employed in the experiments with hydrogen.

Both methane and acetylene are easily decomposed by the electric arc; during the first 10 minutes of the experiment, the gas (methane or acetylene, as the case might be) was very rapidly resolved into its elements, large flakes of carbon being formed in the neighbourhood of the terminals. A smoky flame rose from the terminals and filled the upper part of the globe. At the end of about 10 minutes this extraordinary appearance subsided, after which the arc

presented the same appearance as in the case of the hydrogen experiments.

The principal product in each case was hydrogen with about 9 per cent. of acetylene, and small quantities of methane, nitrogen, and hydrocyanic acid. In the experiment with acetylene, a minute quantity of naphthalene was also formed.

Calcium Carbide, Price of. *Zeits. für Beleuchtungswesen*, 1896, 251.

THE Aluminiumindustrie-Aktiengesellschaft Neuhausen has taken over a large amount of utilisable water power at Rheinfelden, and is erecting a large works for making carbide. When the manufacture is begun, the present price of 40 pfennige per kilo. will be "somewhat reduced." The Elektrochemische Werke in Bitterfeld has also acquired water power in the same district for the same purpose.

—C. S.

Monazite, The Chemistry of the Constituents of. G. P. Drossbach. *Ber.* 29, [15], 2452—2455.

THE finely-pulverised monazite (from the Blue Mountains) was decomposed by sulphuric acid and extracted with cold water as usual, and after fractionating out the feebly basic thorium, strong sulphuric acid in large excess was added. On partly neutralising with sodium hydrate, the sodium sulphate formed caused complete precipitation of Ce , La , and Di as double sulphates; the metals of the erbium group were precipitated from the filtered solution by means of oxalic acid.

Separation of Cerium from Lanthanum and Didymium.—When permanganate is added to Ce_2O_3 (either in the form of hydrate, or in solution which is kept neutral), the latter is oxidised to CeO_2 , which is precipitated along with MnO_2 . In using this reaction to effect the separation, an aliquot part of the solution containing the Ce , La , and Di , was precipitated by ammonia, and the ceria titrated with permanganate solution. To the main quantity of solution was then added a slight excess of KMnO_4 , and the calculated amount of alkali, when the ceria precipitated quantitatively, and with it a didymium body. From the precipitate, slightly dilute nitric acid extracted most of the didymia; stronger acid thereafter extracted the ceria, leaving the MnO_2 , and the ceria solution was crystallised after adding ammonium nitrate to obtain the double salt.

Separation of Lanthanum from Didymium was effected by adding sodium hydrate solution to the La and Di (in solution as nitrates) until the supernatant liquor showed no absorption spectrum; the lanthanum in solution was thus free from didymium, and any lanthana contained in the hydrate precipitate was removed by digesting with red didymium solution.

The *Didymium body* which precipitated along with the CeO_2 differed from ordinary didymium, which shows a large number of absorption bands, by exhibiting only the narrow line to the left of D , and two strong, sharp bands to the right of D .

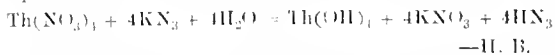
Separation of the Erbium Group.—After converting the above-mentioned precipitate of the oxalates into hydrates by means of potassium hydrate, and dissolving these in nitric acid, a double precipitation with magnesia left all the yttria in solution, the precipitate containing all the ytterbia, ceria, and probably a new oxide. If the last-mentioned precipitate is converted into nitrate and fractionally precipitated with sodium hydrate, the first fractions contain the ytterbia, which can only be recognised by its atomic weight and by its giving no absorption spectrum. Further gradual addition of very dilute sodium hydrate to the yellowish-red solution, until the supernatant liquor no longer showed the erbium absorption spectrum, gave in solution a colourless oxide having an atomic weight, calculated from the sulphate and assuming the formula to be R_2O_3 , of 98.5—100.5. The properties of this new body are: the sulphate is relatively easily soluble in water, only concentrated solutions giving crystals on heating; its solutions show no absorption spectrum; the oxalate is soluble in solutions of alkali oxalates; H_2O_2 and ammonia give a white precipitate (peroxide?); the carbonate and hydrate are easily soluble in excess of alkaline carbonate.

A solution in ammonium carbonate gradually deposits a precipitate of carbonate, but not if ammonia be added; the oxalate is soluble in carbonates. It differs from thoria in its strong basicity and the solubility of its double salts with alkali metals.—H. B.

Thorium, The Separation of, from the other Rare Earths by means of Potassium Trinitride. [*Incandescent Mantles.*] L. M. Denuis. J. Amer. Chem. Soc. **18**, [11], 947–952.

THE solution of potassium trinitride (KN_3) used was prepared by neutralising a dilute solution of hydrogen trinitride with a dilute solution of pure potassium hydrate, and then adding enough hydrogen trinitride to give the solution a distinctly acid reaction; it contained about 3.2 grms. KN_3 per litre. On adding a few c.c. of this solution to a neutral solution of a thorium salt and boiling for one minute, a white flocculent precipitate is obtained, which rapidly settles, the thoria being precipitated quantitatively as hydroxide, which may be filtered off, washed with hot water, ignited, and weighed as ThO_2 . The author's experiments with pure thorium in the form of chloride and of nitrate show that the process yields exact results. Solutions of pure lanthanum chloride and of the mixed chlorides of the rare earths from Brazilian monazite, previously freed from thorium, gave no precipitate with potassium trinitride solution; and when these solutions were mixed with various known quantities of a tested solution of thorium chloride, the author obtained, by the process indicated above, fairly exact separations of the thoria in all cases, the sharpness of the separation not being influenced by variations in the relative amounts of thoria and the other rare earths.

In considering what reaction takes place when thorium solutions are precipitated by means of potassium trinitride, it is evident that if it falls as ThO_2 , then all the hydrogen trinitride equivalent to the potassium salt first added must reappear in the filtrate from the thorium hydroxide and in the gas evolved during the boiling. The author proved this to be the case. 10 c.c. of the KN_3 solution used, gave with neutral silver nitrate solution a precipitate of AgN_3 , which, on washing with cold water, dissolving in hot dilute nitric acid, and precipitating with hydrochloric acid, produced AgCl equal to 0.0416 gm. HN_3 . 10 c.c. of the same KN_3 solution was used to precipitate a solution of thorium nitrate, the gases produced during the boiling being passed through an upright condenser into two absorption vessels containing neutral silver nitrate solution. After two minutes' boiling in this way the condenser was disconnected, the thorium precipitate filtered off, silver nitrate added to the filtrate, the silver trinitride precipitate produced added to that obtained in the absorption vessels, and the whole then dissolved in hot dilute nitric acid and precipitated with hydrochloric acid. The AgCl precipitate obtained, was equal to 0.0134 gm. of hydrogen trinitride, showing a little deficiency, doubtless due to loss of hydrogen trinitride by volatilisation, whilst filtering off the $\text{Th}(\text{OH})_3$ precipitate. The reaction is therefore correctly represented by the equation—



Thorium Mantles, The Influence of Foreign Oxides on the Lighting Power of. G. P. Drossbach. J. Gas Lighting, **68**, 1018.

IN trying to discover substances capable of forming efficient incandescence mantles without coming within the scope of the Welsbach patents, the author experimented with oxides of the heavy metals and with the alkaline earths. In a blowpipe flame the light-emitting value of the separate oxides was found to be according to the formula: (Mol. wt. \times sp. gr.) \div sp. heat; but the oxides were gradually reduced and vaporised in the flame. If, however, refractory oxides are introduced into the mantle with the reducible ones, in the author's opinion, the former act as bases towards the latter, and much better results are obtained than from the reducible oxides alone, especially if thoria, or another oxide having a high molecular weight, be employed as the base. Cr_2O_3 , TiO_2 , or WO_3 on the

one side gave excellent mantles with ThO_2 (containing traces of CeO_2); CaO , SrO , or ZnO on the other. As solutions of salts of the metals named, give precipitates with solutions of thorium salts, the cotton fabric is first steeped in the metallic salt solution, pressed and dried, and then further treated as usual with the thorium solution. The proportion of acid to basic oxides must be such that acid or neutral precipitates—not basic precipitates—are always formed in the mantle before burning off the cotton. The cotton fabric used should be washed previously in hydrofluoric acid, to remove the detrimental mineral matter which it usually contains.—H. B.

Incandescent Lamps, Method of Measuring the Temperature of. P. Janet. Comptes rend. **123**, 1896, 690–691.

THE resistance of the filament of a lamp varies greatly with its temperature. Suppose a difference of potential varying from 0 to E to be applied to the terminals of the lamp; for every value of E the temperature will take a value θ and the resistance a value R. We can construct a curve (A), having for abscissae R, and for ordinates $\frac{E^2}{R}$, i.e.

the power lost by radiation at the temperature θ . Now let the current be stopped at the time 0, and, as it cools, let the variation of the resistance of the filament be studied as a function of the time. Construct a curve (B), having for abscissae the times, and for ordinates the resistance R. By means of curve A we can deduce a third curve C, having for abscissae the times and for ordinates the power lost by radiation at each instant. The area of this curve gives the total energy lost by radiation from the maximum temperature of the filament down to the ordinary temperature: dividing by the mechanical equivalent of heat, we get the amount of heat which corresponds to this. Finally, if we weigh the filament and assume that certain data are known, we can deduce the temperature. The method enables us to investigate the variation of the resistance of the filament with temperature, and the variation of the radiation with temperature.

The data required have been supplied by Violle's determinations of the mean specific heat of carbon from 0 to temperatures above 1,000°. The above method further involves the assumption that the filament consists of pure carbon.—D. E. J.

Acetylene, Motor Force of. [*Gas Engines.*] Ravel. Journ. de l'Eclairage au Gaz, **4** (1895), 266–268.

EXPERIMENTS were made with a double-action, two horse-power gas engine. Alternate experiments were made with coal-gas for comparison and control. Preliminary experiments were made on the explosibility of acetylene.

At atmospheric pressure the lowest limit of explosibility is reached, when 1 vol. of acetylene is mixed with 0.71 vol. of air; the limit rises gradually with increasing proportion of air to the maximum at 1 vol. of acetylene to 12 of air, and then decreases till a mixture containing 1 vol. acetylene to 20 of air ceases to be explosive. Le Chatelier gives the rate of propagation of explosions in mixtures of acetylene and air as 0.18 metre per second in a mixture containing 2.9 per cent. of acetylene, rising to 5 metres for 5 per cent. of acetylene, and to the maximum of 6 metres for 10 per cent. of acetylene. The latter rate is far in excess of the maximum rate in mixtures of air and coal-gas.

The ignition temperature of acetylene is about 480° C., whilst that of ordinary coal-gas is about 600° C. The temperature of combustion of equal volumes of acetylene and oxygen is 4,000°, or about 1,000° more than that of the oxyhydrogen flame. The flame produced by the explosion of a mixture of air and acetylene under a pressure of $1\frac{1}{2}$ lb. on the square inch is of a brilliant yellowish-white colour.

The explosive force of mixtures of acetylene and oxygen or air, is much greater than that of similar mixtures of coal-gas or of hydrogen, and is almost of detonating character.

In working with acetylene, it is therefore most important to bear in mind (i.) the great rapidity of propagation of its

flame; (ii.) its very low ignition temperature; (iii.) the high temperature of its flame; and (iv.) its very high explosive force.

The acetylene was made from calcium carbide and supplied to the engine from a holder at 160–165 mm. of water pressure. The compression in the engine was regulated to 42.6 lb. on the square inch in some of the experiments, to 32 lb. in others. An accurate meter was placed between the holder and the engine. Owing to the high disruptive force observed in acetylene explosions, great precautions were observed, and only small percentages of acetylene used. When the percentage of acetylene in the cylinder exceeded 4 per cent., the explosion gave a hard metallic report, causing such violent shock to the engine as to be alarming, and to make the taking of diagrams difficult and uncertain, and in some cases impossible. The amount of lubricating material required when using acetylene is about double that required when using gas.

The results of the acetylene experiments are given in the following table. Graphic diagrams were also taken:—

No. of Experiment and of diagram.	Strokes of Engine per Minute.	Horse-power indicated.	Consumption of Acetylene per Hour in Cubic Feet.	Horse-power Generated per Cubic Foot of Acetylene consumed.	Percentage of Acetylene in Explosion Mixture.	Compression in Lb. per Square Inch.
1	364	1.951	26.06	269.5	2.77	42.6
2	250	2.232	28.10	282.9	3.18	42.6
3	314	1.981	27.55	258.9	3.45	42.6
4	300	2.262	32.21	252.8	4.20	42.6
5	322	..	33.65	..	4.00	42.6
6	329	..	33.47	..	4.10	42.6
7	314	2.204	26.27	362.0	3.30	32.0
8	316	2.180	28.10	311.4	3.50	32.0

The diagrams show that the initial pressure increases with the percentage of acetylene, but the fall of that pressure becomes concurrently quicker. Thus, at percentages of acetylene approaching 5, the initial pressure is almost dangerously high, but subsides instantaneously—a condition very much against efficient and economical working. The author considers that the explosive charge is subject to great internal vibrations during combustion. In order to lessen these vibrations as indicated in experiments 5 and 6, the author, in 7 and 8, increased the volume of the charge at the moment of ignition, i.e., decreased the compression and, as will be seen, thereby increased the effective work.

From the results given in the table, the author concludes that 1 cb. ft. of acetylene in a two horse-power gas engine produces a work on the piston of 320–325 horse-power. In the same engine the normal consumption of coal-gas is 33.7–34.4 cb. ft. per hour for 1 indicated horse-power.

The consumption per hour per effective horse-power (French, i.e., 0.985 horse-power English) of acetylene at 160 mm. water pressure, would be $385.7 \text{ kilogr. metres} \div 850 = 453 \text{ litres}$, which equals 460 litres at atmospheric pressure and weighs 550 grms.

In larger engines the effective power would probably be higher, but the ratio between that of acetylene and of coal gas would probably remain the same.

The author does not believe that the high explosive force of acetylene can be effectively utilised in the present form of gas engine. For either the acetylene must be used in considerable proportions in the explosive mixture, and then only gives a small part of its real power, owing to the suddenness of the explosion, or the dilution with air must be so great that the heating power of the acetylene is not enough to heat the whole mass of the mixture sufficiently to give by expansion the full power under economical conditions. Possibly better results may be obtainable in a rotary or turbine form of engine.—L. T. T.

Acetylene, Use of, in Gas Engines. A. v. Ihering. Journ. f. Gasbeleucht. 39, (1896), 685–687.

THE author gives the substance of Ravel's paper (see preceding abstract) and discusses the results therein

published. He believes that with a quadruplex engine better results may possibly be obtained than with the double-action one used by Ravel.

Taking the mean of Ravel's first four experiments, 380 litres of acetylene are required per hour per horse-power against 950 litres of coal-gas; the ratio value of acetylene to coal-gas would thus be about 2.5:1. Using a 5 H.P. engine the author found 303 litres of acetylene produce 1 I.H.P., and the ratio of acetylene to coal-gas as 2.7:1, showing that the effectiveness is greater in large engines than in small.

Reckoning the cost of calcium carbide as 150 marks per 1,000 kilos. (about 7l. 12s. per ton) and the yield of acetylene as 300 litres per ton of carbide, and taking Ravel's figures of 380 litres of acetylene, or 950 litres of coal-gas, per I.H.P. (French), the cost per H.P. would be for acetylene 19 pf. (2.38d.), and for coal-gas 11.4 pf. (1.43d.); coal-gas being reckoned at 12 pf. per cb. m. (3s. 4d. per 1,000 cb. ft.). Coal-gas is thus only about two-thirds the cost of acetylene as a motive power.—L. T. T.

Purifying Material [Gas Works], Testing the Regeneration of. Leybold. J. de l'Éclair. au Gaz, 44, [21], 407.

See under XXIII., page 921.

Mineral Oils, Estimation of Gasifying Value of. F. Helfers. Zeits. f. ang. Chem. 1896, 650.

See under XXIII., page 922.

PATENTS.

Coke, Porous [from Coal with admixed Sawdust], New Process for Making. O. Heimaun, Oppeln, Germany. Eng. Pat. 23,051, Dec. 2, 1895.

To diminish the density and increase the porosity of the coke produced from pit coal the inventor proposes to mix with the coal, from 1 to 90 per cent. of sawdust, wood-chips, spent-tan, or other finely-divided vegetable matter, which, it is said, prevents the coal from caking and shrinking in bulk to the same extent as when employed alone, the copious evolution of gases during the combustion of the added vegetable substances also rendering the coke more porous.—C. S.

Gas Liquor Separators, Impts. in. S. Cutler, Millwall. Eng. Pat. 24,383, Dec. 19, 1895.

The separator consists of a long chamber with a trough-shaped bottom sloping towards one end. The liquids from the gas washer are admitted at the shallow end and pass a series of transverse baffles, whereby the tar and heavier liquids are caused to settle down into the trough and flow into a separate division at the deeper end of the chamber, the water being drawn off through a sump. Gauges are provided to show the level of the liquids.—C. S.

Gas Carburetters, Improved Oil Atomiser for. S. Cutler, Millwall. Eng. Pat. 24,384, Dec. 19, 1895.

The apparatus consists of a tube descending into the carburetter. It is fitted with a nozzle at the lower end and contains a core-rod terminating below in an inverted cup, perforated with a series of oblique holes and fitting tightly in the pipe. The oil entering the pipe under pressure is atomised by passing through the apertures, the spray gyrating at a high rate of velocity in the cup and issuing from the nozzle, and the area of the spray is controlled by raising or lowering the cup, an operation performed by the aid of a screw or other device at the upper end of the core.—C. S.

Regenerative and other Furnaces [Liquid Fuel, and injecting Compressed and Heated Air], Impts. in. L. Moyes, Glasgow. Eng. Pat. 24,664, Dec. 24, 1895.

THE inventor proposes to inject compressed heated air into the furnace (for oil or liquid fuel) described in Eng. Pat. 13,761 of 1894 (this Journal, 1895, 21), in cases

where superheated steam is found unsuitable. The air blast may be supplied by any suitable means, and at any desired temperature and pressure (30 lb. per square inch will, in general, give good results), the size of the pipes employed being adapted to the conditions prevailing in this respect.—C. S.

Generator Gas, Impts. in Apparatus for. [*Direction of Steam and Air Jet through centre of Fuel, &c.*] J. E. Dowson, Westminster. Eng. Pat. 6919, March 30, 1896.

THE improvement consists in reducing the area of the grate or firebar space in the bottom of the generator, so that the steam and (or) air blown in through the grate may ascend through the centre of the fuel. By this means less clinker is formed around the lining of the generator, and a gas of improved heating power can be produced with inferior fuel.

In the case of fuel softer than anthracite or coke, the upper part of the generator is fitted with an internal shell of iron (down to the level where good gas can be drawn off), the interior of which is filled with fuel, leaving an annular space for the withdrawal of gas of good quality. The fuel in the upper part, being heated by the fuel below and the hot gases in the annular space, evolves condensable vapours, which are exhausted through an aperture in the top by the steam or air blast, and are conveyed thereby into the space below the grate, and thus into the lower part of the generator, where they are burnt or converted into fixed gases.—C. S.

Burners for Gasifying and Burning Hydrocarbons [*Lumps fed with Light or Heavy Hydrocarbons*], chiefly designed for the Production of Light by Incandescence; Impts. in. S. Marcus, Vienna, Eng. Pat. 16,735, July 28, 1896.

THE mouth of the burner-tube is closed by a small dome of wire gauze, and the rim of the tube is toothed, corrugated, or perforated, and projects over the base of the flame for the purpose of exposing a great contact surface to the flame, that the heat may be conducted to the vaporising chamber. The latter comprises a hollow ring or annular piece (arranged outside or inside, near the mouth of the burner) in which terminate two tubes, one of which leads the liquid fuel up into the vaporising chamber, and the other conducts the generated gas downwards to a nozzle placed centrally within the burner-tube. The gas, on issuing upwards from the nozzle, draws in air through the wall of the burner-tube, which is provided with longitudinal slits, the outer casing being supplied with similar slits. The upper part of the burner tube may be divided into mixing chambers by interposing diaphragms of wire gauze in the path of the current of air and gas. In the special form of burner for light hydrocarbons, the vaporising chamber simply consists of a chamber at the base of the burner, near the point at which the liquid passes the entrance valve, and communicating directly with the nozzle, no conducting tubes being then necessary.—H. B.

Acetylene Gas, Improved Apparatus for Producing, Storing, and Utilising. G. Trouvé, Paris. Eng. Pat. 23,521, Dec. 7, 1895.

THE gas generator comprises a stoppered vessel immersed in a second vessel containing water, the former vessel having an aperture at the bottom and enclosing a suspended wire cage containing calcium carbide crystals. The crystals are arranged in superposed layers, separated by glass discs, to cause the successive immersion of the layers and ensure a uniform production of the gas. One or more generators may be connected to a holder for storing the gas. A portable lamp, consisting of a generator provided with a burner and fittings, is also described, the generator being connected to the burner by two concentric tubes, one for conveying the gas and the other for siphoning off the condensed water. In a modification, the concentric tubes are replaced by a spiral metal strip enclosed in a box through which the gas passes, the strip serving to condense and collect the aqueous vapour.—R. A.

Acetylene Gas Generators, Impts. in or connected with. W. W. R. Warn and L. F. King, both of Poole, Dorset. Eng. Pat. 75, Jan. 1, 1896.

THE generator consists of inner and outer chambers, having a space between them filled with water under pressure, a revolvable table mounted within the inner chamber and carrying a number of cells containing calcium carbide, &c., and pipes for supplying the water to the cells. These cells are filled with calcium carbide and stone lime, ("the latter to prevent smoking"), and suitable taps operated by means of rods are provided to control the supply of water to the cells. A grid placed above the cell is adapted to contain lime or other suitable desiccant for drying the gas. The apparatus is also provided with suitable gauges, &c. The generation of the gas is regulated according to the amount consumed, as the supply of water to the cells is checked or increased according as the pressure of the gas rises above or falls below that of the water.—R. A.

Gas [Acetylene, &c.] Generating Apparatus, Improved. A. J. Boulton, London. From H. F. Fuller, Chicago, U.S.A. Eng. Pat. 19,288, Sept. 1, 1896.

THE apparatus is a gas-holder constructed on the principle of intermittent contact of the solid gas-generating material with the sealing liquid, the volume of the liquid, and therefore the weight of the apparatus, being lessened by turning up the walls of the outer vessel inward, so as to form an annular space into which the gas-holder cover dips. In the upper part of the cover is fitted a perforated plate on which the carbide is laid, a reserve supply—which also serves to dry the evolved gas—being inserted both in a basket placed over an opening in the cover and in an upper chamber surmounted by a second (smaller) gas-holder containing the outflow tap. The waste lime is caught in a receiver placed on the raised bottom of the outer vessel, and the prevention of overflow from the latter by reason of the displacement of the sealing liquid (in this case water), by the waste lime, is secured by raising the height of the external walls. It is furthermore claimed that this construction ensures regularity of pressure during the working of the apparatus.—C. S.

Acetylene Gas, Impts. in and relating to a Method of and Apparatus for Producing. J. A. Denthier, Boston, U.S.A. Eng. Pat. 20,599, Sept. 17, 1896.

THE calcium carbide or other gas-generating substance is made in the form of tablets, which are stored in a hopper above a reservoir containing water, &c., the tablets being fed singly from the hopper into the reservoir by means of a reciprocating slide connected through suitable levers to, and operated by the bell of the gasometer, &c. As the bell falls, a fresh tablet is fed into the reservoir, and a fresh quantity of gas generated, the supply of gas being thereby automatically regulated according to the consumption.—R. A.

Acetylene Gas, Apparatus for the Production of. W. B. Rickman, 38, Leadenhall Street, London. From J. Pintsch, Berlin. Eng. Pat. 20,602, Sept. 17, 1896.

THE apparatus consists of a closed receptacle containing water, and provided at its lower end with a horizontal grating, on to which the calcium carbide is fed in lumps through a hopper at the side. Water is also supplied through the hopper, and is maintained at a constant level within the receptacle by means of an overflow pipe which is closed by a water seal. The grating is mounted on pivots, and can be oscillated by a handle from the outside, to prevent it from becoming clogged.—R. A.

Acetylene Gas, Impts. in Apparatus for the Manufacture of. V. Sardi, Turin, Italy. Eng. Pat. 20,903, Sept. 21, 1896.

THE apparatus consists of a gas generator and a gas holder, the former being mounted on or connected to the bell of the latter. The calcium carbide is contained within a perforated cylinder having a rod which passes through a gland in the top of the generator, this top being formed by a bell sealed to the body of the cylinder by a water joint.

In operation, the generator sinks with the bell of the gas holder as the gas is consumed, until the carbide comes in contact with the water contained in the gas holder, when a fresh supply of gas is generated, which again raises the bell and the generator until the carbide is clear of the water. The perforated cylinder can be removed and recharged with the carbide without stopping the supply of gas from the gas holder.—R. A.

Acetylene Gas, Impts. in Generators for. S. Kon, Warsaw, Russia. Eng. Pat. 21,468, Sept. 28, 1896.

The gas generator is affixed to the outside of the water reservoir of the gas holder, from which it is supplied with water. The calcium carbide is contained in a perforated cylinder having a rod which passes through a stuffing-box in the top of the generator, the rod being provided with stops which engage a pair of spring arms on the bell of the gas holder, so that the carbide is immersed in or removed from the water as the bell of the gas holder sinks or rises. When the generation of the gas is excessive, the spring arms are forced apart by a releasing device, so that they pass over the upper stop. For the purpose of mixing the gas with air, a cylinder supplied with air from the outside is affixed within the bell of the gas holder, the air passing from this cylinder through a U-tube to the annular space between the cylinder and the bell, into which space the gas from the generator is also delivered.—R. A.

Vapour Burners for Heating Purposes, Impts. in. H. Kretschmann, Berlin. Eng. Pat. 19,352, Sept. 1, 1896.

The patentee claims a heating burner, fed with liquid fuel, the main feature of which is that, above or below a gasification chamber wherein the liquid fuel is converted into gas, there is arranged a chamber wherein the gas and air mix, and are superheated; from this last-mentioned chamber there descends a length of tube, the object of which is to "receive the gas jet or current supplied from the gasification chamber, together with the air carried along by such current or jet, and to deliver both the gas and the air, through lateral apertures," into the mixing and superheating chamber. The mixture issues in an annular flame on all sides of the lower part of the mixing (superheating) chamber, the flame serving to heat both the mixing and gasifying chambers.—H. B.

Incandescent Gas Burners, Impts. in. [Superheating Air, and Gas Mixture.] P. Bode, Berlin. Eng. Pat. 19,973, Sept. 9, 1896.

The short Bunsen tube is provided with more air-holes than usual, and the perforated part of the tube is surrounded by a grid with inclined slots, the object being to cause the air which is drawn in to take an inclined direction. Concentric with the Bunsen tube and surrounding its upper part is a tube (1), which is closed by a plate a short distance above the mouth of the Bunsen tube, and which has outlet slots at its lower part. Concentric with and surrounding tube (1) is a tube (2) closed at its lower end. The mixture of gas and air issuing from the mouth of the innermost (Bunsen) tube passes downwards through the annular space between the latter and tube (1), flows through the slots at the base of tube (1), and again flows upwards in the annular space between tubes (1) and (2). The burner rim, at which the gas is burned, consists, instead of wire gauze, of two concentric fluted or corrugated ring inset pieces, separated by a ring-shaped, non-corrugated partition and having a central socket to hold the carrier of the mantle. The gas and air mixture in its zig-zag passage through the tubes receives a preliminary heating and becomes intimately mixed.—H. B.

Incandescent Lighting [Alcohol or Hydrocarbon Lamps], Portable and Hygienic, wherein the Evaporation of Hydrocarbons is produced under Pressure. G. Musso, Naples. Eng. Pat. 13,648, June 20, 1896.

ARRANGED in a circle are a number of tubes containing wicks which dip into a reservoir containing alcohol, or gasoline, or other liquid hydrocarbon. These tubes at the upper end are joined to a small "evaporating chamber," into which the wicks project slightly, and in the centre of

the circle of tubes is a lamp, the flame of which plays on the bottom of the evaporating chamber, and to some extent on the upper ends of the tubes, vaporising the hydrocarbon which has been drawn up by the wicks inside. A small portion of the vapour thus produced is led off through a side pipe to supply the lamp above referred to, the size of the flame being regulated by the gas itself on passing through a spring needle governor. The main body of the gas passes at a considerable pressure through a small conical nozzle into an upright tube, the latter being perforated with air-holes near its base and acting as a Bunsen burner. To promote the thorough mixing of the gas and air, a perforated diaphragm is fixed inside the burner tube at its upper part, the mouth of the burner being fitted with a small perforated dome. The rod, which serves to support the mantle, is fixed into a socket in the centre of the perforated dome and diaphragm, and the asbestos thread of the mantle is fastened to the fork of the support by means of a mixture of chalk and silicate of potash.—H. B.

Mantles for Incandescent Burners, Improved Process of Manufacturing. [Impregnating before Weaving.] H. Wellstein, Berlin. Eng. Pat. 19,357, Sept. 9, 1896.

IN order to obtain mantles having a more even distribution of the oxides on their peripheries than have hitherto been made, the patentee impregnates thread-like material of suitable thickness with a solution of the suitable salts ("more particularly thorium oxide, with eventually the addition of other suitable metallic oxides"), afterwards knitting or weaving the thread to form tubular mantles.—H. B.

Gas for Artificial Lighting and Motive Power Purposes, Impts. in and Apparatus for the Production or Generation of. A. Devis, Charleroi, Belgium. Eng. Pat. 19,830, Oct. 22, 1896.

A DOME-TOPPED cylinder, somewhat like a small gas holder in form, works in a receiver containing water. On opposite sides of this cylinder are two pistons in long cylinders, the piston rods being connected at their upper ends to the crown of the dome-topped cylinder, and forced upwards by water pressure in such a way as to carry the cylinder with them; the latter during its ascent, sucking in air by a valve on the top of the dome, which closes automatically at the same time as the water pressure is relieved. On opening the water-escape valve, the pistons drop, along with the cylinder, and the air is blown out by a stand pipe inside the cylinder, the head of which is above the water level.

The air passes into a second receiver, in the lower part of which are a number of superposed trays communicating with one another and containing petroleum "or any other rich mineral oil." Each tray is connected to a tap outside the vessel, which serves for introducing the petroleum, &c., and in each compartment, about 4 inches above the surface of the petroleum, is a perforated tin shelf supporting a layer of cotton waste. The air bubbles through the petroleum in each tray successively, the carburetted air filtering through the layers of cotton waste, and being then passed upwards through a stand-pipe into a dome-topped gas-holder working in a vessel of water in the upper part of this second receiver.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Oil and Ozokerite Deposits in Russia. J. Soc. Arts, 1896, 44, 859.

THE oil which is found in the island of Teheleken, in the Caspian Sea, is stated to be forced to the surface by numerous springs of hot "sulphur water" (102° F.), and accumulates in wells. Analytical tests made in the laboratory of the Technical Committee of Baku have shown that the crude oil is of thick consistency at 9° C., and becomes solid at a little below 0° C. The water in it is difficult to remove, and this circumstance proves a serious obstacle in the distillation. Its specific gravity at 15° C. is 0.868, and its flashing point 51.5° C. A characteristic of the oil is its high content of paraffin (5.5 per cent.).—A. S.

Asphalt, Mining and Preparation of, at Lobsann. Jasper. Zeits. f. Berg-, Hütten- u. Salinen Wesen, **44**, [4], 387—392.

ASPHALT rock has been worked at the Lobsann brown coal concession ever since 1820, but not to any great extent, owing partly to lack of demand for the products and partly to prolonged litigation with the neighbouring petroleum concession at Pechelbroun.

The deposit extends eastward of the great fault separating the younger geological formations of the Rhine plain from the Vosges red sandstone rock, and consists of four layers of fresh-water lime impregnated with bitumen. These strata are interspersed with limestone containing no bitumen, and are situated in a brown coal deposit some 30 to 40 metres in thickness, of the volume of which they compose some nine-tenths. The percentage of bitumen ranges from 8 to 11 per cent., the richest layers yielding up to 18 per cent.; and the consistency of the rock varies, some being soft and easily extracted with the pick, whereas other portions are very tough and can only be got out by blasting. The bitumen itself is so strongly adherent to the particles of lime that (unlike the pitch sand) it cannot be extracted by boiling with water.

A hauling way, driven at a slight incline for a distance of 60 metres from the bank, leads to the workings, which have been opened up by sundry cross-headings and galleries, most of the asphalt hitherto obtained having been derived from the *déchets* of these development works, so that it is calculated there is at present an accessible reserve of fully 3½ million tons of asphalt rock ready for working, a quantity sufficient to last for 100 years, even by increasing the present output tenfold.

The crude rock is dried and heated by steam in vertical cylindrical iron retorts, to render it more readily pulverisable in the mills and disintegrators.

This asphalt powder is partly sold as such and partly made up into mastic ("asphalt mastix") by admixture with 10 per cent. of pure natural Trinidad asphalt, or—as has been found to give equal results at less cost—with 6 per cent. of Alsation petroleum residue (flashing above 220° C.) and 4 per cent. of Trinidad asphalt previously melted and filtered. The materials are incorporated by stirring together in horizontal semi-cylindrical iron vessels for 12 hours at 160° C. to 170° C., and the mass is cast into blocks weighing about ½ cwt. apiece.

A third product—"asphalt comprimé" powder—is prepared from hand-picked rock, containing on an average more than 13 per cent. of bitumen, dried and ground twice, and packed in sacks. For use, this powder is heated to 120° C. in iron ovens and spread over the surface to be paved, where it is compressed by hot rammers and smoothed irons.

The "asphalt goudron"—another product—consists of 70 per cent. of filtered Trinidad asphalt and 30 per cent. of Alsation petroleum residue, fused and mixed during 48 hours, and, after standing for the separation of earthy impurities, packed in casks.

For small sections of paving (footways, &c.) and places where the smell of hot asphalt is objectionable, "asphalt comprimé" slabs are made 3—5 cm. thick, in moulds under 150 to 180 atmospheres pressure.

The total output has varied of late considerably, between 8,000 and 11,000 tons per annum from 1878 to 1882, sinking to 704 tons in 1889, and averaging 3,208 tons from 1892 to 1895, during which period 50 to 60 hands were employed. Germany forms the sole market for the products, and until recently foreign asphalts have been preferred by the various municipal and other authorities—a condition of things that militated against any extension of output, but which is now fast disappearing.—C. S.

Coal-tar Thioxen. K. Keiser. Ber. 1896, **29**, 2560—2564.

THE experiments described were undertaken in order to determine whether coal-tar thioxen contains different isomers, of which there are four theoretically possible. With this object the author converted the crude thioxen first into a monobromo derivative; this he sulphonated, treated with sodium amalgam to remove the bromine, and

finally converted the product into sulphonie amide. By crystallising the latter from water, it was found to consist of various isomers. Two of these are shown by analysis to be different thioxen-sulphonie amides, and a third was found to be identical with the sulphonie amide obtained from synthetic thioxen. A fourth substance was also obtained, but its composition could not be determined.—A. K. M.

Durene-carboxylic Acids. V. Meyer and L. Wöhler. Ber. 1896, **29**, 2569—2573.

IN view of the incorrect statements recently made by Claus regarding the properties of the durene-carboxylic acids (J. prakt. Chem. **52**, 529), the authors have re-investigated them. They confirm Gattermann's statement that, under certain circumstances, the introduction of the carboxyl group into solid durene is accompanied by a partial rearrangement of the methyl groups, with formation of Prehnitic acid; but they also find that when the quantity of aluminium chloride is diminished, and only a short time allowed for the reaction, this intramolecular change does not occur, and the carboxylic acid derived from solid durene is alone formed. It is also shown that, whilst Prehnitic acid readily forms ethers, the corresponding acids derived from durene and iso-durene do not.—A. K. M.

PATENT.

Solidified Petroleum, Impts. in the Manufacture of. [Wool-Fat Acids, Heat, and Caustic Alkalis.] M. Ekenberg, Stockholm. Eng. Pat. 16,541, July 25, 1896.

THE improvements claimed are: the addition of fatty acids of wool-fat to petroleum or petroleum distillates, heating the mixture to a temperature of 120°—200° C., and then adding hydrates of alkalis or alkaline earths, or by dissolving in petroleum or petroleum distillates anhydrous soaps previously prepared from wool-fat, fatty acids, and alkalis or alkaline earths. The temperature of the mixture must not be below 120° C. during the addition of the hydrates, and the fatty acids should not contain any glycerides. From 1 per cent. to 15 per cent. of the fatty acids may be added, according to the consistency required in the resulting product, which, when thus prepared, is an anhydrous, transparent, and homogeneous substance.—W. P. S.

IV.—COLOURING MATTERS AND DYES.

Colours, The Examination of, and their Appearance under Artificial Illuminants. D. Paterson. J. Soc. Dyers and Colourists, 1896, **12**, 191.

THE artificial illuminants, arranged according to their respective colour-matching qualities, may be given as follows:—(1) Magnesium light; (2) electric arc light; (3) "Welsbach" light; (4) acetylene gas and lime light; (5) good oil lamp, coal-gas, electric glow lamp, candles.

The modifications of hue seen under artificial light depend upon the impurity of the light used and the nature of the absorption spectrum given by the colour. There are, however other causes which affect, in a very slight degree, such changes; these are *dichroism* and *fluorescence* possessed by the colours themselves, also the optical properties of the fibres. The chemical composition of the fibre does not appear to have any effect, but the *physical* or *optical* structure has a decided influence in such modifications of hue. Colours dyed on a fibre of good lustre and transparency, such as silk, China grass, or the finer qualities of jute, appear brighter and more enhanced, and of richer quality, in artificial lights.

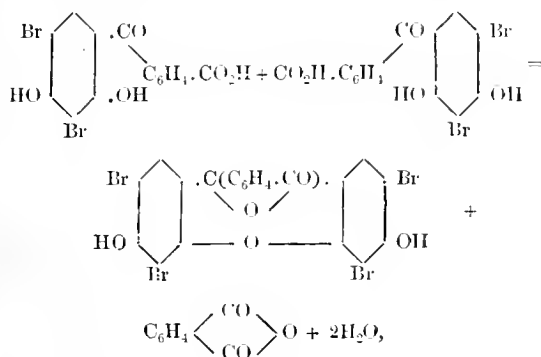
Colours which to the eye match each other closely, yet present different absorption spectra, behave differently when viewed in artificial light. Colours possessing absolutely the same absorption spectra and properties behave identically under different illuminants.

The chemical constitution of the colouring matter, it is said, in no way affects such alterations in hue in artificial light.

Colours, though obscured in combination with other colouring matters, still preserve their individuality of character and behaviour towards these illuminants.—A. S.

The Phthaleins. II. R. Meyer and H. Meyer. Ber. 29, 2623—2626.

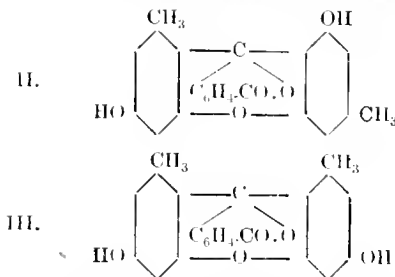
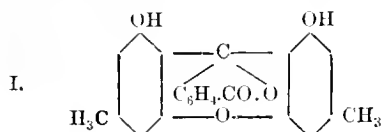
In a previous paper (Ber. 28, 1576; this Journal, 1895, 860) it was shown that the hydroxyls in fluorescein are symmetrically placed, and in the present paper a similar symmetrical formula is proved for the eosines. Baeyer (Annalen, 183, 25) has already shown that fluorescein when treated with fused potash decomposes into resorcinol and dihydroxybenzoylbenzoic acid. This latter, when heated above its melting point, gives off phthalic anhydride, reforming fluorescein. The reaction takes place in such a way that one molecule of dihydroxybenzoylbenzoic acid splits up into phthalic anhydride and resorcinol, and the latter then combines with a second molecule of the acid. This, however, affords no evidence of the symmetrical constitution of fluorescein, since the replacement in the resorcinol molecule could take place either *o-p* to both hydroxyls or between them. It is, however, otherwise with the dibromodihydroxybenzoylbenzoic acid obtained from eosine, for which Heller has shown that the substituents in the resorcinol residue have the following positions, $(\text{OH})_2 : \text{Br}_2 = 1:3:2:4$, and thus the position between the hydroxyls is occupied. If therefore eosine can be obtained from its decomposition product, dibromodihydroxybenzoylbenzoic acid, as fluorescein is from the non-brominated acid, its symmetrical constitution is proved, and this was found to be the case. The dibromodihydroxybenzoylbenzoic acid was obtained by heating commercial potassium eosine with twice its weight of 50 per cent. caustic soda lye to 140°C . until the blue colour of the melt changed to brown. The whole is then poured into ice-water, and slowly neutralised at a low temperature. On crystallisation from glacial acetic acid the acid melts at 224°C . When heated with one-fifth its weight of zinc chloride for 20 minutes to $235^\circ\text{---}240^\circ \text{C}$. it gives a good yield (87 per cent.) of eosine, which is identical in every particular with the substance originally started with. A red by-product which on reduction and oxidation gave fluorescein is formed simultaneously. The reaction expressing the formation of eosine takes place according to the following scheme:—



and since the phthalic acid residue certainly does not enter meta to the hydroxyl, the symmetrical formula for eosine may be considered as fully proved.—T. A. L.

The Phthaleins. III. R. Meyer and H. Meyer. Ber. 29, 2627—2640.

THE authors, in continuation of their work on hydroquinone phthalein, have examined the orcinolphthaleins as compared with ordinary fluorescein. The condensation of orcinol with phthalic anhydride only takes place in presence of a condensing agent, and three products are formed which have the following formulae:—



In order to distinguish these three products it is proposed to call that one α which dissolves in alkali with a carmine-red colour, β the one which is soluble in alkali with a cherry-red colour, whilst the fluorescent compound is termed γ . The α and β compounds are obtained in about equal quantities by the use of condensing agents such as sulphuric acid, zinc chloride, tin tetrachloride, phosphorus pentoxide, or ferric chloride, whilst a relatively larger quantity of the γ -isomeride is obtained by the use of vitreous phosphoric acid. The three compounds can be separated by their different behaviour to alkalis. The α product is insoluble in ammonia and carbonates, but soluble in potash; the β compound is soluble in carbonates, but not in ammonia sesquicarbonate; whilst γ -orcinolphthalein combines with ammonia vapour, forming an easily soluble ammonium salt, although the separation by these methods is by no means a perfect one. In addition to orcinol (dihydroxytoluene, $\text{CH}_3 : (\text{OH})_2 = 1:3:5$), the following compounds have been examined regarding their behaviour in the fluorescein reaction. Cresorcinol (dihydroxytoluene, $\text{CH}_3 : (\text{OH})_2 = 1:2:4$) gives on fusing with phthalic anhydride a compound analogous to fluorescein, which is converted by bromine into an eosine. The fluorescein reaction is also given by dihydroxytoluene ($\text{CH}_3 : (\text{OH})_2 = 1:2:6$), by dihydroxy-*m*-xylene [$(\text{CH}_3)_2 : (\text{OH})_2 = 1:3:2:4$], and by dihydroxy-*o*-xylene [$(\text{CH}_3)_2 : (\text{OH})_2 = 1:2:3:5$], whilst β -orcinol (dihydroxyxylene, $(\text{CH}_3)_2 : (\text{OH})_2 = 1:4:2:6$) does not give a fluorescein when fused with phthalic anhydride, but in presence of sulphuric acid, a compound similar to E. Fischer's orcinolphthalein. Di-iso-amylresorcinol gives no fluorescein, whilst *m*-xyloresorcinol [$(\text{CH}_3)_2 : (\text{OH})_2 = 1:3:4:6$] and mesoresorcinol [$(\text{CH}_3)_2 : (\text{OH})_2 = 1:3:5:2:4$] gives tarry melts with phthalic anhydride alone; in presence of sulphuric acid a fluorescent condensation product is obtained, which, however, is also formed in the absence of phthalic anhydride. Thus, except in the case of β -orcinol, the formation of fluorescein has been observed in all *m*-dihydroxybenzenes containing free positions *para* to one and *ortho* to the other hydroxyl. Certain substituents appear to modify or entirely remove the capability of fluorescing, and this may be an explanation of the behaviour of hydroquinone phthalein, which, although it shows no fluorescence, must undoubtedly be a dihydroxyfluorane. The experimental part of the paper is chiefly concerned with an examination of the properties of the three orcinol phthaleins, which can be separated to a certain extent, as already mentioned, by their different behaviour to alkalis.

α -Orcinolphthalein crystallises from glacial acetic acid in colourless crystals. The product has very feeble acid properties, since it can be extracted by ether from its solution in very dilute caustic potash. When brominated in glacial acetic acid, tetrabrom- α -orcinolphthalein is produced, and separates in yellowish needles, soluble in caustic soda lye with a violet colour, which on heating turns blue, but returns on cooling. Reduction of the phthalein with caustic soda lye and zinc dust yields the corresponding phthalin (m.p. 256°C), which gives a diacetate melting at 219°C .

β -Orcinolphthalein separates either in brownish needles or orange plates from alcohol. It yields a diacetate melting at 228°C , and a dibenzoate, m.p. 245°C , and when reduced with zinc dust and caustic soda lye gives a white precipitate of the phthalin, which is readily oxidised by potassium ferricyanide or permanganate to the phthalein. Tetrabrom- β -orcinolphthalein is in no respect a dyestuff. It dissolves in sodium hydrate or carbonate with a greenish-black colour, which in very dilute solutions is dirty red by transmitted

light, but it is not acted on by ammonia vapour, and may therefore be easily separated from its isomerides by this treatment.

γ-Orcinolphtalein is separated by means of the action of ammonia vapour on the crude product obtained by the action of phthalic anhydride on orcinol in presence of phosphorus pentoxide. The substance dissolves easily in alcohol, methyl alcohol, and glacial acetic acid, and has a great similarity to fluorescein. It dissolves in caustic alkalis, ammonia, and carbonates, with a brown colour and a green fluorescence. It dyes silk yellow, and dissolves on warming in sodium phosphate to a fluorescent solution, which is not decolorised by shaking with ether (difference from *β*-orcinolphtalein). When boiled with acetic anhydride it forms a colourless diacetate, melting at 208° C., which is easily hydrolysed. Reduction with zinc dust and caustic soda lye yields a colourless phthalin, whilst bromination in acetic acid gives tetrabrom-*γ*-orcinolphtalein or homo-cosine. This substance is sparingly soluble in all solvents, but separates from nitrobenzene in brownish prisms. It dissolves readily in caustic alkalis and in carbonates with an eosine-red colour. The solutions do not fluoresce, but appear yellowish-red by reflected and pink by transmitted light. Silk is dyed red similar to eosine, but the colour is not so strong. When heated with caustic soda the compound is decomposed in a manner evidently analogous to that in the case of eosine into dibromoresorcinol and dibromodihydroxybenzoylbenzoic acid. A more characteristic reaction of this homo-cosine is its behaviour to sodium amalgam and water. The prolonged action of these reagents, just as in the case of eosine, produces a colourless solution in which potassium permanganate gives a brown coloration and a dark green fluorescence. Hence, like eosine, nascent hydrogen removes bromine and produces a phthalin.—T. A. L.

Colouring Matters occurring in Various British Plants.
Part I. A. G. Perkin and J. J. Hummel. Proc. Chem. Soc. 1896, [169], 185—186.

FORMERLY numerous British plants were employed in dyeing, and at present in remote districts, notably the Highlands of Scotland, some are still used for this purpose. Many of these have been found sufficiently strong in colouring matter to warrant their chemical examination.

The Colouring Matters of the Yellow Wallflower. Cheiranthus cheiri.—An aqueous extract of the flowers when digested with acid, deposits a precipitate of colouring matter; this was found to consist of two substances which could be separated readily, owing to the difference of their solubilities in alcohol. The more soluble product, which was obtained as yellow needles, had the formula $C_{15}H_{10}O_7$, yielded an acetyl compound, $C_{15}H_8O_7(C_2H_5O)_2$; colourless needles, m.p. 189°—191°; when decomposed with fused alkali, protocathecinic acid and phloroglucin were produced. It was found to be *quercetin*.

The Sparingly Soluble Colouring Matter. $C_{16}H_{12}O_7$, minute yellow needles, gave an acetyl compound, colourless needles, melting at 195°—196°, and when acted upon by hydriodic acid, it yielded *quercetin*, and one molecule of methylic iodide. It was thus a *quercetin monomethyl ether*. Though closely resembling rhamnetin, it is not identical with it, for acetylramnetin melts at 184°—185°; and for it, is proposed the name *isorhamnetin*.

The Colouring Matter in White Hawthorn Blossoms. Crataegus oxyacantha, was obtained as yellow needles having the formula $C_{15}H_{10}O_7$. Its acetyl compound, colourless needles, melted at 189°—191°, and when fused with alkali, phloroglucin and protocathecinic acid were formed. There could be no doubt as to its identity with *quercetin*. It is most probable that these colouring matters exist in the above plants as glucosides. This point will be studied at a later date.

Natural Yellow Colouring Matters. Acid Compounds of.
Part II. A. G. Perkin. Proc. Chem. Soc. 1896, [169], 167—168.

IN a previous communication by Perkin and Pate (this Journal, 1895, 745), it was shown that when treated with mineral acids in presence of acetic acid, quercetin, ram-

netin, rhamnazin, fisetin, and morin, yielded crystalline compounds, the formula of which is generally represented as an addition product of one molecule of acid to one molecule of colouring matter. It has since been shown that luteolin and myricetin behave similarly, and there can be little doubt that all these colouring matters belong to the so-called quercetin group. In this paper certain of these compounds not previously examined are described, viz.: quercetin hydrochloride, $C_{15}H_{10}O_7.HCl$; morin hydriodide, $C_{15}H_{10}O_7.HI$; and luteolin hydriodide, $C_{15}H_{10}O_6.HI$. It is also shown that whereas quercetin tetramethyl ether resembles the monomethyl ether of rhamnetin in reacting with sulphuric acid, and not with the haloid acids, dibromoquercetin and tetrabromo-morin yield no compounds with mineral acids. The other known members of the quercetin series are dioxylavone (Friedländer and Rüd., Ber. 1896, 878) and chrysin, the colouring matter of poplar buds. The former has been shown by its discoverers to yield acid compounds, but, on examination, the latter was found to be devoid of this property. Various members of the ketone group (gallaacetophenone, alizarin, and maelurin), of the xanthone group (gentisin, euxanthone, datiscetin), and of the anthraquinone group, were examined in this respect, but yielded no compounds with mineral acids. Catechin and kinoin also, the latter a constituent of malabar kino, did not react.

For the constitution of the acid compounds two schemes are put forward, the first a similar one to that suggested by Nietzki and Schröber (Ber. 1895, 50) for the phthalicin salts, and a second depending upon the saturation of the ethylene bond in the *γ*-pyrone ring.

It is considered probable that this reaction is characteristic of the quercetin group, and will thus be of service for distinguishing its members from the other classes of non-nitrogenous, yellow, mordant dyestuffs which are at present known to exist.

Acid Magenta and Schiff's Reaction. L. Lefèvre. Bull. Soc. Chim. 15, 1169.

See under XXIII., page 922.

Benzene Sulphinic Acid: A New Reagent. [Presence of Quinone and Quinonoid Groups.] O. Hinsberg and A. Himmelschein. Ber. 1896, 29, 2019.

See under XXIII., page 922.

PATENTS.

Dyestuffs [Yellow, Brown, and Black] for Cotton. The Manufacture and Production of. H. E. Newton, London. From "The Farbenfabriken vormals F. Bayer and Co.," Elberfeld, Germany. Eng. Pat. 22,417, Nov. 23, 1895.

COTTON colouring matters have been obtained by heating sulphur and alkaline sulphides together with amidosulphonic acids or nitrosulphonic acids, amido or nitrohydroxysulphonic acids, hydroxy- or dihydroxysulphonic acids of the benzene or naphthalene series. In the present specification these sulphonic acids may be replaced by carboxylic acid derivatives or by the simple hydroxy derivatives of the benzene or naphthalene series, such as phenol, the cresols, xylenols, resorcinol, its isomers and homologues, *α*- and *β*-naphthol, dihydroxynaphthalene, and the like. The colouring matters dye unmordanted cotton from yellow, through brown and olive-green, to greyish-black and deep black, not only from hot but also from cold baths, and give shades fast to light, alkalis, acids, washing, and fulling. For example, a mixture of 1 kilo. of nitrosalicylic acid, 2 kilos. of sulphur, and 6 kilos. of sodium sulphide ($Na_2S + 9H_2O$) is heated in an oil-bath to 160° C., with constant agitation. The melt at first froths violently, and when this has subsided, the temperature is slowly raised to about 250° C., which is maintained for about 3—4 hours. When cold, the melt is dissolved, together with 3 kilos. of sodium sulphide, in hot water, filtered, and evaporated to dryness. The greenish-black mass produced, can be employed directly for dyeing, and cotton kept for several hours in a cold aqueous solution of it becomes dyed a greenish-black. An analogous method may be employed for obtaining a dyestuff from crude cresol. A mixture of

1 kilo. of crude cresol, 1 kilo. of sulphur, and 1.4 kilos. of caustic soda-lye (sp. gr. 1.355) is heated under an inverted condenser on a water-bath until the melt has become uniform. It is then heated in an oil-bath for 4 hours to 170° C., and for a further 4 hours to 250° C. (temperature of the oil in each case). The melt may then be used directly for dyeing, and it gives in a cold bath, together with a little sodium sulphide, dark brown or brownish-black shades on unmordanted cotton fast to alkalis, acids, washing, and light. Instead of using the melt directly, it may be dissolved in 10 litres of water, filtered, and the dyestuff salted out. On drying, it then forms a greyish-black powder, which dissolves easily in water and turns blue on the addition of an alkaline sulphide. One kilo. of β -naphthol is heated on the water-bath under a reflux condenser, with 2 kilos. of sulphur and 5 kilos. of sodium sulphide until a uniform melt is obtained. The temperature is then raised by means of an oil-bath, first to 160° C. and afterwards to 200° C., where it is maintained for 2–3 hours with constant agitation. When cold, the melt is dissolved in hot water, filtered, and evaporated to dryness. The brownish-black mass obtained may be readily powdered, and dyes unmordanted cotton brown from a hot bath containing soap and potassium carbonate, and a deep brown-black from a cold bath in presence of an alkaline sulphide. Under similar treatment, α -naphthol gives a greyish-black and 2,3'- or 2,2'-dihydroxynaphthalene give dark-black colouring matters.—T. A. L.

Basic Blue Dyestuffs, Manufacture of. O. Imray, London. From "The Farbwerke vormals Meister, Lucius, and Brüning," Höchst a. M., Germany. Eng. Pat. 23,853, Dec. 12, 1895.

THE process consists in heating together under pressure in an indifferent solvent, a safranin together with an aromatic diamine. The most valuable colouring matters thus obtained have been those produced from a safranin containing an alkylated nitrogen and diamidodiphenylmethane, diamidodiphenylmethane, diamidodiphenylmethane, and *p*- and *m*-phenylenediamine. An autoclave, provided with an agitator, is charged with 50 kilos. of dimethylsafranin (from dimethyl-*p*-phenylenediamine and aniline), 25 kilos. of diamidodiphenylmethane, and 250 litres of water, and heated for 4–6 hours at 180° C. until the reddish-violet safranin colour has disappeared. More water and the necessary quantity of hydrochloric acid are then added, when the whole melt dissolves up. The dyestuff may be precipitated with salt and zinc chloride, when it forms a black sandy powder, which dissolves easily in water with a blue colour. Sodium carbonate or acetate precipitate the violet-red base, and sulphuric or hydrochloric acid also precipitate the dyestuff. The solution in concentrated sulphuric acid is green, which turns blue on dilution with water. By heating in the same manner as above 50 kilos. of dimethylsafranin with 300 litres of an aqueous solution containing 25 kilos. of *p*-phenylenediamine, a similar colouring matter is obtained, which, however, gives a pure blue, and not a reddish-violet, when its solution is precipitated with alkalis. The condensation can also take place in alcoholic solution, the alcohol being distilled off previous to the separation of the dyestuff.—T. A. L.

Colouring Matters [Cotton Yellow], Impts. in the Manufacture of. H. H. Lake, London. From K. Ochler, Offenbach-on-the-Maine, Germany. Eng. Pat. 1331, Jan. 18, 1896.

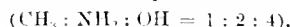
THIS colouring matter, which dyes unmordanted cotton yellow, is a derivative of tolylene diamine sulphonic acid [$\text{CH}_3 : \text{NH}_2 : \text{SO}_2\text{H} : \text{NH}_2 = 1 : 2 : 4 : 6$] and nitro-*m*-phenylenediamine, and is obtained according to the following process. A solution containing 11.2 kilos. of the sodium salt of the above-mentioned tolylene diamine sulphonic acid together with 6.9 kilos. of sodium nitrite in 500 litres of cold water is poured into an ice-cold dilute solution containing 50 kilos. of hydrochloric acid of 22.5° B. When the nitrite has all been taken up, the liquor is poured into a solution of 15.5 kilos. of nitro-*m*-phenylene diamine "in the calculated quantity of strong diluted muriatic acid," when an orange precipitate is at once formed. After

standing 24 hours, the whole is heated to boiling and the dyestuff acid is converted into its sodium salt by the addition of 35 kilos. of sodium carbonate, after which it is salted out and dried. It forms a light brown powder, soluble in water to a yellow solution, which gives a gelatinous yellowish precipitate on the addition of an acid. The colouring matter gives clear yellow shades on unmordanted cotton, whilst by employing an acetic acid solution in the above process very much paler shades can be obtained.

—T. A. L.

Colouring Matters of the Rhodamine and Rhodol Groups, Manufacture of. O. Imray, London. From "The Society of Chemical Industry in Basle," Basle, Switzerland. Eng. Pat. 19,516, Sept. 3, 1896.

IN the preparation of rhodamine sulphonic acids it is the *o*-tolyl derivatives which are the most valuable. Hitherto it has been impossible to obtain a remunerative yield of a sufficiently pure product. The patentees have discovered a method of separating a phthalic derivative of *m*-oxyphenyl-*o*-tolylamine which can be applied for the preparation of a whole series of *o*-tolylrhodamines. When *m*-oxyphenyl-*o*-tolylamine is heated with phthalic anhydride it is observed that the melt, which at first is fluid, thickens towards 120°–130° C. If, when this takes place, the melt be cooled and extracted with alcohol, the residue consists of the condensation product (consisting of equivalent quantities of phthalic anhydride and *m*-oxyphenyl-*o*-tolylamine), which forms minute greenish-yellow tablets. The new compound is sparingly soluble in ordinary organic solvents and is insoluble in dilute mineral acids, but dissolves easily in alkalis. It turns violet when heated to 180° C. and melts above 200° C. with complete decomposition. On fusing with resorcinol or other products employed in the production of rhodamines, reaction readily takes place, forming *o*-tolylrhodol and *o*-tolylrhodamine. These products can be very readily sulphated by heating with 80 per cent. sulphuric acid on the water-bath, and yield rhodamines soluble in water, which dye wool and silk evenly from an acid bath violet-red to reddish-violet shades fast to air and light. The following examples give the quantities employed. A mixture of 17.5 kilos. of the condensation product, 5.5 kilos. of resorcinol, and 15 kilos. of potassium bisulphate, is heated with constant agitation to 170°–175° C. for about one hour until the melt thickens. On cooling, it forms a brittle vitreous mass, which, after pulverisation, is extracted first with water and afterwards with toluene. The resultant residue when ground forms a brown powder and consists of the sulphate of *o*-tolylrhodol. (According to Ger. Pat. 54,684 "rhodol" is the simplest rhodamine in which an amido group has been replaced by hydroxyl.) In a similar manner the sulphate of *o*-tolylhomorhodamine is obtained by heating together 17.5 kilos. of the condensation product, 6.2 kilos. of *o*-amido-*p*-cresol—



and 15 kilos. of potassium bisulphate to 190° C. until a fluid melt is obtained, when it is allowed to fall to 180°–183° C. and kept at this temperature for one hour, being subsequently worked up as above. The sulphonation is carried out as follows:—1 kilo. of *o*-tolylrhodol sulphate is dissolved in 5 kilos. of sulphuric acid (66° B.), and heated to 45°–50° C. until a sample is completely soluble in sodium carbonate solution. The melt is then run into 90 litres of water and the sulphonic acid filtered off. After washing, to remove the greater part of the sulphuric acid, it is dissolved in sodium carbonate solution, and the sodium salt of *o*-tolylrhodol sulphonic acid is salted out. The brilliant brown powder obtained is readily soluble in water, and dyes wool and silk reddish-violet from an acid bath. In a similar manner dimethyl-*o*-tolylrhodamine sulphate (from dimethyl-*m*-amidophenol and the condensation product) is converted into a sulphonic acid by heating with 10 times its weight of 80 per cent. sulphuric acid for 4–5 hours on the water-bath. The sulphonation can also be effected by means of fuming sulphuric acid, but in this case at a temperature of 0–5° C. A table is appended to the specification giving reactions of the various rhodols and rhodamines obtained by the methods described.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Cotton, A New Process for the Production of Silk-like Gloss on. II. Lange. *Färber Zeit.* 7, 441—442.

In the well-known mercerising process, the cotton contracts by about 17 per cent. of its original length, and after the treatment with caustic soda and washing with water, it is not possible by stretching to restore the fibre to its former length. According, however, to a patent of Messrs. Thomas and Prevost, of Crefeld, if the cotton be kept in a stretched condition during the mercerising process, or if it be stretched after the treatment with caustic soda and before washing, the yarn or fabric may not only be caused to retain its original length, but the cotton acquires at the same time a lustrous appearance similar to that of *chappe silk*. Cotton thus treated is inferior in tenacity to mercerised but superior to unmercerised cotton, and in power of attraction for colouring matters it also occupies an intermediate place. When examined microscopically, the fibres appear round and perfectly transparent.—R. B. B.

Waterproofing of Fabrics, Fibres, and Paper by means of Formaldehyde. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 484.

ACCORDING to Ger. Pat. 88,114, Sept. 24, 1893, *Chemische Fabrik auf Actien* vormals E. Schering, Berlin, textile fabrics or paper, &c., are saturated with gum or gelatin solution, and then subjected to the action of gaseous or dissolved formaldehyde. The gelatin becomes insoluble in hot water and forms an impervious elastic coating. Substitutes for gutta-percha paper for antiseptic bandages may thus be prepared.—R. B. B.

New Process of Retting Flax and Hemp. U.S. Cons. Reps., Oct. 1896, 295.

AT a meeting of the Flax Supply Association of Belfast, held on July 29 last, a paper on an improved system of retting flax and hemp, the invention of Messrs. Loppens and De Swarte, was read, in which it was claimed that by a simple arrangement of apparatus, the virtues of the system of steeping flax in the River Lys, which had hitherto been supposed to belong to that river alone, could be extended indefinitely. Any water free from a mixture of lime or iron could be made as efficient as the waters of the Lys.

The new process has been at work two years, and flax retted thereby has been regularly sold in the market of Courtrai, Belgium.

The following is an abstract of the system:—

It appears that the retting tanks are made up of two principal parts, the upper and the lower, separated from each other by an open floor. On the walls of the upper part, means are provided for keeping the flax straw suitably submerged by crossbeams, working in vertical slides, and capable of being fixed at any required height. In the lower part of the tank the inlet is provided just under the open floor, and the outlet at the floor proper. The flax straw is tied up in double sheaves, the root end of one half being placed alongside the top end of the other, and so approximately cylindrical in shape; these sheaves are placed in a vertical position on the open floor, moderately tight, and as regularly as possible; ordinary straw is then spread over the top to keep off dust or the effects of the weather, and boards are placed on this to equalise the pressure of the crossbeams, which are fixed so as to insure the straw being suitably submerged when the tank is full and working. The tank is then filled by opening the inlet and closing the outlet, and, as the level of the water rises, the straw rises also, till it is stopped by the crossbeams, where it remains motionless, pressing upwards all the time more or less. The inlet and outlet taps are then regulated so as to maintain the water at the right level and insure its being often enough changed. The changes which occur in the retting mass may be set down as follows:—The water surrounding the stalks dissolves various vegetable substances, some of which are naturally soluble, while others become so under the action of fermenta-

tion. Thin streamlets of heavy juices are thus formed which flow down the stalks and slowly cross the layer of fresh water below the retting mass, and this without mixing with it, owing to the extreme slowness of the motion; on the bottom of the tank they then form a layer of dirty and denser water, which runs off by the outlet, while, at the same time, the fresh water just above it works its way up through the retting straw, also in the form of thin streamlets, which take the place of the descending ones. This circulation, consisting in the natural fall of heavy juices and the corresponding rise of fresh water, takes place uniformly and to the exclusion of every other with equal facility in every part of the retting mass, owing to the vertical position of the stocks and the equal pressure all over the tank. The principal advantages which may be expected to be derived from the system are the following:—(1) The possibility of natural retting in running water—that is to say, the best; (2) the greatest uniformity obtainable in retting; (3) larger yield of fibre than any other system; (4) the results are certain and invariable; (5) it saves labour; (6) it limits the water consumption to what is strictly necessary to natural fermentation; (7) full benefit is derived from the water used in retting; (8) rivers are not contaminated; and (9) it is suitable for every part of the world where flax or hemp is cultivated.

The association considered this method of steeping flax so important that a committee was appointed to confer with the patentees and ascertain from them on what terms they would be prepared to grant a license for the use of their patent in Ireland, and report to a joint committee appointed by the Irish Land Commission for the improvement of the culture of flax.

Weighting in Silk Yarn, The Quantitative Estimation of. Herzfeld. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 485.

See under XXIII., page 923.

PATENT.

Cotton Waste or other Fibrous or Textile Material, Impts. in Cleaning or Removing Grease from, and in Apparatus therefor, and for Recovering the Solvents. J. W. Mitchell, Rawtenstall. Eng. Pat. 23,429, Dec. 6, 1895.

THIS invention relates to the bleaching and scouring of cotton waste that has been used for the cleaning of machinery, the oil being removed by means of volatile solvents such as "benzene," both oil and solvent being recovered.

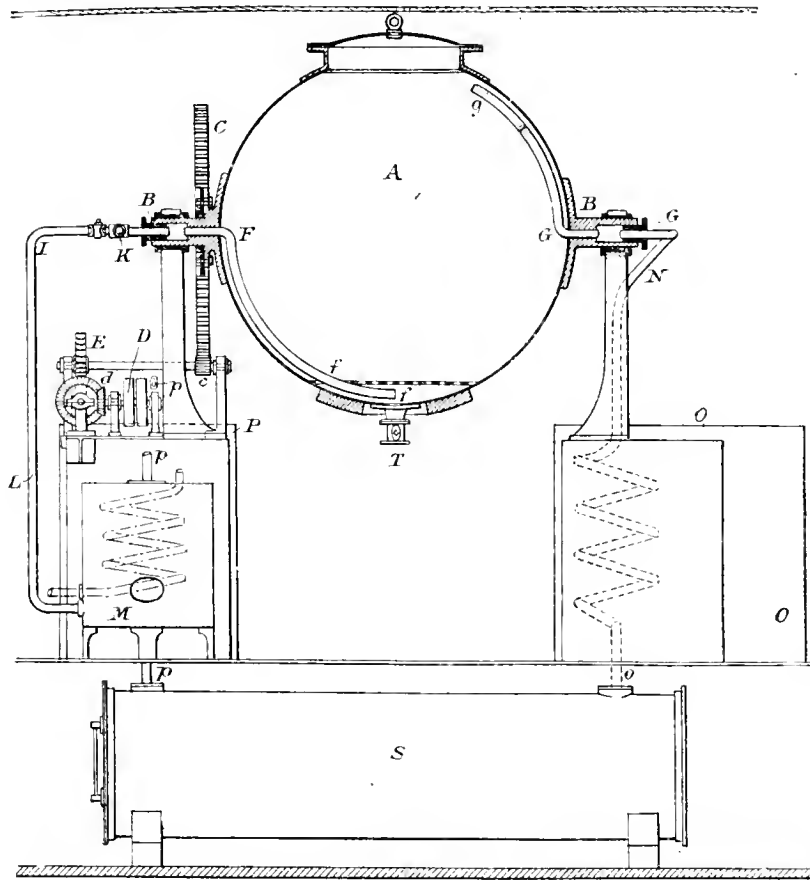
The apparatus consists of a kier A, mounted upon trunnions B, upon which it is caused to rotate by suitable gearing, such as the spur wheel C on one trunnion, and the pinion *c* driven from the pulleys D by the bevel wheels *d*, worm (not shown), and worm wheel E. Through each of the trunnions B is passed a pipe F and G respectively, terminating inside the kier, one at the top and the other at the bottom, in pipes *f* and *g*. To the tube F are connected three branch pipes, of which L leads to the still M, K to the reservoir containing "any suitable scouring liquor," and H (not shown) serves as a supply of steam. The tube G at the other trunnion is connected by means of the pipe N with the condenser O. Each of these pipes is provided with suitable valves or stop cocks. The still M is connected with the condenser P, and the condensers are respectively connected with the tanks R and S (of which the latter only is shown) by the pipes *o* and *p*.

The still M, which is heated "by a steam coil or other suitable means," and the condenser P are so arranged that a continuous circulation of the "benzene" or other solvent can be carried on through the kier A, being pumped in through the tube G, and back through the still M, and condenser P, to the store tank R (on the other side of S, and not shown), from which it is again pumped into the kier.

The operation is as follows:—The greasy waste is put into the kier A, which is then caused to rotate slowly. The solvent is pumped into the kier through pipe G, until it overflows through pipe L, into the still M, until the solvent

runs off nearly clear. The solvent is recovered from the oil in the still M by distillation, the vapours being passed through condenser P, and thence through the pipe p to the

tank R (not visible). Steam is then admitted into the kier to vaporise the solvent remaining in the material, the vapours being passed through the condenser O to the storage tank S.



"A suitable lye or scouring liquor" is then pumped into the kier through branch pipe K, and "the material boiled until the operation is completed."—1. S.

VI.—DYEING, CALICO PRINTING, PAPER-STAINING, AND BLEACHING.

Leather, The Dyeing of, for Shoes. H. Burgess. J. Soc. Dyers and Colourists, 1896, 12, 207.

Brown shoe leather, for which a largely increased demand has been evident for the last few years, is manufactured principally from calf skin for the better article, and from sheep skin for the inferior. Sheep skins are largely imported from Australia and New Zealand, already tanned, the tanning agent being the bark of the various species of acacia, natives of Australia, which contain the deep red mimotannic acid, and consequently the tannage is of a reddish-tint; these skins are capable of being beautifully dyed.

In preparing tanned calf skins for dyeing, the large quantity of ellagic acid ("bloom"), which is almost invariably precipitated during the tanning process, and which becomes intimately mixed with the fibres of the skin, must be removed, or very poor shades will result. The goods are first shaved down to the required substance, and are then agitated with warm water in a revolving drum to break and soften them, this operation also removing a portion of the "bloom." The skins are then placed on a marble slab, and each one knocked out perfectly flat and level, the grain of the skin being smoothed out until it presents an even surface. The grain of the skin is then scoured with a kind of brass brush, and the

"smoothing-out" process repeated, thus removing the remainder of the "bloom" from the skin. The skins are then treated with a very weak, warm solution of soda crystals to remove surface grease, then with sulphuric acid of about 0.75 per cent. strength, and finally with water until they no longer taste acid, or, if to be dyed with acid colouring matters, only slightly so. After draining, the skins are smoothed out on the grain side, and are then placed flesh side together in pairs, ready for the dye-bath.

Owing to the great difference in weight of similar-sized skins, and to the fact that only the grain side of the skin must necessarily be dyed, it is impossible to calculate percentages of colouring matter simply to weight of skins; the correct proportions are only to be learnt by experience. The acid colouring matters are so easily applied to leather, and the results are so satisfactory, that they are to a large extent replacing other classes of colouring matters. The goods are entered into the bath at the maximum temperature (about 112° F.), and the bath allowed to cool slowly. The goods are turned over by hand in the dye bath, care being taken that no single pair shall remain long at the bottom of the pile. To effect a saving of labour, the skins may be dyed in large paddles or reels, but a certain amount of colouring matter is wasted by being absorbed on the flesh side of the skins; also the variety of shades obtained is greater, skin for skin, than when the first method is used.

With the following three colours, *viz.*, Azo Flavin R S, Fast Brown, and Blue Black (Induline), almost any shade of brown required for shoe purposes may be obtained.

Eight parts of Azo Flavin and 0.5 part of Fast Brown produced a light Russia brown shade.

Four parts of Azo Flavin, 1 part of Fast Brown, and 0.5 part of Blue-Black produce a medium shade of brown.

Four parts of Azo Flavin and 2 parts of Fast Brown produce a red-brown.

To produce a chocolate or dark brown, 1 part of Blue-Black and 1 part of Fast Brown are first applied to the skins; afterwards to the same bath is added a mixture of 4 parts of Azo Flavin and 1 part of Fast Brown.—A. S.

Cotton, Bleaching of, by means of Electrolytically prepared Solutions. H. Wartner. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 449—451.

MEETING with considerable difficulties in the industrial application of the electric bleaching process, A. Vogelsang, of Dresden, has recently devised improved apparatus with which he is said to have achieved perfectly satisfactory results.

The cotton yarn should be closely packed in very concentrated liquors prepared in a vessel (the electrolyser) through which flows a solution of rock salt, while at the same time an electric current from a dynamo machine circulates through the liquid. The bleaching liquid obtained in this manner is kept in closed vessels until required for use. The advantages of the electric bleach are thorough and even bleaching, and, compared with the use of bleaching powder, less liability to tender the cotton, and decreased cost. Although the initial expenditure is somewhat great, the cost of working is low, and at present prices a bleacher could recoup himself in two years for his original outlay. The cost of the necessary plant, exclusive of buildings, is about 425*l.*, made up as follows:—Electrolyser, 180*l.*; vessels for boiling and bleaching, each to hold 1,500 lb., complete with pump, 75*l.*; dynamo machine, which can also be used for electric lighting purposes, 45*l.*; squeezing rollers or hydro-extractor, 30*l.*; washing machine, 75*l.*; various wooden casks, 20*l.*. Two men can bleach and wash off 1,500 lb. of yarn in a day.

It is important to note that a water supply which is unsuitable for bleaching by the ordinary method is equally so for the purpose of electric bleaching.—R. B. B.

Chappe Silk, A New Process for the Softening and Bleaching of. A. Eichholzer. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 483—484.

"CHAPPE silk" is the product of bored and double cocoons, as well as of those injured in steaming, also the inner and outermost portions of the cocoons. It finds extended use in the manufacture of plush and velvet, and its chief requirements are softness and a thorough bleach, in order that pure and bright colours may be obtained.

Softening.—If the acid remaining in the fibre from dyeing be not perfectly neutralised, the iron and steel parts of the looms are attacked, and, to avoid this, dyeing usually takes place in a very weak acid bath with the addition of chappe "boiled-off" liquor. After dyeing, the silk is worked in two or three successive baths of cold water and then softened in a bath containing per kilo. of silk, 20 grms. of alum and 10 grms. of soda. In this process there is a great waste of dye-stuff on account of the insufficient acidity of the dye-bath. According to the new process the chappe is dyed in a "broken" soap-bath, as usually employed with acid colours for silk, and after one or two baths of cold water it is softened with a mixture consisting of 2 litres of olive oil, 1 litre of sulphuric acid of 66° B., and 1 litre of alcohol. Of this mixture 150 c.c. are used per kilo. of silk, the yarn is given seven turns and then hydro-extracted.

Bleaching.—Until recently, "chappe" was bleached with hydrogen peroxide and silicate of soda. Sodium peroxide is, however, to be preferred, and the process may be carried out as follows:—After boiling-off in the usual manner and washing out the soap, the silk is entered into a bath prepared by gradually dissolving 3 kilos. of sodium peroxide in 25—30 litres of cold water and pouring the solution into water at 55° C. In this bath the silk is turned three times, the temperature is then raised to the boil, and after working half an hour in the cooling bath, the temperature is again raised to the boil. After another half hour the silk is taken out, given three turns in water at 30° C., and

worked a quarter of an hour in a bath containing 30 per cent. of Marseilles soap. It is then hydro-extracted and is ready for dyeing.

For very pale shades the chappe may be further bleached in the sulphur chamber or with liquid sulphurous acid.

—R. B. B.

Wool-Bleaching with Bisulphite by the Wet Process.

Leipziger Färber u. Zeugdrucker Zeit. 45, 471.

THE process for 10—15 kilos. of wool in the form of loose wool, yarn, or piece goods is as follows:—The wool is well washed and hydro-extracted, then worked in a bath containing 500 litres of cold water free from iron, 4 litres of sodium bisulphite 38°—40° B., and 300 c.c. of sulphuric acid 66° B. After 25—30 mins. it is taken out, allowed to drain, and then tinted in a fresh bath with Alkali Violet or Methyl Blue. Finally, it is rinsed and dried at the ordinary temperature, or, if the presence of bisulphite be unobjectionable in the operations which follow, rinsing may be omitted.

The bleaching bath may be used for several successive lots of material, if for each fresh lot four-fifths of the original amounts of bisulphite and sulphuric acid are added.

—R. B. B.

Coloured Woollen and White Half-Wool Goods, Acid Stains on. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 468—469.

DARK stains on dyed woollen pieces are a well-known source of trouble to the dyer, and a frequent cause of this defect is imperfect neutralisation after the carbonising process. If goods from which the acid has not been entirely removed are imperfectly hydro-extracted, or if the pieces remain hanging over frames, &c., the acid collects in patches and causes dark stains when dyeing in a neutral or alkaline bath, e.g., with Indigo or Alkali blue.

Similar stains occasionally occur in pieces which have not been carbonised, and may arise from want of perfect cleanliness, e.g., a piece may be washed or hydro-extracted in a washing machine or hydro-extractor in which a piece containing acid has been previously treated.

In the case of white half-wool flannels dirty-yellow stains may be caused, and the cotton may even be tendered and holes made in the fabric by the oxidation of the sulphurous acid on the material during bleaching to sulphuric acid, owing to the admittance of air into the sulphur chamber. The sulphuric acid can be prevented from spreading and its injurious action confined to the parts originally attacked by steeping the goods in water after bleaching, and such treatment is also useful in removing the odour of SO₂. It is possible that the purity of the white may be affected by this treatment with water, but the pure white is easily restored by tinting with Methyl Violet.—R. B. B.

Alizarin Blue S, in Paste and Powder, and its Application in Calico and Linen Printing. *Leipziger Färber u. Zeugdrucker Zeit.* 45, 459.

THE application of Alizarin Blue S in printing depends upon its decomposition during steaming into its constituent parts, viz., insoluble Alizarin Blue and sodium bisulphite. Evidently a premature decomposition of the colour before printing must be avoided, and for this reason the ingredients of the printing colour should be mixed together in the cold. This is easily carried out, since Alizarin Blue S, even in powder form, is readily soluble in cold water, or in the cold thickening. The colour should be used as soon as prepared, since it rapidly deteriorates and produces only poor and dull shades. An addition of potassium sulphocyanide is frequently made, to obviate the deleterious effect on the colour of contact with iron. The printing colour for a medium blue shade should consist of 100 grms. of Alizarin Blue S paste, 740 grms. of starch-tragacanth thickening, 10 grms. of potassium sulphocyanide, 20 grms. of calcium acetate at 20° B., and 130 grms. of water. After printing, steam for half an hour without pressure, and finish by clearing and seaping in the usual manner. The colours are said to be exceedingly fast to light, soap, and chlorine.—R. B. B.

Diazo Compounds with Zinc Chloride in Printing on Goods prepared with Sodium-Beta-Naphthol; The Application of Double Salts of. A. A. Smirnoff and B. A. Rosenthal. *Färber Zeit.* 7, 442—443.

The chief obstacle to the more extended use of "ice colours" in printing is the unstable nature of the diazo printing colour, it being necessary to prepare fresh colour three or four times daily, and this involves the expenditure of much time and labour and the use of large quantities of ice. This difficulty may be removed by substituting for the diazo compounds, their double salts with zinc chloride, for these salts mixed with cold tragacanth thickening may be preserved unchanged for several days.

The diazo solution is prepared in aluminium or enamelled iron vessels in the ordinary manner, and when diazotisation is complete the requisite amount of zinc chloride is gradually added with continual stirring. The double salt is formed as a voluminous precipitate, which, after settling, is thrown on to a filter and allowed to drain.

The goods prepared with sodium- β -naphthol (to which is added sodium acetate) are printed with a colour consisting of this paste and tragacanth thickening, then passed through a weak hydrochloric acid bath, washed, and soaped. The most satisfactory results have been obtained with α -naphthylamine hydrochloride, which yields a bright cardinal of a yellowish tone.—R. B. B.

Woollen Pieces dyed with certain Colouring Matters. Process to make Fast to Finishing Operations. [Addition of Oxidising Agent with Colour.] Leipziger Färber u. Zeugdrucker Zeit. 45, 471.

ACCORDING to a recent German patent, the colour of woollen goods dyed with certain azo dyestuffs suffers a considerable change during finishing operations where heat is employed, owing to decomposition of the colouring matter into its component parts. The blacks, for example, dyed with amido-azo naphthalene derivatives change to brown on steaming under pressure. This decomposition can be avoided by the addition of a suitable oxidising agent to the dye-bath. The oxidising agent must be one which is not reduced by the wool itself, and copper salts or chlorates are found to be the best for this purpose. An addition should be made of 3—4 per cent. of copper sulphate, or 5—8 per cent. of a chlorate (on the weight of wool); if chlorates are employed the pieces must not be washed after dyeing. Dyestuffs which are rendered fast by this process are Naphthylamine Black D, Naphthyl Blue-Black N, Anthracite Black, Jet Black, and Sulphone Black.

—R. B. B.

p-Nitraniline Red on Cotton Yarn. W. Römer. *Färber Zeit.* 7, [27], 425—426.

THE processes published by the colour manufacturers were all intended for the use of piece dyers, for which purpose they are well suited, but did not answer for dyeing in the hank. Even the special process of Ulrich (*Färber Zeit.* 5, [18], 285—287) has been found difficult of application on account of the great care that was necessary in carrying it out. The first practical process for yarns, the author says, originated in Alsace. Its main features are simplicity of manipulation and its adaptation to the machinery of the Turkey-red dyer. The process is as follows:—A lead-lined vessel of about 15 litres capacity is charged with 30 litres of water and 1 kilo. of soda-lye of 10° B., and the mixture is heated to boiling with steam, using a lead pipe for the purpose. 1,200 kilos. of β -naphthol are next added, and when this is dissolved, 4,250 kilos. of 50 per cent. Turkey-red oil. The whole is then made up to 40 litres, and allowed to cool.

The previously boiled and dried yarn is impregnated with this solution in single lots of $\frac{1}{2}$ kilo. each. This is done in precisely the same manner as the oiling in the Turkey-red process, the same machine being used for the purpose. The hooks and the pan of the machine are all lead-coated. After impregnation, the yarns are centrifugalised (the surplus liquor being returned to the stock) and dried on a Hartmann rotating drying machine at 60° C.

The developing bath is prepared as follows:—In a wooden vessel of about 12 litres capacity, 2,070 kilos. of *p*-nitraniline are made into a paste with 1,750 litres of boiling water, 3,900 kilos. of hydrochloric acid of 20° B. are next added, and then 3,25 litres of boiling water, the whole being stirred whilst these additions are being made. A clear solution is thus obtained, which is immediately allowed to run in a thin stream, preferably through a glass siphon, into 350 litres of cold water, the latter being kept stirred. A fine precipitate separates, which, on the addition of 1,080 kilo. of sodium nitrite, soon dissolves again. The nitrite solution must be added quickly and all at once, whilst stirring briskly.

$\frac{5}{8}$ litres of this solution are put into the pan of an oiling machine, along with 400 c.c. of a cold solution of sodium acetate (3 kilos. to 30 litres of water) and 3 litres of cold water. One half kilo. of yarn is immersed in this solution, and passed through the machine until the colour is developed. The surplus liquor is run into an empty vessel and preserved. A second lot of $\frac{1}{2}$ kilo. is treated in a similar way, and to the liquor now remaining in the pan is added that left from the first lot, and in this a third lot is developed, after which the liquor is considered exhausted, and run to waste. This process is continued until the whole batch is developed. The yarn is then soaped, rinsed, passed through acidulated water, rinsed again, and dried.—I. S.

PATENTS.

Coloured Border Effects, Impts. in the Production of, on Fast Black-dyed Grounds upon ordinary Grey Cotton Cloths, especially suitable for Umbrella Cloths, Selvedges, and the like. L. C. G. Sharp, Low Moor, Bradford. Eng. Pat. 21,355, Nov. 11, 1895.

THE production of white or coloured selvedges on fast black cloth, consisting essentially in printing white or coloured resists on cloth impregnated with an aniline black mixture, after drying, but before the development of the black.—I. S.

[Cotton] Bleaching, Washing, Dyeing, and Drying Yarn in the Cop, Impts. in Apparatus for. M. H. Smallwood. Manchester. Eng. Pat. 22,185, Nov. 21, 1895.

THE apparatus consists of an upright cylindrical vessel, steam jacketed, and provided with a hinged cover secured by swivel bolts. A smaller cylindrical vessel, also provided with a removable lid, is placed inside the large vessel, and in its sides are drilled and tapped rows of small holes, into each of which is screwed a perforated tube carrying the cops. To charge the apparatus, the inner vessel is raised by means of a crane, the tubes carrying the cops are screwed into the holes, and the vessel is then lowered into the outer case, which is closed by the lid.

A system of pipes and valves communicate with the inner and outer vessels, and several tanks containing bleaching, dyeing, washing, and other liquors, which are circulated through the apparatus as may be required.—I. S.

Cotton and Cotton Goods, A New or Improved Process of Bleaching. A. Ender, Dornach-Mülhausen, Alsace, Germany. Eng. Pat. 14,252, June 27, 1896.

BLEACHING cotton and cotton goods by treating them with a lye containing an alkaline chloride or similar compound, and thereafter steaming and pressing them.—I. S.

Dyeing Improved Spot, Random, or any other Particoloured Dyed Yarns. [Use of Metal Clips.] G. White, Leicester. Eng. Pat. 23,466, Dec. 7, 1895.

THE improvement consists in using metal clips to take the place of paper, string, knots, &c., hitherto used for the purpose of protecting parts of the yarn from being acted on by the dye-liquor.—I. S.

Mordants, Metallic; Impts. in Fixing on Fibres and Fabrics. A. Ashworth, Bury. Eng. Pat. 4890, March 4, 1896.

THE inventor claims the discovery of a new method of mordanting fibres, "rendering the steaming or dunging

process used with vegetable fibres unnecessary, simplifying also the mordanting of animal fibres, and producing fixed metallic mordants on the fibre." This new process requires the employment of "two metallic salts, both or one of them containing a metallic mordant, or consisting of a salt capable of conversion into a metallic mordant, selected in such a way that, if one of the salts only belong to the class of metallic mordanting agents, it must be easily decomposable and contain an acid more powerful than the one contained in the second salt, the acid of which has to be volatile; or if both be metallic mordanting agents, both must be decomposable and one of them must be combined with a more powerful acid than the other, whilst the acid combined with the latter must be volatile."

The following examples are given:—(1.) 100 parts of "bisulphite of iron," 18° Tw., and 50 parts of "muriate of chrome," 32° Tw., are mixed together, the cloth or fibre is passed through until it is saturated, dried, preferably in hot air, washed in hot water at about 90°–95° C., and dried. "The mordants will be found to be fixed without the aid of further dunging or steaming, and the fibre or fabric is ready for use." (2.) 100 parts of iron bisulphite, 18° Tw., and 100 parts of a 1 per cent. solution of sodium bichromate. (3.) 100 parts of aluminium acetate, 20° Tw., and 50 parts "muriate of iron," 20° Tw. (4.) 100 parts of aluminium chloride, 23° Tw., and 100 parts of sodium bisulphite 75° Tw. (5.) 100 parts of "muriate of chrome," 32° Tw., and 100 parts of sodium bisulphite, 75° Tw. (6.) 100 parts of a 10 per cent. solution of stannous chloride, and 100 parts of aluminium bisulphite, 26° Tw.

Some of these mordants may be used without further treatment as colours themselves.—I. S.

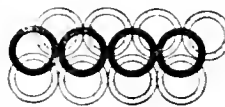
VII.—ACIDS, ALKALIS, AND SALTS.

Glover Tower. F. Lütj. Zeits. f. ang. Chem. 1896, 645–649.

In recent times many proposals have been made to replace the lead chambers in vitriol manufacture by reaction towers, so that the system consists of Glover and Gay-Lussac towers with the reaction towers between these. Should this proposal be carried into effect the Glover tower would become still more important than at present, and its proper construction would be a matter of still greater moment. Whilst the position of the tower, its dimensions, distance from the burners, and arrangement of the dust flue are important factors for a proper working, the inner arrangement plays still greater part than these. The function of this inner arrangement is to bring the hot gases entering below into the best possible contact with a down-flowing liquid without at the same time rendering the gas current too slow. Whilst a flint packing, as formerly used, only leaves some 15 per cent. of the tower space for the entering gases, the regular stone blocks allowed 35 per cent. of this space to be used, and with a properly-arranged cylinder-filling, this value can readily be increased to 58 per cent. This large capacity for gas is not, however, alone sufficient to ensure satisfactory working; it is still more necessary to bring the gas into intimate contact with large surfaces of the down flowing acid. On account of the tendency of the gas to travel upwards in a perpendicular direction, horizontal contact surfaces are to be avoided, and therefore the horizontally disposed stones before mentioned are not the most advantageous form of filling. The author also considers it open to question whether the recently introduced distributing cones are really efficient, since they both diminish the draught and have much useless surface.

With cylinders it is possible, by making use of the exterior and interior surfaces, to divide up a liquid very completely, and at the same time to offer continually fresh acid surfaces to the rising gases. It is essential that the cylinders should have a rough surface to hold the acid as much as possible during its descent, and also that they should be properly arranged in the tower. The author has employed, since 1885, cylinders of 160 mm. diameter, 120 mm. high, and having a wall thickness of 20 mm.

These are arranged as shown in the figure, so that each cylinder stands over the junction of three others standing in the row below.



There is thus above and below each cylinder four small passages, which are just sufficiently large to prevent frothing in the tower. About eight tiers of these cylinders give a height of one metre, and the gas must, therefore, in each metre traversed, divide and recombine itself eight times, the gas leaving each cylinder splitting up into four currents, which further on reunite. The acid passing downwards trickles partially down the sides of the cylinder and also partially falls in drops from tier to tier. Experience shows that rough-surfaced cylinders will take up more than ten times the amount of acid held by cylinders having glazed walls.

The cylinders described are white in colour and show a white stony fracture; they are harder than glass and capable of withstanding moisture, temperature change, a high temperature, and the long-continued action of various acids. They consist essentially of silica and clay burnt at a very high temperature.

The towers should not be left standing idle and open to the atmosphere, since a cylinder once used will disintegrate after a few weeks' exposure to the air, although the same cylinder will last for many years in a tower continually worked. This disintegrating action seems to be entirely mechanical, since no aluminium sulphate was found in the destroyed cylinder.

The author gives the following description of the method now adopted for packing a Glover tower:—Only moulding stones of highly acid-proof material are used; the figures apply to a round tower of 3 m. diameter. The floor is formed of a double layer of acid-proof plates 200 × 200 × 70 mm. in size, and the side walls are lined as far as the lower edge of the grid with large curved stones, 360 mm. long, resting on lead. This leaves an inner space of 2.280 m. diameter. The inlet piece for the acid-proof gas main is built into this lining and is formed by four large stones of the same thickness as the lining. The packing of the tower is borne by a grating of acid-proof plates resting on columns, which also serve to divide the gas. These columns are 1,400 mm. high and 200 × 200 mm. in section, and the plates resting on these, and supported also by the sides, are 500 mm. high and 120 mm. thick. Square stones are arranged between the columns and the sides to prevent slipping. The interspaces between the plates is 160 mm. across. On these plates are two layers of stones 340 × 80 × 200 mm., and these are followed by two layers of 250 × 125 × 60, all being arranged to form a grid. The whole is made fast by circumferential stones 250 mm., built in dry, and in a tower 10 m. high these stones are continued for some 3.5 m. above the grating, thus giving a total height of 6.25 m. From here to the top the walls are only 140 mm. thick. From the grating to the gas exit the tower is filled with the cylinders, arranged as already described. Such a tower can take large quantities of gas, will denitrate and concentrate very efficiently, and with careful treatment last a considerable period.—J. T. C.

Tetrachromite of Barium: A New Combination of Chromium Sesquioxide. M. E. Dufau. Bull. Soc. Chim. (3), 15, 1137.

This work was carried out in M. Moissan's laboratory.

The chromites of the formula MOCr_2O_3 , prepared by dry methods, are the most numerous and the better known. They are known as neutral chromites. M. Viard has formed basic chromites, whilst the author has now completed the series by forming an acid chromite of the constitution $4\text{Cr}_2\text{O}_3 \cdot \text{H}_2\text{O}$.

The author used one of Moissan's electric furnaces, lined sufficiently thickly with baryta, and charged with an intimate mixture of chromium sesquioxide and of anhydrous barium oxide in equal proportions. An arc produced by a current of 300 amperes at 50 volts pressure, was then passed over the mixture for 10 minutes. On cooling, he found a melted green mass, having a crystalline fracture. On treating this with hydrochloric acid, rapid action occurred, with liberation of much chlorine gas, and change of colour of the liquid from brown to green. He isolated and purified this crystalline portion, by repeated treatment with boiling hydrochloric acid, until nothing more was dissolved. There remained a mixture of crystals, separable into two layers by agitation in the liquid used for washing them—the lower one, dark and brilliant, representing the tetrachromite, and the upper one composed of lamellar green crystals of chromic acid.

The chromite of barium obtained in this way as small black brilliant crystals, yielded a brown powder with a slight greenish tinge. Their density was 5.4 at 15° C.

The author found this new chromite to be unattacked by hydrofluoric, hydrochloric, nitric, or sulphuric acids. Chlorine and bromine attacked it very slowly at a bright red heat, forming barium chloride and bromide respectively. Iodine had no reaction under similar conditions. Oxygen, below a red heat, produced a rapid incandescence with formation of chromate of barium; the oxygen of the air sufficed to produce this change slowly, if the chromite were powdered before heating. This great tendency to oxidise, explained the presence of the chromate in the mass found in the furnace, and also the changes which occurred on boiling the fused mass with hydrochloric acid. Steam at a red heat had no action upon the crystals; sulphur was equally inactive at a temperature which softened glass. Anhydrous hydrochloric and hydrofluoric acids acted very slowly at a red heat, and yielded amorphous fluoride and chloride of barium. The chromic oxide remained unattacked. The chromite was easily attacked by chlorate or nitrate of potash on fusion; the alkalis, both caustic and carbonate, acted similarly.

The author notes that, whilst barium yields a polychromite or acid chromite, calcium, under exactly similar conditions, yields a neutral chromite, and strontium yields no chromite, but only a chromate.—J. B. C. K.

PATENTS.

Electrolysis, A Process and Apparatus for Effecting. [Liquid Electrodes.] F. W. Golby, London. From O. Arlt, Goerlitz, Germany. Eng. Pat. 15,129, July 8, 1896.

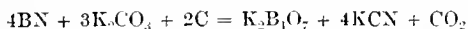
See under XI. A., page 908.

Electrolytic Decomposition of Liquids, Impts. in or connected with Apparatus for. [Mercury Cathodes.] G. Bell and G. W. Bell, Liverpool. Eng. Pat. 20,542, Oct. 31, 1895.

See under XI. A., page 908.

Alkaline Cyanides, Ferrocyanides, and their Derivatives: Impts. in the Manufacture of [through Medium of Boron Nitride]. G. C. Downing, London. From J. R. Moise, Paris. Eng. Pat. 19,201, Oct. 12, 1895.

ANHYDROUS borax is heated with ammonium chloride to obtain boron nitride, any ammonium chloride volatilised, being condensed. The mixture of boron nitride and sodium chloride obtained is washed with hot water, acidulated with hydrochloric acid, and the boron nitride separated is heated with stated proportions of potassium carbonate and carbon, to produce a mixture of potassium cyanide and borate, according to the equation—



The cyanide is dissolved out by alcohol. When it is desired to obtain a ferrocyanide, iron filings are added to

the materials treated, and the salts are separated by crystallising out the ferrocyanide from an aqueous solution of the mixture.—E. S.

Sulphuric Acid, The Concentration of [Utilisation of Heat], Impts. in or connected with. R. England, London. Eng. Pat. 22,715, Nov. 27, 1895.

CONCENTRATED and still hot sulphuric acid is cooled by means of cold dilute (chamber) acid, which latter is thus warmed before passing to the concentrating vessels. Also, the steam and acid vapour given off from the concentrators, is passed through coils immersed in tanks, into which cold acid is run, such acid being thus partially heated preparatory to concentration.—E. S.

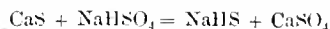
Alkaline Phosphates and Caustic Alkali, Impts. in or connected with the Manufacture of. [Electrolytic Method.] W. P. Thompson, London. From The Chemische Werke, formerly H. and E. Albert, Biebrich-on-Rhine, Germany. Eng. Pat. 23,572, Dec. 9, 1895.

CONCENTRATED solutions of phosphoric acid and of a soluble alkali salt, such as sodium nitrate, chloride, or sulphate, separated by a suitable diaphragm in an electrolytic cell, are electrolysed to obtain, in the anode compartment, nitric or sulphuric acid or chlorine, as the case may be; and in the cathode compartment, either a mono-, di-, or trisodium orthophosphate. The process may be interrupted at the proper time to obtain any one of these salts. A carbon anode and a lead cathode are preferably employed. When nitric acid or chlorine is produced, it may be recovered by heating the solution.

To obtain a caustic alkali, the sodium or potassium phosphate, obtained as described, is treated with caustic lime, calcium phosphate being produced as a by-product.—E. S.

Obtaining Hydrosulphide of Sodium, or Sulphate of Sodium, and Sulphuretted Hydrogen and Sulphate of Calcium from Sulphide of Calcium or Soda Residues, and Monosodium Sulphate or Bisulphate of Soda; A Process for. B. Willcox, London. From The Chemische Fabrik Griesheim, Frankfurt-on-the-Main, Germany. Eng. Pat. 720, Jan 10, 1896.

ALKALI waste is stirred in a large closed iron chamber with a little water, and then with a concentrated solution of acid sodium sulphate, which is gradually added. The reaction that takes place and the proportions to be used are indicated by the following equation:—



The lye, when separated from the calcium sulphate formed, may be used directly, or evaporated without access of air to obtain solid sodium hydrosulphide; or it may be converted into sodium sulphide by known methods. When it is desired to extract all the sulphur of the calcium sulphide, the proportion of bisulphate used is doubled, thus:—



the products being calcium sulphate, sodium sulphate, and hydrogen sulphide. The "bisulphate" used, is preferably that occurring as a by-product in certain chemical manufactures.—E. S.

Concentrating and Evaporating Liquids, Impts. in the Method of and Apparatus for, applicable also for obtaining Solutions of Salts and the like. [Circulation under Diminished Pressure.] A. Kumpmiller, Höcklingen, Westphalia; E. Schüttgen, Ischrohn, Westphalia. Eng. Pat. 17,488, Aug. 7, 1896.

THE liquid to be concentrated or evaporated is circulated through an upper vessel, called an evaporator, a vertical pipe leading from the bottom thereof to a coil in a heating vessel (through which steam or other heating medium passes), and thence through another vertical pipe back to

the first vessel, from which the vapour given off is withdrawn by means of a vacuum. If crystals separate out, there is introduced into the pipe leading from the evaporator a vessel containing a sieve upon which the crystals collect. If it is desired to dissolve salts or lixiviate ashes, they are placed on the sieve of another similar vessel, arranged on the second vertical pipe—that leading from the heater up to the evaporator. Fresh liquid may be introduced by a branch pipe into the first vertical pipe just beneath the collector for crystals, and this liquid may be the water of condensation from a condenser connected to the evaporator. —R. S.

VIII.—GLASS, POTTERY, ENAMELS.

Glass Substitutes in Germany. J. Soc. Arts, 1896, **44**, 858.

The principal substitutes for glass, in use in Germany, are tectorium, *fenster-pappe* and *hornglas*. Tectorium is a sheet of tough, insoluble gum—said to be bichromated gelatin—about one-sixteenth of an inch in thickness, overlying on both sides a network of galvanised iron or steel wire, the meshes of which are generally about one-eighth of an inch square. The tectorium in ordinary use is stated to be apparently covered on both sides with a varnish of boiled linseed oil. It is lighter than glass of equal thickness, is tough, pliant, and practically indestructible by exposure to rain, wind, hail, or any shock or blow which does not pierce or break the wire netting. It may be bent in any desired form and fastened in position by crimping, nailing, or with putty, like ordinary glass, and when punctured may easily be repaired. Its translucence is about the same as that of opal glass, its colour a greenish amber-yellow, which fades gradually to white from exposure to the sun. It is well adapted for use for illuminated windows, signs, and transparencies. For ordinary hotbeds and forcing houses, another and cheaper substitute for glass is the so-called *fenster-pappe*, which is, however, less durable than tectorium. It is prepared in the following manner:—Light wooden frames are covered with a tough, strong manila paper, fastened by nailing at the edges. The paper is then painted with ordinary boiled linseed oil until it is so saturated, that the last coat of oil forms a smooth glistening surface, like varnish. As soon as it is dry, the frame is ready for use. It admits sufficient light for growing plants, does not require to be shaded in hot sunshine, is light, durable, secure against breakage by hail or ordinary accident, and is stated to be about 100 times cheaper than glass. *Hornglas*, which has been recently patented in Germany, resembles tectorium in appearance, but is thinner and consequently lighter in weight, and the insoluble gelatin with which the wire gauze is covered is whiter and more nearly transparent than tectorium, although it may be coloured any tint that may be desired for special purposes. It is manufactured in two qualities, one being of heavier wire and with larger meshes than the other, and it is sold wholesale for a little over 5d per sq. ft. The special advantage claimed for *hornglas* is that it does not soften under sun heat. Its uses and general characteristics are similar to those of tectorium. —A. S.

PATENT.

Glass, An Improved Manufacture of. From Soc. Anonyme Belge pour la Fabrication des Émaux Artistiques. Eng. Pat. 21,286, Dec. 18, 1895.

For producing a plate of the new material a mould of cast iron is made, at the bottom of which is placed a layer of plaster of Paris. On this is spread a mixture of one-half crushed glass and one-half stoneware, chinaware, bits of bricks or tiles, or other crushed refractory material, "massed glass," and this is covered by a thin layer of powdered glass. The mould is now introduced into the glass furnace, where the parts are welded into a compact body of complicated texture. The mould is then exposed for a very short time in a reverberatory furnace, where the flame imparts a brilliant polish to the glass surface or enamel. —V. C.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Sheet Zinc, Application of, for Roofing and other Purposes. Seamon. Eng. and Mining J. **62**, [20], 461.
See under X., page 906.

PATENTS.

Kilns, Impts. in the Construction of, for Burning Limestone, Cement, and other Similar Materials. J. Foster, Carnlough, co. Antrim. Eng. Pat. 17,830, Aug. 12, 1896.

THE new kiln is provided with a superimposed arch, through which, by means of a shoot, the charging is effected. By this system of charging centrally from above, the upper chambers can be carried to any reasonable height, and an indefinitely large quantity of material may thus be subjected to the heat arising from the lower chamber. —V. C.

Artificial Stone, Impts. in the Production of. L. Preussner, Berlin. Eng. Pat. 8314, April 20, 1896.

THIS consists of a binding material and of filling masses. The latter may be sand, flint, barytes, and the like, or cellulose and the like, and (in the production of whetstones) emery may be added.

An analysis of the binding material yields the following percentage results:— $MgCl_2$, 31.72; $MgO + H_2O + CO_2$, 34.26; $Ca_3P_2O_8$, 8.37; $Mg_3P_2O_8$, 5.32; H_2O , 20.30. This is produced from strongly basic chloride of magnesium and soluble (acid) phosphate of lime or phosphoric acid. —V. C.

Building, Impts. in Plastic Substances [Antiseptic Plastic Substance] used for Building and Decorative Purposes. H. D. Lake, Middlesex. From M. Friedheim, Hamburg. Eng. Pat. 11,738, May 29, 1896.

THIS product may be shaped into bricks, gutters, bowls, &c. It contains an antiseptic chloride, such as "chloride of lime," which is said to constitute its value for sanitary building purposes. —V. C.

X.—METALLURGY.

Pyrometer for Blast-Furnace Tiewers. G. Braubach. Proc. Inst. Civil Eng. **126**, (iv.), 67. From Stahl und Eisen, 1896, 572.

WATER at constant pressure flows from a 70-gall. cistern placed just above the twyer-level, through an 8-mm. copper pipe placed across the goose-neck of the twyer. The temperature of the water before and after flowing through this pipe is measured by sensitive thermometers. The apparatus is standardised daily by means of a water pyrometer, and the flow of water through the copper tube is so regulated that a difference of 1° between the thermometers corresponds to 100° in the blast. This instrument has been in constant use at the works at Bendorf since March 1895, and is accurate to within ± 5 . —W. G. M.

Certain Metals and Alloys, Solution and Diffusion of, in Mercury. Part II. W. J. Humphreys. Proc. Chem. Soc. 1896, [170], 220.

THE author has extended this investigation (this Journal, 1896, 199) to aluminium, antimony, cadmium, magnesium, thallium, and a few alloys. Aluminium and antimony diffuse in mere traces. The cadmium amalgam heavier than mercury was not formed. The author considers that solution and diffusion in mercury may serve to distinguish between mixtures and compounds in the case of alloys. Metals that belong to the same group in Mendeléef's table increase in their power of solution and diffusion with their atomic weight.

Silver Amalgam, Ag_2Hg_8 ; Note on the Heat of Formation of the. F. T. Littleton. Proc. Chem. Soc. 1896, [170], 220.

IN a previous communication (Trans. 1895, **67**, 239) an account was given of a silver amalgam exhibiting remarkable behaviour on being moderately heated, swelling up as

if from the evolution of gas, and becoming hard, brittle, and crystalline in structure. It was noted that this behaviour was most marked when the silver and mercury were present in the ratio of 1 atom of the former to 4 of the latter, and that, when these metals were brought together, the silver, in the state of a fine crystalline powder (as reduced from the pulverulent chloride by zinc and a little hydrochloric acid), and the mercury simply poured over it, there was very considerable rise of temperature, amounting to 38° or 40°; so that the amalgam could not be borne on the palm of the hand without pain.

If the formula assumed for the amalgam be Ag_2Hg_3 , and the molecular weight be taken as 1,813.8 ($H = 1$), the heat evolved in the formation of one molecule is equal to about 3,432 units, the molecular weight being counted in grams, and the unit of heat as the heat required to raise the temperature of 1 gm. of water (at about 22°) by 1°. These determinations gave the values 3,395, 3,418, and 3,484. It is to be observed that the amalgam, just after its production, is a soft, pasty, semi-fluid mass. Calculating from Person's figures, for the latent heat of fluidity of the metals concerned, 1,813.8 grms. of the amalgam consist of 215.4 grms. of silver, the fusion of which would absorb 4,537 heat units and 1,598.4 grms. of mercury, the solidification of which would evolve 4,507 heat units.

Nickel and Nickel Steel. H. Wedding and Rudeloff. Verhändl. des Vereins zur Beförderung des Gewerbefleißes, Berlin, 1894—1896; Monit. Scient. 10, October 1896, 742—760.

A PRELIMINARY statement of the Committee appointed to inquire into the alloys of nickel was issued in 1894 (see this Journal, 1894, 13, 955). The present is an elaborate report with many tables of analyses and tests, and is divided into two parts, one relating to pure nickel and the other to nickel steel. Ordinary commercial nickel was operated upon, and after fusion, with the addition of a little magnesium prior to casting to remove oxygen, was cast into bars which contained per cent.:—Ni, 97—98; Co, 1—1.3; Fe, 0.3—0.6; Cu, 0.1; Mg, 0.1; Si, 0.06—0.1; and a trace of sulphur. The coefficient of linear expansion expressed in thousandths of a mm. per metre per 1° C. was found to agree well with the following formulæ—

$$\text{For cast bars (mean)} = 12.65 \pm 0.009 + (0.010 \pm 0.002) t,$$

$$\text{For forged bars (mean)} = 12.67 \pm 0.007 + (0.0085 \pm 0.0035) t,$$

where t is the temperature in Centigrade degrees. Hence the coefficient of dilatation is practically the same for cast and wrought nickel. The same remark may be made as to the electrical resistance of the two classes of material, the specific resistance (in microhms-centimetre), averaging 9, excluding two cases in which 1.2 per cent. of manganese was present and the resistance was 11.5. Tensile tests gave results that were somewhat variable among themselves, but showed a marked difference between the merely fused and the worked samples. Thus, in cast metal the elastic limit, breaking load, and extension, averaged respectively 3.5 and 9.2 tons per square inch and 4.7 per cent.; whilst in the wrought nickel the corresponding numbers were 18.35 and 29.5 tons per square inch and 17.9 per cent. The bars in which 1 per cent. of nickel was replaced by 1.2 per cent. of manganese gave the following noteworthy results:—For cast bars, 4.4 and 18.2 tons and 14.4 per cent.; and for wrought metal, 21.9 and 30.8 tons per square inch and 15.5 per cent. extension respectively.

Alloys of Nickel and Iron.—A series of test-pieces, free from carbon, was made, containing varying proportions of nickel from 0 to 100 per cent.; the principal impurity was cobalt, which increased in quantity with the percentage of nickel, but never exceeded 1 per cent. Of the other elements, the maximum percentages present were as follows: Cu = 0.1, Mn = 0.06, Mg = 0.09, Al = 0.07, Si = 0.1, and S = 0.02. The mean results of tensile tests are given in the following table.

TENSILE TESTS OF CAST FERRO-NICKEL BARS.

Nickel.	Load in Tons, per Sq. in. at		Modulus of Elasticity in Kilos. per Sq. Mm.	Elongations	
	Limit of Proportionality.	Rupture.		On 1-in. Length.	On 2-in. Length.
Per Cent.				Per Cent.	Per Cent.
0.05	3.8	29.6	32,525	36.8	29.7
0.76	3.9	29.4	29,706	25.1	20.6
1.01	4.5	21.4	21,050	31.8	25.4
2.05	6.5	23.5	20,710	26.1	22.7
3.01	10.2	25.8	20,070	23.4	20.0
3.98	10.5	25.8	20,178	29.1	17.6
4.92	12.4	28.3	19,930	12.9	10.8
7.84	14.5	33.7	19,280	11.1	9.6
15.60	10.2	26.0	16,200	0.9	0.6
29.71	4.0	6.3	12,300	2.8	2.2
50.60	3.8	24.0	14,400	37.9	36.1
93.52	2.6	21.1	17,400	20.1	19.0
98.56	2.3	19.4	16,870	18.2	17.1

From this table it is seen that the limit of proportionality increases with the percentage of nickel, until the latter attains to 10 per cent.; it then falls abruptly to 30 per cent. of Ni, and then more gradually. The tensile strength, however, reaches a second maximum at 60 per cent. of Ni, which is also the point of maximum elongation. The extension of the 15 per cent. alloy is practically *nil*. The fractures of the alloys containing 1—3 per cent. of Ni were granular; with an increasing percentage of nickel they were more and more crystalline, excepting the 60 per cent. alloy, in which the granular structure reappeared, and the 30 per cent. metal, in which the needle-like crystals showed traces of oxidation that would account for the inferior tenacity of the bar. The structure, however, may be either granular-crystalline or acicular; the former is best seen in the 16 per cent. alloy, and appears to be characteristic of the metals having the highest tenacity. A second series of tests (quoted in full) shows that the limit of proportionality was in all cases considerably raised by applying the load very gradually, and allowing the bar to remain under tension for two minutes before applying the next increment, which was, in every case, 0.6 ton per sq. in. Compression tests showed similar indications to those obtained by tension, excepting that the alloy which gave the highest result contained 16 per cent. instead of 8 per cent. of nickel. Test-pieces 15 mm. high and of the same diameter were submitted to the action of a falling weight, and the percentage reduction in length was measured after each blow. Twenty blows were delivered to each piece, three series of tests being made, in which the blows corresponded respectively to 5, 10, and 20 kilogrammetres per sq. cm. It was thus found that the resistance to shock varies in direct proportion to the percentage of nickel up to the 16 per cent. alloy; in the 30 per cent. metal it is equal to that of pure iron, and then increases slightly up to the 60 per cent. mixture, and finally falls again to the 30 per cent. level for pure nickel. In each individual test the effects of successive blows were less and less marked, especially as the proportion of nickel was increased; but this would be expected, as the method of testing was merely one of applying cold-work to the bars. Shearing tests showed variations which agreed with those observed in the compression-bars, only that the influence of nickel was less marked in the former case. Finally, the coefficients of dilatation were found to be about 11.56, 10.9, 10.3, and 12.61 for the materials containing 0, 4, 16, and 100 per cent. of nickel respectively, the full formula for the 16 per cent. alloy being—

$$10.30 \pm 0.05 + (0.0056 \pm 0.0015) t.$$

—W. G. M.

Steels, The Influence of Heat Treatment and Carbon upon the Solubility of Phosphorus in. E. D. Campbell and S. C. Babcock. Amer. Chem. J. 1896, 18, 719—723.

Owing to the brittleness of steel, due to phosphorus, being more marked when the carbon is high than when low, and in the same steel when it is hardened than when it is in its

annealed or normal state, experiments were made to ascertain if there was any relationship between the carbon and phosphorus compounds in the metal, and if the chemical condition of the phosphorus is changed by varying the heat treatment. Three samples of steel were used, containing 0.1, 0.37, and 0.73 per cent. of carbon, and 0.119, 0.160, and 0.114 per cent. of phosphorus respectively. The quantity of phosphorus in each of these metals in their annealed, normal, and hardened conditions was determined distinctively in respect (1) To the amount dissolved by neutral mercuric chloride, (2) To that insoluble in mercuric chloride but soluble in 4 per cent. hydrochloric acid, and (3) To that insoluble in both mercuric chloride and hydrochloric acid. From the results, the following facts are derived:—(1) With very low percentage of carbon, the effect of heat treatment upon the solubility of phosphorus is slight—probably if carbon were entirely absent there would be no effect; (2) with increase of carbon the effect of hardening is to diminish the solubility of the phosphorus; and (3) with high percentage of carbon the solubility is increased by slow cooling.

These three facts point to the probable formation, at a high temperature, of a compound of iron with carbon and phosphorus, soluble with difficulty, which is transformed on slow cooling into an easily soluble one. Since the difference in the chemical behaviour of phosphorus in hardened and annealed steels is as marked as that of carbon under similar conditions, it is not improbable that the heat absorbed or evolved in the transformation of one form into another, might account for one of the retardation points of Osmond in the same way that the transformation of carbon into cement carbon accounts for one of those points of recalcrescence.—A. W.

Steel, The Diffusion of Sulphides through. E. D. Campbell. Amer. Chem. J. 1896, 18, 707—719.

To ascertain the conditions best suited to the diffusion of iron sulphide through steel, experiments were conducted by melting differently prepared sulphides in open and closed cavities in bars of that metal. It was observed that the diffusion was dependent on the presence of an oxy-sulphide of iron, and to fully establish this the following experiments were performed:—

A pure normal sulphide of iron, free from oxide, was prepared by melting the ordinary sulphide in an atmosphere of sulphur for a lengthened period, and was heated for some time at a bright red heat in the cavities of the steel. The sulphide simply melted down, and showed no evidence of diffusion. A sub-sulphide was then prepared containing 5.84 per cent. of FeS and 92.41 per cent. of Fe₂S. This was also heated in the open and closed cavities, and the result showed that in the open hole it had sunk very slightly, whilst in the plugged hole there was no sign of diffusion. An oxy-sulphide of iron containing a ratio of FeS to FeO of 2.7 to 2, treated in a similar manner, disappeared rapidly, and the diffusion was complete in both cases in a very short time. Some of the same oxy-sulphide heated in a porcelain crucible placed near the bar of steel, showed no loss in weight, proving that volatilisation could not account for any loss of sulphide.

The sulphide diffused through the entire length of the bars, and not merely through the narrow sides between the cavities and the surface. This was proved by the blackening of asbestos plugs placed at the furthest end of the bar, due to the saturation with oxide of iron produced by the oxidation therein of the diffused sulphide. Experiments with sulphides of other metals showed that copper sulphide did not diffuse, and that a mixture of oxy-sulphide of iron and cuprous sulphide diffused almost completely. Both sulphides appeared to pass through the steel without decomposition. Nickel sulphide showed very little, if any, signs of diffusion.

The authors explain the above results by assuming that the extra mobility of the oxy-sulphide of iron enables it to travel through the pores of the heated metal. The rapidity of its absorption by the crucible in which it was made will support this view. The accumulation of the sulphide towards the lower part of the bar showed the influence of gravity, and also that the diffusion is a liquid and not a gaseous one.

The fact that cuprous sulphide would not diffuse except when mixed with oxy-sulphide of iron is also explained by the assumption that it is not sufficiently mobile when liquid to penetrate the fine pores of the steel, and increased mobility by the mixture enables it to do so.—A. W.

Sheet Zinc, Application of, for Roofing and other Purposes. Seamon. Eng. and Mining J. 62, [20], 461—462.

A TABLE is given of cost of roofing in Europe and America, based on current contract prices, and on the assumption that labour costs 50 per cent. more in America than in Europe. The cost per 100 sq. ft. varies, according to style of roofing and thickness of zinc, from 8.37 dols. to 12.20 dols. in Europe, and from 10.48 dols. to 15.61 dols. in America. A second table gives the comparative cost of laying and maintaining for 30 years, roofs of different materials, including interest on expenditure on original roof and on repairs; the figures are, in dols. per 100 sq. ft., zinc, 35.05; tinplate, 46.87; slate, 37.05; galvanised iron, 38.95; tiles, 39.75; lead, 58.80; copper, 84.00.

The coating formed on zinc by ordinary air containing carbonic acid is very tenacious and protective. Experiments showed that such coated zinc, exposed to the action of water containing 0.5 gm. of sulphurous or carbonic acid per litre, was dissolved at a rate which would require 300 years to completely dissolve a sheet of No. 13 zinc.

The amounts of carbon and of sulphur usually found in commercial zinc are without influence on its suitability for roofing. Iron above 0.13 per cent. makes the zinc too brittle to be properly rolled and bent. Lead up to 1 per cent. is beneficial, but above 1½ per cent. will not dissolve, and the excess collects and forms weak spots. Arsenic, antimony, cadmium, tin, and copper practically never occur in quantities sufficient to be injurious. The following table gives the impurities of a European zinc largely used for roofing, followed by those of nine samples of zinc from Missouri ores:—

Lead	0.708	0.6331	0.6295	0.6725	0.4105
Cadmium	0.017	0.0058	Trace	0.0011	Trace
Arsenic	0.006	0.0353	None	None	None
Iron	0.023	0.0095	0.0315	0.0546	0.0523
Nickel	Trace	Trace	None	Trace	Trace
Sulphur	0.022	Trace	Trace	Trace	Trace
Bismuth	None	None	None	None	None
Antimony	0.175	Trace	Trace	Trace	Trace
Silicon	0.002	..	..	..	..
Carbon	0.016	..	..	..	..

Lead	0.8728	0.3063	0.5875	0.3765	0.2513
Cadmium	Trace	Trace	Trace	Trace	0.0188
Arsenic	None	None	None	None	Trace
Iron	0.0233	0.0283	0.0357	0.0330	0.0175
Nickel	None	None	None	None	None
Sulphur	0.0601	Trace	Trace	Trace	Trace
Bismuth	None	None	..	None	..
Antimony .....	..	..	..	Trace	..
Silicon .....	..	..	..	..	..
Carbon .....	..	..	..	..	..

Among other uses of zinc mentioned, are those for ornamental castings (statuettes, &c.) and metallic monuments—so-called "white bronze"—which are cast from spelter, and roughened on the surface by the sand blast.—J. T. D.

Alloys, Fusibility of Metallic. H. Gautier. Bull. Soc. d'Encouragement, Oct. 1896, 1233—1318.

THE author has examined a large number of alloys, and has arrived at the following conclusions:—

Alloys in no respect resemble glasses, as has sometimes been stated. They are crystalline substances formed either by the juxtaposition of the crystals of the constituent metals, as in the case of the alloys:—Tin-zinc, tin-bismuth, tin-lead, lead-antimony, cadmium-zinc, zinc-aluminium, and antimony-silver; or by the juxtaposition of the crystals of one of the metals with a definite compound, as in alloys of:—Tin-copper, antimony-copper, aluminium-copper, lead-copper, bismuth-copper, tin-aluminium, tin-nickel, copper-nickel, zinc-antimony, aluminium-silver, and antimony-aluminium.

Other much more complex alloys may form isomorphous mixtures, either because the metals themselves are really

isomorphous—bismuth-antimony, silver-gold,—or because they form isomorphous combinations with one of the metals; this appears to be the case with the alloys:—Zinc-copper, zinc-silver, tin-silver, cadmium-silver, and tin-antimony.

The fusing point of an alloy is nearly always lower than that of the least fusible of its constituents; the only exceptions to this rule are certain alloys of gold with aluminium, and the greater number of those of antimony with aluminium.

The solidification of an alloy of given composition always begins at the same temperature. Except in the case of isomorphous mixtures, either pure metal or a definite compound separates out on solidification. This deposit causes a variation in the composition of the still liquid portion to take place, and the solidification can only continue if the temperature is still further lowered, and so on; hence the temperature does not remain constant during the whole process of solidification. Again, if the density of the substance which separates out is notably different from that of the remaining liquid, it collects either at the top or bottom of the crucible, and, after cooling, forms an ingot, the composition of which varies from top to bottom, *i.e.*, from a metal or definite compound to an alloy of minimum fusing point. This is the well-known phenomenon of "liquation."

Solidification takes place at constant temperatures either when the composition of the alloy corresponds to a definite compound (in this case the separation of the solid does not modify the composition of the remaining liquid), or when the composition corresponds to an angular point on the fusibility curve, *i.e.*, to a eutectic alloy (in this case the metals which separate out correspond to the two branches of the curve which cut at the point, and the composition of the liquid bath still remains constant).

Isomorphous mixtures sometimes solidify at constant temperature, and sometimes at a gradually decreasing temperature.

Eutectic and isomorphous alloys do not exhibit a crystalline fracture, even after polishing and treatment with an appropriate etching reagent, as the crystals of these alloys are so extremely fine that they give to the fracture a peculiar appearance resembling that of a vitreous mass.

—J. S.

PATENTS.

Metallic Alloy [Copper, Nickel, Zinc, and Antimony]. A New or Improved. W. Woolf, London, and J. Andrews, Birmingham. Eng. Pat. 22,137, Nov. 20, 1895.

An alloy of copper, "mixed nickel" (a copper-nickel alloy), spelter, regulus of antimony, and "copper flux," produced by melting together the copper and mixed nickel, and adding the other ingredients under a flux. The mixed nickel consists of 1 part of B.S. copper and 1 part of pure nickel; the "copper flux" is formed of 1 part of common salt, $\frac{1}{2}$ part of borax, and $1\frac{1}{2}$ parts of "sal-enixon."

—J. T. D.

Gold, An Improved Process of Extracting, from Refractory Auriferous Ores. [Alloying with Lead.] H. S. Maxim, London. Eng. Pat. 22,812, Nov. 28, 1895.

ORES containing a high percentage of gold, but containing substances which prevent the ordinary processes from being applicable, are treated by a process resembling amalgamation, with lead at a high temperature, in a rotatory apparatus containing a number of iron balls, which assist in the subdivision and thorough mixture of the pulverised ore and melted lead, whilst an atmosphere of hydrogen or other reducing gas prevents oxidation. The reducing atmosphere, the ponding or mixing operation, and the form of apparatus described and figured in the patent, are all subjects of claim.—J. T. D.

Sodium or Potassium, Impts. in or connected with the Manufacture of. [Crucible of Nickel or Cobalt.] J. A. Kendall, Surrey. Eng. Pat. 23,045, Dec. 2, 1895.

CARBON and a carbamate or hydrate of the alkali metal to be obtained, are submitted to a high temperature in a vessel

of nickel or cobalt, and surrounded or mainly surrounded by another vessel or jacket, so as to enclose a space into which hydrogen or a similar gas is passed.—A. S.

Sulphide Ores containing Zinc and other Metals, An Improved Process for Treating [for Zinc and Silver]. T. Parker, Wolverhampton, and J. Pullman, London. Eng. Pat. 23,543, Dec. 9, 1895.

THE pulverised ores are treated with strong hydrochloric acid at a temperature of 90° C., the clear solution made and maintained neutral by zinc carbonate, lead chloride deposited from the cooled solution and treated for lead, and the zinc extracted by electrolysis. The treatment with zinc carbonate (or with a little cold bleach liquor) frees the solution from any iron it may contain. The residue from the process, after further lixiviation with hydrochloric acid, is treated with sodium hyposulphite or strong brine to recover silver.—J. T. D.

Copper, Impts. in the Method and Means for obtaining, from Copper Ores. C. A. Burghardt, Manchester, and G. Rigg, Eccles. Eng. Pat. 9388, May 4, 1896.

THE ore, well roasted and crushed, is treated with strong solution of ammonium carbonate in which has been dissolved zinc oxide to the amount of 4,000 or 5,000 grains of zinc per gallon, loss of ammonia being prevented by a layer of petroleum. The copper is recovered from the settled solution by zinc or zinc and tin plates, and the zinc from time to time removed by electrolysis from the liquor, which is used over and over again.—J. T. D.

Amalgamating Apparatus for Extracting Gold and Silver from their Ores, Impts. in and connected with. J. W. Clarke, London. Eng. Pat. 22,715, Oct. 13, 1896.

A DISHED bed-plate containing the requisite mercury, in which work two or more fluted rollers partially immersed in the mercury, and all rotating at slightly different rates. Thus the ore is carried under the mercury, to the rear, and to a rake, which works transversely, and on which a number of jets of water play, to separate the tailings from any mercury which they may carry with them. Between the rollers and the rake is a vertical splash-guard to catch mercury thrown off by the last roller. An electric current passes continually through the mercury, to lessen the loss by "flouring" or "sickening."—J. T. D.

Engraved Copper Plates, An Improved Process for the Protection of, by the Use of Nickel. K. P. Beck and W. Moss, Hanley, and A. Hioros, Handsworth. Eng. Pat. 20,545, Oct. 31, 1896.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Porous Carbon Cylinders for Electrolytic Work. [Organic Electro-synthetic Work, &c.] W. Löb. Zeits. f. Elektrochem. 1896, 3, 185—187.

IN the form in which Bunsen first introduced the cell which bears his name, it contained no porous cylinder. The carbon was in the form of a hollow cylinder containing the oxidising liquid, and this dipped directly into the dilute acid containing the zinc. The carbon rod and porous cylinder were only introduced later.

For the purpose of performing organic electro-syntheses without a primary battery (the organic substance forming part of the cell itself), the author has endeavoured to get rid of the usual porous cell, which offers considerable resistance. The most convenient way of doing this is to use moulded carbon cylinders as porous cells. In its conducting power carbon nearly approaches the metals, and when used in this way it acts as an intermediate conductor. Electrolysis takes place on both sides of the carbon cylinder; if the anode be immersed in the outer liquid, the outside of the cylinder plays the part of a cathode and the inside that of an anode. Its behaviour, then, is twofold. It behaves as a porous

diaphragm, through which ions pass freely. It also behaves as a solid conductor, of which the two surfaces act as anode and cathode respectively. For example:—An anode of platinum foil is immersed in a beaker containing dilute sulphuric acid; a hollow carbon cylinder containing copper sulphate is used as cathode. When the circuit is closed, oxygen is evolved at the anode. A few bubbles of hydrogen rise from the outside of the cylinder, but the amount is very small compared with the oxygen. After an hour, copper is found to be deposited on the inside of the cylinder, mainly on the part nearest to the anode. If we use as cathode a carbon rod dipping into the copper sulphate in the cylinder, copper is deposited on the cathode and also on the outside of the cylinder.

When a carbon cylinder is used directly as an electrode we might expect it to behave simply as a metallic electrode, the electrolytic action taking place only outside it, in the liquid which surrounds the cylinder and in which the second electrode is immersed. But experiments made by the author on this point indicate that the expectation is not realised. He concludes that when a carbon cylinder is used directly as a cathode (or anode), its whole surface—both inside and outside—behaves as a cathode (or anode). Lastly, he finds that when a cathode (or anode) is brought into metallic connection with a carbon cylinder, so that both are at the same potential, the whole system behaves as a cathode (or anode), the result being simply to increase the active surface.—D. E. J.

Electricity, Production of, by Chemical Means. E. Andreas. *Zeits. f. Elektrochem.* 1896, **3**, 188—189.

THE author has further investigated the behaviour of primary batteries, the action of which depends upon the continuous oxidation of hydrogen, carbon monoxide, &c. His results are mostly of a negative nature. He considers that the weak point in the batteries investigated by Borchers and himself is the use of electrodes which become dissolved as the battery acts, and that success can only be secured by the introduction of electrodes which do not go into solution during the oxidation of the gas used in the battery.

—D. E. J.

PATENTS.

Electrical Primary Batteries, Impts. in or relating to. [Use of Treated Coal in Cell.] J. B. Whittemore, London. Eng. Pat. 18,549, Aug. 21, 1896.

A BLOCK of coal of about 5 lb. weight is taken, and on it is burned a small portion of sulphur, camphor, pitch, or analogous inflammable substance. The use is claimed, in the liquid of electrical primary battery cells, of pieces of the coal thus treated. Such cells are formed of an iron and carbon couple immersed in water, or if they are added to the nitric acid solution in a Bunsen cell, the zinc may be replaced by iron. An electromotive force of 1 volt is claimed for this cell. The specially "treated coal," it is said, when added in small quantity to the acid solution of an ordinary battery cell, increases the quantity and strength of the current therefrom to such an extent that iron can be used in place of zinc as the positive element in the cell.

—G. H. R.

Electrolytic Decomposition of Liquids, Impts. in or connected with Apparatus for. [Mercury Cathodes.] G. Bell and G. W. Bell, Liverpool. Eng. Pat. 20,542, Oct. 31, 1895.

THIS apparatus consists of three parts. The lower one, being the anode chamber, in which the brine or other liquid is decomposed, is separated by a porous partition, on which a layer of mercury rests, from the cathode chamber, in which caustic soda is produced. Above the chamber, and separated from it by a suitable diaphragm, is a gas chamber, in which the chlorine evolved in the anode compartment is collected. This chamber is separated from the anode compartment of the next series of cells above it by a metallic insulated diaphragm, and groups of these cells are thus arranged above each other. The cathode chambers are connected so that the caustic soda formed in the uppermost compartment becomes concentrated as it

flows down through the apparatus. The strength of the brine is maintained by adding salt to a separate vessel through which the solution from the anode compartment is circulated by a pump, where it is freed from chlorine by means of waste heat. The chambers described are preferably metallic, and lined with a protective coating of rubber or the like, and the tubes which carry off the chlorine serve also as supports to the porous diaphragms.

—G. H. R.

Storage Batteries, Impts. in. [Thin Negatives.] A. Preiss, Norwood, South Australia. Eng. Pat. 19,301, Sept. 1, 1896.

THE positives are of lead, and of the normal construction, but the negatives, which simply serve as conductors, are merely thin sheets of zinc, or aluminium, or any other suitable metal having the same superficial area as the positives. The electrolyte preferred is a dilute solution of sulphuric acid and sulphate of ammonia, having a density of 1.2. The cell is preferably formed of papier maché, and, by the improved construction, it is claimed that a reduction in weight of two-thirds can be effected.—G. H. R.

Electrolysis, A Process and Apparatus for Effecting. [Liquid Electrodes.] F. W. Golby, London. From O. Arlt, Goerlitz, Germany. Eng. Pat. 15,129, July 8, 1896.

THE apparatus consists of a tightly closed vessel with a bottom sloping to an outlet. The electrodes are introduced through perforations in the cover, and are packed to prevent the escape of gas, which is led off through a stand-pipe. The positive electrode consists generally of carbon, and the negative electrode of a jet or spray of mercury in the case of the electrolysis of brine or any other liquid metal or mixture of one or more liquid metals. The mercury which cannot flow off quickly enough is protected from the action of the brine by a layer of fluid, such as chloroform or bisulphide of carbon, which is heavier than the electrolyte, and is not acted on by the products of electrolysis; and the sodium amalgam formed is withdrawn from the vessel and treated with steam or water, with the formation of caustic soda and the regeneration of the mercury. Both electrodes may be fluid, and they are introduced into the electrolyte in jets and sprays of any convenient form, their introduction and withdrawal being so regulated that the electrical circuit is never broken.

—G. H. R.

Secondary Galvanic Batteries, Improved Plates for, and a Method of Producing the Same. [Block Plates.] C. Marschner, Berlin, Germany. Eng. Pat. 12,250, June 4, 1896.

THE binding agent consists of a solution of amber or other similar fossil resin, dissolved in alcohol or oil of turpentine and alcohol, and is added to the lead oxide so as to form a plastic mass, which is then spread out in a suitable frame of hard lead. The plates are dried at a moderate temperature, acidulated for a few days in a bath of dilute sulphuric acid, and finally shaped and arranged. The plates require no trellis support, and are very solid and elastic.—G. H. R.

(B.)—ELECTRO-METALLURGY.

Metals, Electric Furnaces for the Reduction and Refining of. W. Borchers. *Zeits. f. Elektrochem.* 1896, **3**, 189—192.

THE first of a series of papers on the development and construction of electric furnaces for metallurgical purposes. They may be divided into two great classes:—I. Furnaces of the first class depend upon what the author calls "resistance-heating." The principle here employed may be applied in two ways:—(1) The substance to be heated is itself introduced as a resistance into the circuit; (2) it is placed in contact with another substance, which is electrically heated. II. Furnaces of the second class depend upon what the author calls "arc-light heating." As a resistance has also to be overcome in the electric arc, the classification

is not free from objection, but for practical purposes it is intelligible and useful. Here again the principle may be applied in two ways:—(1) The substance to be heated forms one or both poles of an arc light; (2) it is placed in a space heated by the arc. For a given distance between the poles, a furnace of Class I. requires a large current, but only a low E.M.F., whereas a furnace of Class II. requires a high E.M.F., but only a small current. The present paper deals with furnaces of the kind I (1), in which the substance to be heated is introduced directly as a resistance into the circuit. We find an illustration of this principle as far back as 1815, in the Phil. Trans., where Pepys describes a sort of "electric cementation" experiment in which iron wire, in contact with diamond powder, is converted into steel. But the first practical application of the principle to the reduction of metals was made by the brothers Cowles in 1884. They intended it to be used for zinc as well as aluminium, but for the former purpose it has not been a success. Fig. 1 is a diagrammatic representation of a furnace intended for the reduction of aluminium, and Fig. 2 shows the form into which this furnace has now developed. The electrodes consist of carbon rods fixed in iron or copper holders, which are introduced into the furnace through cast-iron tubes. They are adjusted by screws and hand-wheels. In the position shown in the figure, two of the carbons project far enough to touch. The heating effect of the current here is very intense, and these two rods soon waste away. Meanwhile, the part of the mixture surrounding them has become heated, and by gradually withdrawing the electrodes, the whole of it can be submitted to the action of the current. The distance of the electrodes is regulated in accordance with the indications of the measuring instruments. When

Fig. 1.

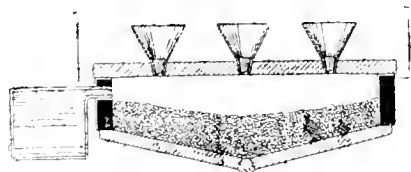
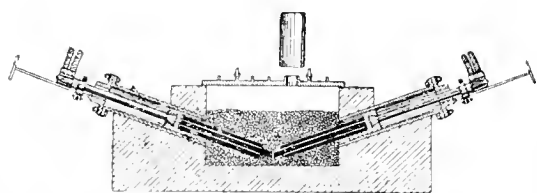


Fig. 2.



the whole of the mixture is fused, the current is stopped and the next furnace is thrown into action. Not only the continuous current, but also the alternating current, can be used in this furnace; in fact, the latter gives a more uniform heating effect. This shows that the Cowles process is purely one of reduction, and that electrolysis plays no part in it.—D. E. J.

PATENTS.

Metallic Zinc from Ores of Zinc, and Metallic Zinc and Metallic Copper from Zinc Ores containing Copper, and the Production of Oxygen Gas in the Cases specified; Impts. in a Process and Apparatus for the Electrolytic Production of. [Ammoniacal Bath.] C. A. Burghardt, Manchester, and G. Rigg, Eccles. Eng. Pat. 22,732, Nov. 28, 1895.

THE ores, which have been thoroughly oxidised by roasting, are ground and treated with a concentrated solution of either the normal carbonate, the sesquicarbonate, or the bicarbonate of ammonium, or a mixture of these; or a solution of ammonia gas in water may be employed, but in the latter case no oxygen is evolved in the later stages of

the process. The bath is covered with a layer of paraffin or other mineral oil of high flashing point and low viscosity, to prevent loss of ammonia, and a mechanical stirrer is set in motion. When all the oxides have been dissolved, the clear liquor is drawn off into another tank, and again covered with a layer of oil. The solution is freed from any iron it may contain by treatment, at about 40° C., with a certain proportion of hydrated oxide of tin, and the clear liquid is again drawn off into another tank. If copper be present, it is recovered by immersing in the bath plates of zinc, or, preferably, of zinc in contact with tin, and the copper deposited on the zinc strips easily, and is entirely free from oxides, owing to the layer of oil. The solution, freed from copper, is electrolysed in a bath covered with a layer of paraffin and provided with sheet zinc cathodes and tin or lead anodes. If a solution of the carbonates has been employed, the oxygen given off at the positive pole is collected and washed.—G. H. R.

Electrodes for Electrolytical Purposes, Impts. in. [Platinum Tubes.] W. Heraeus, Hanau-on-the-Main, Germany. Eng. Pat. 1144, Jan. 16, 1896.

THE electrodes are formed of thin tubes of platinum surrounding an accurately fitting core of copper or other good conductor. The tubes are connected together by conducting or non-conducting transverse top bars, and by a thin sheet of platinum in the intermediate spaces for the depth to which the tubes are immersed in the bath. The lower ends of the tubes are also closed with platinum. This composite electrode allows of the use of large currents with a small weight of platinum.—G. H. R.

XII.—FATS, OILS, AND SOAP.

PATENTS.

Cotton Waste or other Fibrous or Textile Material, Impts. in Cleaning or Removing Grease from, and in Apparatus therefor, and for Recovering the Solvents. J. W. Mitchell, Rawtenstall. Eng. Pat. 23,129, Dec. 6, 1895.

See under V., page 898.

Solidified Petroleum, Impts. in the Manufacture of. [Wool-fat Acids, Heat, and Caustic Alkalis.] M. Ekenberg, Stockholm. Eng. Pat. 16,541, July 25, 1896.

{See under III., page 894.

Sebacic Acid from Wool or Fulling Grease, A Process of Obtaining. F. Sahlfeld, Hanover. Eng. Pat. 18,940, Aug. 27, 1896.

DARK wool grease or fulling grease is distilled by heating in a retort, superheated to a temperature of 360° C., steam being injected into the neck of the retort. A light fatty acid distils over. By this exterior and interior heating, the distillation is much accelerated. The jet of steam also tends to separate the "sebacic" (fatty) acid from the carburetted hydrogen compounds formed during the distillation, and a purer product is thus obtained.—W. P. S.

Batymeters or like Fat-testing Instruments, Impts. in or relating to. N. Gerber, Zürich. Eng. Pat. 18,282, Aug. 18, 1896.

See under XXIII., page 921.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A).—PIGMENTS, PAINTS.

PATENTS.

White Lead, Impts. in the Manufacture of. A. B. Browne, Boston, U.S.A. Eng. Pat. 14,988, July 7, 1896.

A SOLUTION of a salt of an alkaline base, such as sodium nitrate, is electrolysed in a vessel divided by porous partitions into three compartments. The central chamber contains excess of the electrolyte, whilst one end chamber

contains a pig-lead anode, and the other a cathode, preferably of copper. The solution under electrolysis is decomposed; the nitric acid attacks the lead anode, forming nitrate of lead, whilst the caustic soda goes to the cathode. The two solutions are drawn off into tanks and then mixed, thus forming sodium nitrate (for use over again) and precipitating the lead as hydrate. The lead hydrate is filtered off and carbonated to form basic amorphous carbonate of lead.

Means are described for preventing the re-commingling of the acid and alkali in the electrolyser, and also for preventing the formation of objectionable sub-salts of lead. (See also this Journal, 1896, 207.)—A. S.

Enamel Paint and Combination of Materials for Composing same. [Shellac, Copaiba Balsam, Camphor, and Dextrin.] G. W. N. Hamilton, Albert Park, Victoria. Eng. Pat. 19,318, Sept. 1, 1896.

This is composed of 1 gall. of methylated spirit, 3 lb. of shellac, 1 lb. of white pine resin or copaiba, 4 oz. of camphor, 4 oz. of gum-arabic or dextrin, and a sufficiency of pigment, all mixed together and strained. The gum-arabic is dissolved separately in a little water. The material dries in about 10 minutes, giving a perfectly smooth surface, and is particularly suited for painting ships' bottoms, &c.—F. H. L.

Blanc Floc, Preparation of. Papier Zeit. 1896, 2883.

See under XIX., page 918.

(B.)—RESINS, VARNISHES.

Resin, Mayr's Method of Tapping Trees for the Extraction of. Chem. Rev. Fett-u. Harz-Ind. 3, [19], 203—205.

To prevent the loss of volatile oil, estimated at 50 per cent., and minimise the drying up of the wood occasioned by the ordinary method of tapping resinous trees, it is proposed to proceed as follows:—A hole is first bored in an upward direction, about 12 ins. from the ground, through the bark and into the wood, on the S.E. side of the tree. Above this aperture a vertical axe cut, some 50 cm. long, is made in the bark, and, by means of a tool inserted through the cut, the bark is loosened from the wood on either side, so that a free space of oval form is left between them, any loose woody tissue being scraped out with the tool. This space is kept open by the insertion of folded strips of sheet metal forming small V-shaped troughs, arranged in diverging pairs thus Λ , to drain the exuding sap from the cleft, so that it runs down between the bark and the wood, and is conveyed by a pair of converging (V) troughs into an effluent placed in the hole at the lower extremity. The vessel to catch the droppings is covered by a funnel, and the whole arrangement keeps the resin clean and minimises evaporation. The bulging of the bark, caused by the underlying troughs, diverts the water flowing down the trunk away from the collecting vessel, the effect being increased by removing a few scales of bark on either side of the bulge.

The second year, the troughs are removed, and the same operation is repeated at a higher level, the bark over the abandoned surface being nailed down to heal; in the case of hard-barked resinous trees the outer scales of bark should be partly removed before tapping.—C. S.

PATENTS.

New or Improved Chemical Substance, and the Application thereof to Industrial Purposes, such as Rubber, Gutta-Percha, or Celluloid Substitutes, Insulations of Electrical Conductors, Coverings for Ships' Bottoms, or Wall and Floor Coverings. P. C. D. Castle, Liverpool. Eng. Pat. 19,130, Oct. 11, 1895.

This consists "in the preparation and application of the gum produced from the kernels of the *cratonia siliqua* (locust tree) as a substitute, solvent, diluent, or joint ingredient of india-rubber, gutta-percha, or celluloid." The two substances may be mixed in any proportions, may be vulcanised or not, and the rubber itself may be replaced by oxidised linseed oil. For the walls or floors of rooms the

composition can either be used as a cement to hold the woodwork together, or the whole floor may be coated with it after the manner of asphalt. (See also this Journal, 1894, 410, and 1895, 632.)—F. H. L.

Nitro Compounds suitable for Moulding, and for Coatings. Varnishes, and the like; Impts. in. W. F. Read, Addlestone, Surrey, and E. J. V. Earle, London. Eng. Pat. 21,995, Nov. 19, 1895.

Ons mainly composed of linolen, such as linseed, poppy or nut oil, or those containing a large proportion of ricinolen, such as castor oil, are nitrated in the usual way. The nitro products obtained are semi-fluid. These are mixed with finely powdered carbonates of the alkalis or alkaline earths (e.g. chalk) in quantity a little more than sufficient to neutralise the free acids remaining in the nitro compounds. The excess of carbonates is removed by heating to 93° C. and allowing to settle. The substance thus prepared is mixed in varying quantities with compounds of nitro-cellulose (parkesine, xylonite, celluloid, &c.), the latter being thus rendered less hard and brittle. The mixing is carried out by malaxation at a temperature not exceeding 100° C. Should the compound be required as a varnish or in solution, the ingredients may be added direct to the solvent, as ordinary solvents of nitrocellulose are also solvents of nitrolinolein and nitroricinolein.—W. P. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Fermentation Phenomena in Tan Liquors. F. Andreasch. (Imp. Research Laboratory, Vienna.) Der Gerber, 1895, 21, [504, 505, 506], 193—220.

TANNING belongs to those industries in which the decomposition of organic materials by micro-organisms plays an important rôle.

The object of the article is to give a more exact account of those decompositions which take place in the tan liquors during the tanning process, with formation of a series of organic acids in considerable quantities. These acids have considerable influence on the tanning process, and the matter is of importance to the practical man, as it is in his power to modify the changes going on in the liquors to his benefit. Some of these decompositions or fermentations, as we shall call them, are actually visible by the rapid formation of a pellicle on the surface of the liquor, or by evolution of gas, e.g., in myrabolans liquors, but, even when not visible, fermentations are almost always going on in the liquors.

In order to thoroughly investigate the matter it was a first condition to isolate the numerous micro-organisms occurring in tan liquors, to study their physiological action on the materials used in tanning, and to separate the important ones from those having no influence on the process.

The author gives an account of the methods he used in the research. For obtaining the pure cultures required, Hansen's method was used for the yeasts (*vide* Micro-organisms of Fermentation, A. Jørgensen, 1893, 28), Koch's gelatin plate method for the bacteria.

As nutrient media, the usual 10 per cent. peptone-gelatin was not as a rule so useful as beer-wort gelatin (10 per cent.); in special cases 3—4 per cent. of alcohol was added to this.

For Hansen's method, unhopped beer wort, lager beer, and tannin infusions were used as media.

Gelatin and agar naturally do not admit of the addition of any tannin, nor does the gelatinous silicic acid. Fortunately the tannin may be replaced in the solid media by carbohydrates, such as glucose and milk sugar; best of all is a strong infusion of a tanning material from which the tannin has been removed by filtration through lüde powder; the filtrate may be used alone for liquid cultures. Glycerin peptone agar, milk serum gelatin, and potatoes were also used as solid media.

As intermediate materials between the gelatin cultures and the tannin liquor to be investigated, milk and beer were used. Following the bacteriological examination of the

liquors, chemical analyses were made to ascertain the changes which had occurred.

The bacteria present in tan liquors may be divided into the following groups:—

- A. Putrefactive bacteria.
- B. Water and air bacteria.
- C. Strictly fermentive bacteria and yeasts.

A. *Putrefactive Bacteria*.—In this division are included most of the organisms existing on and introduced into the liquors with the hides. The author finds that these are chiefly of importance as furnishing nitrogen from the hide substance by peptonisation, which is then used up by the true ferments. Fermentation goes on much quicker in liquors containing skins than in those which do not contain them.

The following recognised putrefactive ferments have been met with in tan liquors:—*Bacillus fluorescens liquefaciens* (Flügge); *B. megatherium* (De Bary); *B. Subtilis* (Ehrenberg); *Potato bacillus*; *B. Mesentericus fuscus* (Flügge); *B. Mycoides* (Flügge); *B. Viscosus* (Frankland); *B. liquidus* (Frankland); *Gas-forming Bacillus* (Eisenberg); *White Bacillus* (Maschek); *Proteus Vulgaris*, *Proteus mirabilis* (Hauser); *Bacillus butyricus* (Hueppe); *White Streptococcus* (Maschek); *Worm-shaped Streptococcus* (Maschek); *Grey Coccus* (Maschek).

Besides these known species there are other yet undescribed but putrefactive organisms, most of which have a similar effect on the subsequent fermentation. They naturally occur most numerous in the weak liquor. As an example of the way certain bacteria get into a tannery, the following example is given:—The waste water of a large works discharged into the neighbouring river was found to contain large numbers of *Proteus Vulgaris* and *B. fluorescens liquefaciens*; the same bacteria were found not only in the water but in the limes and tan liquors of a tannery a mile down stream, drawing its water from the same river. Where the cold-sweat process of unhairing is used, a still larger number of putrefactive organisms are found in the liquors.

B.—*Water and air bacteria*, as a rule, are of small consequence to the tanner, though some grow well, even in the presence of 25–30 per cent. of tannin, and by using up the proteids and carbohydrates of the liquors, and thus overgrowing the true ferments, they exert an influence on the tanning process.

In 120 samples from different tanneries, the following organisms were found:—*Bacillus Aerogenes* (Miller); *Bacterium Zuroianum* (List); *Bacterium Luteum* (List); *Bacillus Ochraceus*; *Bacillus Flavocitraceus* (Adametz-Wickman); *Bacillus fluorescens putridus* (Flügge); *Red Bacillus* (Eisenberg); *White Bacillus* (Eisenberg); *Orange-red Water Bacillus* (Adametz-Wickman); *Citron-yellow Bacillus* (Maschek); *Gas-forming Bacillus III.*, from dung bates and bran drench. *B. prodigiosus*; *Red Coccus* (Maschek); *Schlämpe Micrococcus* (Bräutigam); *Micrococcus luteus* (Cohn); *Micrococcus flavus tardigradus* (Flügge); *Micrococcus Aurantiaceus* (Cohn); *Micrococcus fulvus* (Cohn); *M. Versicolor* (Flügge); *M. Candicans* (Flügge); *M. Fervidus* (Adametz-Wickman); *M. plumosus* (Bräutigam); *M. flavus liquefaciens* (Flügge); *M. flavus desidens* (Flügge); *Cream-coloured micrococcus* (List); *Diplococcus luteus* (Adametz). *Diplococcus liquefaciens flavus tardus*, *Pedococcus acidi lactici* (Lintner); *Pedococcus* (Beer sarcina) (Lintner); *Sarcina Aurantiacea* (Hansen); *Sarcina Lutea* (Hansen); *Chrenothrix Kühniana*.

Of these, *Pedococcus* and *Sarcina* produce small quantities of acids; the latter, with *M. flavus liquefaciens* and *Diplococcus luteus*, occur very frequently in tan liquors. *Chrenothrix Kühniana* is also found in fairly large numbers, but only when the liquors are prepared cold. *Bacillus III.* (*gas-forming*) occurs almost always in upper-leather tanneries, where the goods have been bated or bran-drenched; it is characterised by copious evolution of gas during its growth in all nutrient media examined. It was found that such organisms as *Bacillus prodigiosus* grew vigorously in canaigre, pine, and heolock liquors, owing to the presence of starch in quantities.

Of the moulds, those most frequently occurring are *Penicillium Glaucum*, which grows well on sour liquors. *Mucor Mucedo* grows on moist bark, and from thence the

spores get into the tannery, and *Oidium Lactis*, a frequent but not necessary adjunct to lactic acid fermentation. The moulds do not produce acids directly; they generally make their appearance after the liquors become sour, and produce small quantities of alcohol and CO₂. *Penicillium* also decomposes lactic acid. They act as carriers of the bacteria, which, adhering to the mould spores, are carried with them into the air and thence into other liquors.

Oakwood and quebracho extracts, which ferment with difficulty, owing to a lack of suitable nutrient material, are good growing ground for moulds. Their special function in the decomposition of tannins of a glucoside character will be described in a later research. It will be seen from the above-mentioned organisms that the souring of tan liquors is influenced by numerous factors, and is no regular fermentation such as alcoholic or acetic acid fermentation. A bacteriological examination of the liquors has shown a whole series of bacteria and fungi in the liquors, but chemical analysis shows the following to be the chief products:—Carbonic acid, ethyl alcohol, acetic acid, and lactic acid. Although all these are of equal theoretical importance, only the two latter need be considered, and the bacteriological research is much simplified by considering only those species which produce these two acids. Of the two, lactic swells the skins better than acetic acid.

The author has found no organism in tan liquors capable of fermenting glucoses direct to acetic acid. And he considers that the production of this acid in the liquors is the result of two distinct processes—(1) the formation of alcohol; (2) the oxidation of the alcohol to acetic acid; that lactic and acetic acids are the result of entirely different chemical processes and are produced by different organisms. The production of alcohol and acids will be considered under the third heading.—J. T. W.

Leather, The Dyeing of, for Shoes. H. Burgess, J. Soc. Dyers and Colourists, 1896, 12, 207.

See under VI., page 899.

PATENTS.

Preparing Hides for Tanning, Impts. in Lyes or Liquors for. [Cultivation of Bacteria of Dog and Bird Dung.] C. D. Abel, London. From *The Chemisch-techn. und Hygien. Inst.* (Popp and Becker), Frankfurt a/Main, Germany. Eng. Pat. 21,720, Nov. 15, 1896.

The use of dog, pigeon, or poultry dung as a bate after liming, is apt to give irregular results, especially under unfavourable atmospheric conditions, and a staining of the hides may often take place. It is found that the action of these liquors is traceable to the influence of certain bacteria, which may be cultivated on gelatin plates or otherwise; usually there are also detrimental bacteria present, which are liable to propagate at a far greater rate than the others under certain conditions—a fact that accounts for the non-reliability of ordinary water. Three favourable bacteria are described, of which pure cultures may be prepared. In practice, the parings from the flesh side of the hides (ordinarily a waste product) are boiled with an equal weight of water for half an hour by means of injected steam in a covered vessel. Concentrated sodium carbonate solution is then added until the reaction is slightly alkaline, and the liquor is cooled down to 35° C., after which there is added the pure culture obtained by the gelatin plate process (with dilution), and by the further treatment corresponding to the peculiarities of the bacteria; the whole is then allowed to stand, and covered up from a period of from 12 hours to five days, according to season and temperature. The hides or skins are dipped for a short time in the concentrated decoction, or for a longer time in a diluted liquor, the time depending upon the state of development of the bacteria. The further treatment is the same as that when dung is used, except that the duration is shorter.

Instead of using a pure culture, a dog dung (preferably of the white kind; this being found most effective) may be used, and so treated that only the useful bacteria are allowed to propagate. In the presence of 0.5 per cent. of dilute sulphuric acid, the useful bacteria are the most enduring, the others being killed. With 0.5 per cent. of carbonate of soda the two kinds develop equally, and with 1 per cent.,

the useful bacteria sufficiently preponderate. For preservation, sterilised bran or flour is inoculated with definite quantities of the pure cultures, and the water is reduced by drying or pressure to about 10 or 12 per cent. Sterilised cakes containing a definite proportion of the bacteria may thus be prepared. Or, after the bacteria have been properly developed, they may be killed by heating the liquid; for if a sufficient proportion of their products has been produced, the liquor is found to be as effective as if it contained the living bacteria.—W. G. M.

Tanning of Skins, Improved Process for the [under Hydraulic Pressure]. R. W. James, London. From S. Alimonda, Spezia, Italy. Eng. Pat. 20,154, Sept. 11, 1896.

The skins are prepared in the usual way and placed in the ordinary tanning liquors contained in a brass vat, which is then firmly closed. The contents are subjected to hydraulic pressure, amounting to about five or six atmospheres. About once a day the tanning liquid is strengthened or partly renewed, until, after 15 to 20 days for calves' skins, or 50 to 60 days for cows' skins, the operation is complete.

—W. G. M.

XV.—MANURES, Etc.

Mercury Bichloride, New Application [Germicide] in Agriculture. A. Lomay. Bull. de l'Assoc. Belge des Chimistes, 10, [7], 277.

See under XVIII., page 917.

PATENT.

Manure, Impls. in the Manufacture of. [Humus from Turf, &c.] N. F. B. de Merecy, La Faloise, France. Eng. Pat. 6405, March 23, 1896.

ARTIFICIAL humate of lime is made by working peat or turf into a pulp with a sufficient quantity of water, and mixing the resulting bath with the necessary proportion of slaked lime made up with water into milk of lime. A flaky precipitate is formed, which may be separated by the filter-press and air-dried. The filtrate should give no further precipitate with lime-water. The precipitated humus should be clear brown, and may be associated with superphosphate or any other manure before use.—W. G. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Industry, Progress in, for the Second Quarter of 1896. Dingl. Polyt. J. 1896, 302, 64—70.

Loss in Dry Solids of Beet Pulp on Pressing and Drying.—Results of the loss in nutriment and in dry solids in beet pulp on pressing and drying vary within wide limits according to the varying conditions in each sugar works. During the campaigns 1892-93 to 1895-96 inclusive, Rydlowski (Die deutsche Zuckerind. 1896, 21, 934) has made analyses and calculated the loss for the sugar works at Wasserleben a. H. The drier, heated with brown coal, was a *Büttner-Meyer*, and gave dried pulp of 12 to 13 per cent. of moisture. For the whole period 3,010,430 centner of beets were worked, representing 197,133·87 centner of dry solids, while the dried pulp contained only 177,399·35 centner, being a loss of 0·65 per cent. on the beets, or of 10·01 per cent. on the dry substance. Of this, 0·16 per cent. on the beets, or 2·54 per cent. on the dry solids, was due to the drying process, the rest to pressing.

Preparing Molasses Pulp.—A communication by A. Stift (Oester.-ungar. Zeits. Zuckerind. Landw. 1896, 25, 224) gives the result of a practical test at the Aes sugar works of the process of L. Szyfer, patented under the name of J. Natanson, for preparing molasses pulp. Full-weight molasses at 70 R. (87·5 °C.) was passed for 3 hours through a battery of 10 vats containing the cold pulp, the water driven off being run to waste; but as it contained 31·5 per cent. of potash on the ash, it might, if concentrated, be used as manure. The molasses was drained off and the pulp dried in the centrifugal machine. Although in this instance the beet pulp had previously lain for five

days and had become sour the result was satisfactory, and it was still sound at the end of three months. Cattle ate it eagerly (5 kilos. each animal per day), no laxative action being observed.

Apparatus for Subjecting Atomised Fluids to the Action of Gases.—C. H. Knoop (Ger. Pat. 85,820, March 5, 1895). For carrying out the process described in Patent No. 80,392.

Saturation Vessel for Limed Sugar Juice.—C. H. Knoop (Ger. Pat. 86,815, March 3, 1895). The juice (in Ger. Pat. 80,392) is forced into a holder against conical bodies, from which it rebounds in a finely divided condition, while the current of carbonic acid, which has already acted on the collected juice, is led through cross plates, and rises in the holder. The object of the present invention is a form of vessel suitable for carrying out the process, and is characterised in that the current of carbonic acid rises from trumpet-shaped mouthpieces arranged immediately under the juice atomisers, so that the juice finds itself in a finely divided condition in a conical jet of carbonic acid. The action of the gas on the limed juice is consequently extremely intense.

Fills for Osmose Frames.—Th. Koydl (Ger. Pat. 85,887, Sept. 4, 1894). A novel fill for the frames of osmose apparatus is described, by which a fault hitherto unavoidable in osmosing is completely removed. This fault is met with when the molasses, even when previously proposed fills are employed, pours in thick layers through the apparatus and the expected duty is incompletely fulfilled, for the osmosis can only take place, as is well known, where the molasses is in contact with the paper. This diminished duty is still more influenced in the existing plant, working for the most part without fills, when, as frequently happens, adjacent papers come into contact. According to the invention, the fills consist of hollow or solid plates, provided with grooves or ridges, which are placed in the osmose frames so as to fill the central part and leave only a small space free; thus the molasses is forced to flow through the apparatus in thin layers, while, in addition, the contact of adjacent sheets is prevented.

Evaporating Apparatus.—Gebr. Forstreuter (Ger. Pat. 86,271, April 28, 1895). In previous constructions of vacuum pans, which allowed of a gradual increase of the heating surface, there is for each stage of the heating system a separate steam inlet and a separate steam and water outlet, with its attendant shut-off for each stage. Certainty in working is thereby greatly lessened, and mistakes are very possible on the part of the panman, who has to attend to two independent valves. To avoid uncertainty and hasten the evaporation of liquids to the crystallising point, a heating system is constructed in the vacuum apparatus, consisting of a number of pairs of tubes or coils one above the other, which start from and end either in the centre of the pan or outside, in cylinders in which pistons may be arranged so that, with the increase in the height of the liquid, extra heat with heating surface reaches the liquid.

Process for Preparing Crystals in Refineries.—Th. Drost (Suppl. to Ger. Pat. 58,070, Dec. 25, 1889. Ger. Pat. 86,255, Nov. 11, 1891, expires Dec. 24, 1904). The process is characterised, first, by the use of purified refinery syrup, which has been brought to the necessary concentration, a specific gravity of 1·325, either during the liquoring of the sugar to be washed in the centrifugal, or by adding massecuite or raw sugar; or, second, by the use of a cleare prepared by the addition of purified refinery liquor or water to reduce massecuite either crystallised already or near the point of crystallising.

Automatic Tube-Cleaner for Evaporating Apparatus and Boilers.—A. D. Lagrelle and C. H. Chantrelle (Aus. Pat. 16—847, Jan. 25, 1896). This arrangement consists essentially of a floating or non-floating body placed in the tubes of an evaporating apparatus, and which receives an up and down or swinging or rotatory motion from the boiling liquid itself, and by rubbing against the inner walls of these tubes prevents any deposit thereon.

Process for Preparing Refined Sugar in Bars from Raw.—L. Ste. Ele. Fontenilles and Desormeaux (Aus. Pat. 46—1057, Oct. 24, 1895). This process has some points in common with known processes, but differs essentially in others, and is characterised by the following claims:—

(a) Heating of the vessel in which the solution, purification, and concentration of the sugar takes place by a water-bath or other heating arrangement which does not produce a higher temperature than 100° C. in contact with the walls of the vessel; (b) the crystallisation of the massecuite takes place in vessels of convenient size, which rest on a perforated bottom; (c) the crystallised mass, when drained, is broken up for conversion into bars or lumps and (d) agitated in a closed vessel with water in case the addition of water is necessary, in consequence of slow draining, to give the mass the requisite consistence for pressing into bars or lumps.

Process for Purifying Molasses, Syrup, or other Sugar Solutions.—G. E. Cassel and D. Kempe (Aus. Pat. 46—1251, March 5, 1896). According to this process the constituents possessing an unpleasant smell and taste are to be removed from molasses, syrup, and other sugar solutions. The molasses has an alkali or calcium sulphite, containing excess of sulphurous acid, added to it, and is then warmed. The action of the sulphite is increased by heating to 100° C. or higher; in the latter case in a closed vessel under pressure. Concentration of the liquor is of no importance. The excess of sulphurous acid may be added any time before the treatment, and, after this is over, any excess of lime remaining may be removed by carbonic acid.

The Use of Soda in the Manufacture of Cane Sugar.—(From the report by Dr. W. Krüger, Die deutsche Zuckerind. 1896, 21, 933.) There have been various attempts made to remove the disadvantages, caused by the salts of organic acids in the juice, attending the use of lime (incrustations in the evaporating apparatus, bad boiling, the large quantity of molasses), chiefly depending on preparations of phosphoric acid, but also by means of soda. According to Winter, it is advisable to limit as far as possible the formation of lime salts in the Indian cane-sugar works during defecation. In the defecation in general practice the action of the chalk is to throw down the precipitable substances of the cane-juice and to neutralise the organic acids. Winter now recommends defecation with lime and neutralisation with soda-lye. The advantages of this procedure are, it is said: slight incrustation, quicker evaporation in the triple effect, higher yields in first product, sharp, hard, and dry grain; in the syrups, better grain, and for the most part a higher yield.

Separation of Cane-Juice under Pressure.—Pohlmann (Centralblatt Zuckerind. d. Welt, 1896, 4, 659) gives an account of the saturation under pressure as carried out at Eva Mill, Hawaii. The limed juice is exposed to a temperature of about 122° C. at a pressure of two atmospheres, before passing to the settling tanks. In this way more lime is used than by open settling pans, and on the surface of the juice in the settling tanks a scum collects which must be removed. The principal part of the impurities quickly falls to the bottom. This is so abundant as often to require 2 sq. ft. of surface in the filter-press for a ton of canes. The dry cake is about 1 per cent. on the weight of cane. The superheated juice shows an increase in quotient of 3½ to 4, with a purity of cane-juice of 86. The most noteworthy property of the superheated juice is its freedom from "gum," in consequence of which it evaporates quickly and boils easily. The centrifugal syrup, with an average purity of 72, was not sticky, and could be boiled to grain in the vacuum pan, spinning well, and giving a sugar of 92 polarisation. In the previous year the syrup spun off could not be boiled to grain. The success of the process is further shown in the fact that this year the cane gave a higher yield by mulling than in the previous year on the same quality with diffusion, in spite of the higher extraction of the latter method.—L. J. de W.

Dextrose from Different Sources, The Identity of; with Special Reference to the Cupric Oxide Reducing Power. C. O'Sullivan and A. L. Stern. Proc. Chem. Soc. 1896, [170], 218.

DEXTROSE was prepared from sugar (cane and beet), starch, and lactose, and the optical activity, the cupric oxide reducing power, and the specific gravity of the aqueous solutions of each specimen determined. These factors were found to be the same for each of the different specimens of

dextrose, and consequently from this evidence it is concluded that the dextroses from various sources are identical.

The figures obtained for the cupric oxide reducing power are practically the same as Allihn's, which are in common use in Germany, although the former were obtained by proceeding according to the directions previously given by O'Sullivan, which, however, do not differ materially from Allihn's. A modified form of filtering tube is described, which was found to possess several advantages.

Starch, Yield from Potatoes, 1896 Crop. Zeits. f. Spiritusind. 19, [18], 385.

THE percentage of starch yielded by the potatoes of the 1896 crop (Germany) is reported to be unusually low, averaging about 12 per cent., as compared with 14 per cent. for 1894-95, even the small potatoes thrown out from the cooking grades showing the remarkably low average of 12 to 15 per cent.

It is considered important, both for the producer and starch-maker, that the prices should be fixed per unit of starch, since this would enable the latter to estimate the probable yield of starch products obtainable, and to pay for the raw material accordingly.—C. S.

Starch, New Method of Estimating, in Cereals. J. Effront. La Bière, 4, [10], 145.

See under XXIII., page 923.

Starch in Cereals, Estimation of. L. Lindet. Bull. Soc. Chim. 1896, 15, 1163.

See under XXIII., page 923.

PATENTS.

Drying Sensitive Substances [Starches, &c.], Impts. in the Method of and Apparatus for. W. E. Heys, Manchester. From J. Hundhausen, Hamm, Germany. Eng. Pat. 22,924, Nov. 30, 1895.

See under I., page 887.

Drying Semi-Fluid [Syrups, Slurry, &c.] and like Materials, Impts. in the Method of and Apparatus for. W. E. Heys, Manchester. From J. Hundhausen, Hamm, Westphalia. Eng. Pat. 22,918, Nov. 30, 1895.

See under I., page 887.

Air-Pump, An Improved; Especially Useful for Exhausting or Diminishing the Pressure in Vacuum Pans, Stills, and other Vessels. J. A. Wanklyn and W. J. Cooper, New Malden, Surrey. Eng. Pat. 20,658, Nov. 1, 1895.

See under I., page 887.

XVII.—BREWING, WINES, SPIRITS, Etc.

Brandy, Composition of. Lussan. Monit. Scient. 1896, 10, 785—788.

THE following are the analyses of five new brandies (1895), the so-called impurities being expressed in milligrams per 100 c.c. of absolute alcohol. The sum of these impurities is called the "coefficient of impurities," and should always be over 340:—

	1.	2.	3.	4.	5.
Alcohol per cent.	67.7	64.8	66.1	67.0	70.2
<i>Impurities in mgrms. per 100 c.c. of Absolute Alcohol.</i>					
Acid (as acetic)	50.6	32.5	29.4	25.0	30.7
Aldehyde (as acetic)	5.9	7.4	15.9	14.0	46.1
Furfural	1.3	1.1	0.9	3.8	3.0
Ethers	158.3	131.8	98.4	77.4	287.7
Higher alcohols	151.9	167.7	267.4	222.0	159.0
Coefficient of impurity	367.0	349.5	412.0	342.2	526.5

The impurities may be divided into two groups: (1) oxidation products, acid and aldehyde; and (2) the ethers and the higher alcohols; and as the former group increases with the age of the brandy, its determination is of importance for the valuation of brandies. The percentage of acid and aldehyde in the above analyses, calculated on 100 parts of total impurities varies between 10.9 and 15.4, the mean being 12.9. This number is called the "coefficient of oxidation." The analyses of four brandies of the year 1893 show coefficients of impurities varying between 359.5 and 521.4 and coefficients of oxidation varying between 18.1 and 25.0.

The following are analyses of some older brandies:—

	1878.	1875.	1860.	1845.	1810.
Alcohol, per cent.	61.8	61.4	47.5	49.1	52.0
<i>Impurities expressed as above.</i>					
Acid.....	105.9	114.0	202.1	146.7	127.0
Aldehyde.....	26.0	28.9	48.1	31.4	44.0
Furfural.....	1.3	1.0	1.3	0.7	1.1
Ethers.....	127.0	144.0	133.3	125.5	132.0
Higher alcohols.....	194.6	173.6	345.4	203.5	175.1
Coefficient of impurity	154.8	161.8	730.1	507.8	479.2
Coefficient of oxidation	28.0	30.0	34.2	35.0	36.0

It will be seen from the above that although the numbers representing the ethers and higher alcohols vary considerably in different samples, and not in proportion to the age, the coefficient of oxidation gradually increases with the age of the sample, so that the latter may be at least approximately determined from this number. Thus, new brandies have a coefficient of oxidation of about 11—15, this number increasing fairly rapidly during the first years, but not exceeding 36 in a brandy 50 years old. Brandies to which alcohol has been added, and those obtained by the distillation of alcohol with grape husks, give very different results on analysis. The simple addition of alcohol will evidently reduce the coefficient of impurities. In other cases the coefficient of oxidation will be raised. The following are analyses of "doctored" brandies, of which D was obtained by distillation of alcohol with grape husks:—

	A.	B.	C.	D.
Alcohol, per cent.	47.5	48.0	35.3	50.3
<i>Impurities expressed as above.</i>				
Acid.....	50.5	80.0	20.4	160.8
Aldehyde.....	0.4	9.8	2.8	35.8
Furfural.....	0.1	0.2	0.1	1.2
Ethers.....	25.8	25.6	13.4	153.0
Higher alcohols.....	10.5	11.3	Traces	57.3
Coefficient of impurities	87.3	126.9	36.7	408.1
Coefficient of oxidation	58.3	70.7	63.0	18.0

—A. K. M.

Sherry Wine. E. W. Lucas. Pharm. J. 1896, 57, 397.

The British Pharmacopœia directs that sherry wine used in the preparation of the official wines should contain about 17 per cent. of absolute alcohol, but the author, on examination of some samples, found that the quantity present was generally only 13 to 14 per cent. Samples containing more than 14 per cent. have generally been strengthened by addition of rectified spirit. The author suggests a reduction of the standard. He also gives a series of tests, &c.:—

1. The specific gravity at 60° F. should be between 0.985 and 1.010.

2. The residue, when dried during 12 hours at 212° F., should be from 2 to 5 per cent. by weight.

3. 100 c.c. of the sample should require from 5 to 10 c.c. of normal potash solution for neutralisation (limit of free acid).

4. The wine should not contain more than 4 per cent. by weight of sugar.

5. It should yield by distillation, from 11 to 14 per cent. by weight of absolute alcohol.

6. Sherry wine should not contain citric or free tartaric acids, and should be entirely free from salicylic acid, formaldehyde, or other added preservative.—A. S.

Altered Wines, Proportion of Glycerin in. [Bitterness, &c.] J. Laborde. La Bière, 4, [11], 162—161.

The author has examined the amount of glycerin and its ratio to alcohol in various wines that have sustained alteration through bacterial or other agency. In the case of mannite wines he finds that the presence of mannite does not affect the alcohol-glycerin ratio, which remains at about the normal proportion of 12:1, mannite fermentation—which does not produce glycerol—only setting in, as a rule, when the alcoholic ferment is destroyed or paralysed before all the sugar has been attacked.

Mycoderma vini attacks both the alcohol and glycerin in wine, but in such proportion that their original ratio is finally unchanged; two samples, one infested with the mycoderma and the other free, having exhibited at the end of 12 months the ratios of 11.7 and 11.8 to 1 respectively, although at the outset the alcohol suffered to a greater extent than the glycerin. This was shown by an experiment with a liquid containing 10 c.c. of alcohol and 8 grms. of glycerol per litre, which, after two months' exposure at 25° in a Duclaux flask with aerating tubes, lost the whole of the alcohol, but only 2.8 grms. of glycerin.

Acid Wines.—*Mycoderma aceti* converts the alcohol into acetic acid without affecting the glycerin, but *bacterium xylinum* acts readily on both in presence of air, 5 per cent. of alcohol (converted into acetic acid) and 5 grms. of glycerin per litre being in 10 weeks' time reduced to nil and 0.75 gm. respectively.

In wines that lose their colour ("break") no change in the alcohol-glycerin ratio is apparent.

Turned Wines.—There are no certain indications of any action of the organism concerned in this malady on glycerin, the cause of the low proportion of this latter substance (about 1:16 of alcohol) found by Gayon and Dubourg being probably the inferiority of the must of wines subject to this form of sickness.

Bitter Wines.—A Médoc wine of 1887 vintage, employed by Gayon as a check sample in a pasteurising experiment, was examined by the author and found to exhibit the characteristics of bitter wine, having a pronounced bitter taste, a low percentage of volatile acids, and containing a number of rod-like organisms larger than those causing the wine to "turn." Whilst the amount of alcohol remained the same as in the pasteurised sample, the glycerin had decreased from 7.6 to 4.6 grms. per litre; the loss in this case is very similar to that found by Pasteur (3.4 grms.) in altered Burgundy. A similar loss of glycerin was observed in a Médoc, 1892, wine, part of which turned bitter in bottle. Judged by the flavour alone, the Gironde wines appear to be seldom subject to turning bitter; but since, if examined closely, other characteristics of this malady may be observed in altered wines, it may be, as suggested by Pasteur, that the organisms causing "turning" and bitterness are present together or in succession, and that to this circumstance the low proportion of glycerin in "turned" wines, is due.—C. S.

Beer, A Cause of Musty Taste in. W. Windisch. Wochenschr. für Brau. 1896, 13, 1177.

A raw, musty taste and odour is frequently imparted to beer by impure musty air in the cellar, and sometimes by the employment of old, spoilt, and even mouldy hops. The author has recently come across three cases of mustiness in beer which he has traced to another cause, namely, contamination with *bacterium termo*. The contamination occurred through the worts being left too long on the coolers. *Bacterium termo* thrives vigorously in wort, but perishes after the addition of the yeast. This source of mustiness may therefore be guarded against by shortening

as far as possible the time the wort remains on the cooler and by adding the yeast whilst the wort is running into the fermenting vessel.—A. K. M.

Acid in Potato Wort resulting from the Use of Diseased Tubers; An Excess of. G. Heinzelmann. Zeits. für Spiritusind. 1896, 353.

A DISTILLER who was using badly diseased potatoes obtained a very poor yield of alcohol owing to an excessive development of acid-producing bacteria in the wort. The author found that by adding a small amount of bi-sulphite of lime together with the yeast, he obtained a normal fermentation.—A. L. S.

Malt Extract for Colouring and Flavouring Beer; A Process for preparing a. J. F. Theurer. Ger. Pat. 88,319, 1896.

A MALT wort is prepared in the usual way and concentrated *in vacuo* to a syrup; it is then heated under pressure at a temperature of 115°–120° C. until the required colour and aroma are obtained.—A. L. S.

Lactic Acid in "Souring the Mash." J. Effront. Ann. Inst. Pasteur, Sept. 1896.

FROM his researches the author concludes that the value of the practice of lactic acidification of distillery wort is not due to the antiseptic properties of lactic acid, but rather to the physiological influence exerted on the yeast by the conditions (concentration, acidity, and low temperature) of the operation, whereby the activity of the yeast is increased at the expense of its reproductive power. The temperature (50°) employed in practice appears to result in the selection of a lactic ferment capable of resisting a high temperature and of giving a more rapid acidification with a minimum production of volatile acid.—C. S.

Carbohydrates, Easily and with difficulty fermentable. E. Prior. Bayerisches Brauer J. 1896, 6, 385–386.

THE author is of opinion that the end-products of the hydrolysis of starch by diastase consist of three achroodextrins and maltose, and that Lintner's isomaltose is a mixture of achroodextrin and maltose (Ling and Baker, this Journal, 1895, 175). Achroodextrins I. and II. were described by Lintner and Düll, whilst achroodextrin III., which immediately precedes maltose in a starch conversion, has been isolated and studied by the author. This body in a pure condition has a specific rotatory power of $[\alpha]_D^{20} 171^\circ$, a reducing power of 42.5 (maltose = 100), and a molecular weight favouring the formula $2(C_{12}H_{20}O_{10}) + H_2O$. Achroodextrins I. and II., though unaffected by most yeasts, are fermented by the high-fermentation yeast *Logos* and by *Schizosaccharomyces Pombe*. Experiments carried out under the usual conditions at 25° C. show that achroodextrin III. is partially fermented by Saaz and Froberg yeast, with Froberg to a greater extent than Saaz, and completely by *Logos* in an aqueous yeast extract. In the author's vacuum fermentation apparatus, Saaz and Froberg yeast completely fermented achroodextrin III. This dextrin is the constituent of wort fermentable with difficulty, which causes the differences in the end fermentation products when Saaz, Froberg, and *Logos* yeasts are used; this body has also the important influence on the degree of fermentation and after-fermentation which has hitherto been attributed to isomaltose.

The difficult fermentability of achroodextrin III. arises partly from the slight capability of diffusion as compared with the easily fermentable sugar, and partly from the circumstance that it is hydrated by yeast maltase to maltose, and finally to glucose, in order that it may be ready for fermentation.

The author's recent investigations upon worts which have been fermented by Saaz, Froberg, and *Logos* yeasts, show that maltose is present in the unfermentable portion in all three cases; in the first mentioned, glucose was found, which could only arise from enzyme action on the maltose.

—J. L. B.

Substitutes and Preservatives in American Breweries. Wochenschr. für Brau. 1896, 13, 1177–1179.

THIS is a report of a committee of the United States Brewers' Union on the replies received to a series of questions addressed to the members, concerning the materials which should be employed in the manufacture of beer. With regard to malt substitutes, the question as to whether it is advisable to manufacture beer solely from barley-malt, hops, water, and yeast, was answered in the affirmative only in two cases, and even one of these advocates of pure malt beer, states in another place that in order to produce a beer of greater stability, and having a pure, pleasant taste, it is advisable to use some raw grain, and that the public mostly prefer such beers. This last point is also emphasised by other brewers. With reference to the employment of malted wheat or maize, opinion appears to be about equally divided, but in some cases the question seems to have been assumed to refer to the complete substitution of these substances, which was not intended, and the objections raised only hold good where the quantities employed are excessive. On the other hand, the replies were, with only one exception, in favour of the use of unmalted grain, the majority of the brewers giving preference to rice and maize. The question as to whether raw-grain beers are objectionable from the hygienic point of view was also, with one exception, answered in the negative. With regard to the amount of raw grain recommended, this varies between 20 and 50 per cent. according to local conditions and the character of the beer to be produced, the majority of the brewers being in favour of 30–40 per cent. Opinion is more divided as to the use of grape-sugar, glucose, and syrup, but here again the majority are of opinion that when moderate quantities of pure preparations are used, the quality of the beer will not be affected.

With regard to hop substitutes, the use of any injurious preparations is denied. More than two-thirds of the brewers have never used hop substitutes, and where these have been partially employed, they have consisted of hop extract or lupulin obtained directly from hops, and containing as they do the essential constituents of the latter, these cannot be regarded as injurious substances.

The employment of preservatives is regarded with favour by the majority of the brewers, and in fact, during the hot weather, as necessary for the production of a good and stable beer.—A. K. M.

PATENTS.

Wort: Impts. in Boiling Wort and Extracting the Valuable Properties of the Hops, and Apparatus connected therewith. W. T. Ramsden, Middlesex. Eng. Pat. 20,176, Oct. 26, 1895.

THE wort is heated with the hops in a closed vessel, provided with some arrangement for keeping the wort and hops in circulation. When the desired temperature and pressure have been reached, sufficient heat is supplied to merely maintain these for the necessary length of time. The objects gained consist in saving the aroma due to the volatile constituents of the hops and in economising the fuel.—A. K. M.

Beer, Process for the Preservation of. [Adding Distillates from Strong Beer.] A. Lippke, Tilsit, Prussia. Eng. Pat. 17,183, Aug. 4, 1896.

THE process consists in distilling a strong beer and passing the distillate directly into the beer to be preserved. The amount of alcohol thus introduced should vary with the strength of the beer.—A. K. M.

Mashing and Brewing, An Improved Process and Apparatus for. L. Procházka, Turnau, Bohemia. Eng. Pat. 17,246, Aug. 4, 1896.

THIS is an improvement of the process described in Eng. Pat. 14,919, 1894 (this Journal, 1895, 981). The mash produced at any mashing temperature is allowed to settle, the clear diastatic malt extract is run off, the grains mash heated to 75°, and then boiled, whilst air at a temperature

of 125° is blown through for the purpose of peptonising and dissolving part of the albuminoid matter. The product is then mixed with the diastatic wort in order to saccharify the remaining starch, the whole is then boiled, the wort drawn off and hopped in the usual manner. The specification contains a full description of the apparatus employed.

—A. K. M.

Alcohol, Impts. in Check-Sampling and Measuring Apparatus for. [Use of Tipping Vessel and Gauged Catch Vessel.] L. Gelis, Toulouse, France. Eng. Pat. 20,235, Oct. 26, 1895.

The alcohol from the still runs into a tipping vessel suspended from a lever which is weighted by an adjustable counterpoise. When the tipping vessel discharges its contents, a small but definite proportion of the latter runs into a special reservoir of known capacity, and provided with a gauge so that the quantity can at any moment be measured, and its mean strength will correspond with that of the bulk. The apparatus is provided with four dials, indicating units to thousands, and the whole of the mechanism is actuated by the weight of the alcohol starting the tipping vessel.

—A. K. M.

Vinegar, Impts. in the Manufacture of. [Treating with Animal Charcoal.] F. G. Powell, A. Powell, M. E. W. Powell, and R. H. R. Powell, Bristol. Eng. Pat. 22,765, Nov. 28, 1895.

These improvements refer to the treatment of vinegar with animal charcoal, with the object of making it paler in colour or even colourless.—A. K. M.

Wine, Sparkling; Impts. in the Manufacture of [Addition of Sugar and Further Fermentation], and Apparatus therefor. A. Möller, Berlin. Eng. Pat. 14,501, June 30, 1896.

The apparatus consists of a bottle-shaped glass vessel of 200 or more litres capacity, and constructed to withstand pressure. It is provided with an exit tube reaching nearly to the bottom, and arranged so that no sediment settles in the latter. The vessel is charged with wine, to which some pure sugar candy is added, and the whole is allowed to ferment at a temperature of 16°–25°. In about a fortnight the carbonic acid produced will exert a pressure of about 5–6 atmospheres; the sediment will settle at the bottom and the wine will be bright. The vessel, with contents, is then kept in a cool place for 3–4 months for the wine to mature, after which it is drawn off into bottles, and is clear and brilliant. The pressure of the gas forces the wine out of the vessel as soon as the tap is turned on, but as the pressure diminishes as the wine is drawn off, artificial carbonic acid is forced in through a side tube in the neck of the apparatus. The vessel and outlet tube being made of glass, there is no fear of the wine acquiring any undesirable taste.—A. K. M.

XVIII.—FOODS; SANITATION, WATER PURIFICATION, & DISINFECTANTS.

(B).—SANITATION; WATER PURIFICATION.

Filtration of Sewage Effluents. First portion of a report made by Sir H. Roscoe to the Rivers Committee of the Manchester Corporation. Chem. Trade J., 19, 276–277 and 293.

Two experimental filters were constructed, one containing cinders and the other coke. The upper stratum of each filter was composed of clean-washed gravel, and the material composing the next layer was made to pass a 3-in. mesh but not a 1-in. mesh sieve. The filters were put into operation on Dec. 16th, 1895, and were supplied with the tank effluent from the Davyhulme Sewage Works, where lime and copperas are used as precipitants. From Dec. 15th, 1895, to Jan. 4th, 1896, each filter was emptied and filled once a day, and whilst resting full the water was level with the under surface of the gravel. Filtration took place at the rate of 63·7 galls. per square yard per 24 hours.

From Jan. 6th to Jan. 21st each filter was filled and emptied twice a day, increasing the rate of filtration to 122 galls. per square yard per 24 hours, and during this period the percentage reduction of organic impurity, as measured by the albuminoid ammonia, and the oxygen absorbed in 4 hours, averaged 47 per cent. in the cinder filtrate and 43 per cent. in the coke filtrate. Expressed as grains per gallon, the albuminoid ammonia was, in the—

	Tank Effluent. Cinder Filtrate. Coke Filtrate.		
Maximum	0·35	0·22	0·22
Minimum	0·07	0·025	0·027
Average	0·178	0·09	0·10

and the oxygen absorbed in 4 hours was—

Maximum	2·59	1·45	1·78
Minimum	1·00	0·59	0·58
Average	1·72	0·95	1·00

About half the time was taken up in filling, resting full, and emptying, and the remaining half in aerating the filters.

From Jan. 22nd to March 22nd the rate of filtration was further increased to an average of 171 galls. per square yard per 24 hours, and the daily analyses showed that cinder filtration removed, on an average, about 56 per cent., and coke filtration about 51 per cent. of the organic impurity remaining in the tank effluent. Detailed consideration of the nine weekly averages during this latter period showed that the albuminoid ammonia was in six cases above the limit of impurity which it is desirable should not be exceeded, and in three cases below the limit, in the case of both filters. The oxygen absorbed in 4 hours showed that in only one case was the weekly average above the limit with cinder filtration, the other eight averages being below the limit. The coke filtrate gave four weekly averages slightly above the limit, one decidedly above, and four below. (The limits are not stated.) The cinder filter therefore gave a better result than the coke filter. The chemical results further showed that, generally, the free ammonia was slightly higher in both filtrates than in the tank effluent, and the oxidised nitrogen lower. Thus, although a large oxidation of organic carbon took place, the organic nitrogen was not oxidised, but some nitrite and nitrate were reduced. The total purification effected is regarded as, upon the whole, satisfactory, but it is pointed out that the true aim of purification is the conversion of the organic nitrogen into nitrites and nitrates, and although this had not yet been attained in these filters it was believed that if the experiments had been continued for a longer period this, the main object of the experiments, might have been attained.

The analyses of the effluents from these filters, when compared with the effluents from the land filters which were working at the same time, show that so far as the chemical results are concerned, land filtration far exceeds the results of either cinder or coke filtration; but it is pointed out that the volume of effluent which can be treated permanently on land is limited as compared with the volume which can be filtered by artificial filters.

When the experiments were ended on March 22nd, the materials composing the coke and cinder filters were examined, and there was found to be some accumulation of both organic and inorganic matters throughout the filtering material. Samples placed in stoppered bottles and kept at a temperature favourable to secondary decomposition remained perfectly sweet, and only developed a slight earthy smell. Vegetable moulds appeared, and grains germinated in the material under these conditions.

Peroxide of iron contained in the cinder material was not reduced to a lower oxide, showing that the deposited matters did not appreciably absorb oxygen. To what extent foreign matters may accumulate in this kind of filters without crippling their working, time alone can determine.

In conclusion, it is recommended that an artificial area of cinder filters be constructed, which, under skilful management, ought to be able to deal with about 800,000 galls. of tank effluent per acre per day, the depth of filtering material

to be 3 ft. But it is insisted that the adoption of so large an area of filter beds is only advocated on the understanding that they are worked on the following principles, neglect of which may render them putrid and worse than useless, viz.:—

- 1st. Perfect aëration.
- 2nd. The equable distribution of the effluent over the whole surface of the filter bed, and downward filtration.
- 3rd. The retention of all suspended solids on the upper surface of the filter, which must from time to time be renewed.
- 4th. The free flow of the effluent from the bottom of the filter, drawing air into the pores of the material from the surface downwards.
- 5th. The volume of effluent water applied, not to exceed 800,000 galis. per acre per day.—L. A.

PATENTS.

Water, Improved Process and Apparatus for Purifying. [Automatic Addition of Oxidising Agents, followed by Filtration.] H. L. Doulton and R. Meldrum, Lambeth, Surrey. Eng. Pat. 22,132, Nov. 20, 1895.

THE process consists in adding to the water a soluble substance capable of oxidising organic matter, such as one of the various permanganates and manganates, and then filtering through a material such as charcoal, coke, or porous silica, capable of clarifying the water and at the same time removing from it the chemical reagent. A suitable domestic filter is described for carrying out this purifying process, with a device for automatically adding a suitable quantity of "oxidising material" before filtration.—L. A.

Sewage Matters or other Foul Waters, Impts. in the Production of Composition for Treating. [Nitric Cake roasted with Baucite, &c.] G. C. Kinloch and C. Heap, Rochdale. Eng. Pat. 20,355, Oct. 29, 1895.

NITRE cake is ground with shale, bauxite, clay, or any other suitable material containing alumina and iron, made into a paste with cold water or dilute sulphuric acid, moulded into bricks and allowed to set hard. During this setting process a chemical reaction occurs by which soluble aluminium and iron compounds are formed, and the product is used for purifying sewage.—L. A.

Sewage, Impts. in the Treatment of [Electrolysis of Chlorides], and in the Obtention of Valuable Products. James Hargreaves, Farnworth-in-Widnes, Lancaster. Eng. Pat. 23,064, Dec. 2, 1895.

A PLANT for electrolytically decomposing chlorides is erected in the immediate neighbourhood of a main outfall sewer. The chlorine is used to disinfect the sewage, whilst the metallic elements or hydroxides are obtained as marketable products. Further economy results from a combination of the above with an electric lighting plant, using the day current for electrolysis and the night current for lighting.—L. A.

(C.)—DISINFECTANTS.

Mercury Bichloride, New Application in Agriculture. [Germicide.] A. Lonay. Bull. de l'Assoc. Belge des Chimistes, 10, [7], 277—281.

DURING the last six years experiments have been carried on at Ciply with mercury bichloride solution as a preventive of the ravages of *Peronospora infestans* (potato disease). A 0.015 per cent. solution of the mercury salt is prepared, the liquid being coloured by 0.24 per cent. of copper sulphate. In this mixture the seed potatoes are steeped for about five minutes, and then thrown into heaps for planting. The results obtained are favourable; immunity from the disease being demonstrated. Moreover, the germination of the plants is accelerated, and the seed tubers are better preserved in the ground. Prolonged immersion (15 days) of the tubers in a solution of double the above strength did not retard germination.

For preserving the leaves of the growing plant from infection by the spores of *Peronospora*, the following mixture is found to be superior to Bouillie Bordelaise:—100 kilos. of quicklime are slaked with about one-third by

weight of water containing 200 grms. of copper sulphate per litre, the mixture being sprayed in the dry state over the plants at the rate of 250 kilos. per hectare, after the disease has become fully apparent in neighbouring fields. The powder adheres strongly to the leaves, and will withstand a week's rain.—C. S.

Disinfection of Large Apartments; Use of Formic Aldehyde Gas. E. Pfuhl. Zeits. für Hygiene, 1896, 339; also Proc. Inst. Civil Eng. 126 (iv.), 30—32.

METHYLIC alcohol was imperfectly burned in specially constructed lamps, with a capacity of about 200 c.c. each. Eight such lamps were used in a hospital-room containing 3.248 cb. ft.: and 5.4 grains of methylic alcohol were consumed per cubic foot of space. The larger apertures in the room were pasted up, and the vapours were allowed to remain in the room for about 20 hours. Test-objects, such as fresh and dry tuberculous sputa, and cultures of typhoid-, cholera-, diphtheria-, and other bacilli were spread about the room, the latter being either in the form of fresh agar cultivations or dried upon silk threads. Other experiments in smaller wards were tried, and one in a larger, but the last named was a failure. The lamps were not altogether satisfactory. But the author is of opinion that this gas cannot be used successfully for the disinfection of large spaces. Roux and Trillat have also been unsuccessful in using 8.8 pints of methylic alcohol in a Bardet-Trillat apparatus in a room containing 2,754 cb. ft.—W. G. M.

PATENTS.

Methyleneditannic Acids [Disinfectants], Improved Process for producing from Formaldehyde and Tannin. E. Dürkopff, Darmstadt, Germany. Eng. Pat. 816, Jan. 11, 1896.

THE process for the manufacture of methyleneditannic acids, which consists in adding a condensing agent, for example, concentrated hydrochloric acid, to a mixture of solutions of formaldehyde and a tannin, is claimed, and the products of such condensation, as new products.

—A. C. W.

Antiseptic Disinfectant. An Improved Manufacture of. [Hydroxyquinoline Potassium Sulphate.] A. J. Boulton, London. From F. Fritzsche and Co., Hamburg, Germany. Eng. Pat. 1409, Jan. 20, 1896.

TWO equivalents of o-hydroxyquinoline dissolved in alcohol are boiled with one equivalent of potassium or sodium pyrosulphate ($M_2S_2O_7$), and the crystalline product is dried and pressed. It is not hygroscopic, like the product made by the action of sulphuric acid, and it can be readily moulded into pastilles. It has no smell, and is neither irritating nor poisonous, yet it is a much more powerful disinfectant than phenol. It is soluble in water, and the solution has a remarkable power of dissolving phenols such as cresol and resorcinol.—L. A.

Disinfectant or Composition for Antiseptic, Disinfecting, Sanitary, and other Purposes; The Manufacture of an Improved. H. Hiscott, London. Eng. Pat. 20,246, Sept. 12, 1896.

COMMERCIAL "carbolic acid" is mixed with from one-half to nearly its whole weight of melted rosin, and to the mixture is added a sufficiency of strong alkali solution, with, if necessary, from 4 to 8 per cent. of cotton-seed oil or coconut oil soap to assist solution. The improvement consists in adding to this preparation α -naphthol, in the proportion of from $\frac{1}{2}$ lb. to 2 lb. for every 100 lb. of soluble phenols in the mixture.—L. A.

Sheep-Dip Powder, Impts. in. W. O., T. O., O., and W. B. B. Quibell, Newark, Nottingham. Eng. Pat. 20,702, Sept. 19, 1896.

FOR the preparation of a more or less dry compound which will not set hard by pressure or lapse of time, the inventors mix together arsenic, preferably rendered soluble with an alkali, sulphur, and an oily material, such as "spirits of

tar" (obtained from wood tar), rosin oil, or creosote oil. They prefer to use 100 parts of sulphur, 30 parts of arsenic, and about 5 parts of the fraction obtained from wood tar, having a specific gravity of about 0.874, 85 per cent. of which distils between 155° and 185° C.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Paper in Sweden, Wood Supply for. Papier Zeit. 21, [95], 3102.

IN consequence of the unusual briskness in the Swedish iron and steel industry, there has been an increased demand for wood charcoal, so that the competition of the charcoal burners, who use the same kind of woods as the paper-pulp makers, has raised the price of the raw material for the latter product some 25 to 30 per cent., a rise out of all proportion to the increased rates obtainable for pulp. In view of the serious injuries sustained by the trade in 1895, makers are advised to combine to settle the price of pulp.

—C. S.

Resin-Sizing. Papier Zeit. 1896, 2883.

THE following method is given for preparing resin size :—To convert 500 kilos. of resin, dissolve 56 kilos. of soda-ash in 70 litres of water, and with this solution boil 400 kilos. of resin, added gradually. When dissolved, add the remaining 100 kilos. of resin in the form of a fine powder, after which continue to boil three hours.—C. F. C.

Blanc Fixe, Preparation of. Papier Zeit. 1896, 2883.

INSTRUCTIONS are given for the preparation of a sufficiently pure barium chloride from crude barium sulphide. The sulphide is decomposed by hydrochloric acid in slight excess, and is then boiled to expel sulphuretted hydrogen. The excess of acid is then neutralised with a further addition of barium sulphide. In this way the iron and other metals are precipitated. The precipitation of the sulphate, or blanc fixe, is carried out in 10 per cent. solution of BaCl₂, to which sulphuric acid of 20° B. is added with continual stirring.—C. F. C.

PATENTS.

Paper-Making Machinery, Impts. in Separating Fibres from the Waste Liquors of. T. A. Marshall, London. From G. Smidth, Copenhagen. Eng. Pat. 21,275, Dec. 18, 1895.

DESCRIBES an arrangement of tanks with wire gauze strainers for recovering the waste fibre carried away by the back-water of paper works.—L. A.

Paper, Leather, or other Fabric, or the Like, Coated with Adhesive Material; An Improved Manufacture of. E. A. Zuber, Rixheim, Alsace, Germany. Eng. Pat. 21,637, Dec. 23, 1895.

SIZE-COATED papers or fabrics as at present manufactured, are coated with a uniform smooth layer of adhesive material. The improvement consists in producing a rough layer, by constructing the cylinder, by means of which the material is coated, with a surface full of small cavities, so that the adhesive film is formed of an infinite number of small reliefs or projections connected by a thinner film. Paper sized in this way is very pliable, not breakable, and adheres easily if slightly wetted, qualities which render it serviceable for many purposes for which the paper at present made is useless or unsuitable.—L. A.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Indian Podophyllum. W. R. Dunstan, Scient. and Tech. Research Dept. Imp. Inst. J., Dec. 1896, 441.

A COMPLETE examination is now being conducted in the laboratories of the Scientific and Technical Department, of the constituents of the Indian plant, *podophyllum emodi*, with the object of ascertaining how far its constituents

resemble those of the well-known American drug, *podophyllum peltatum*, from which the resin called "podophyllin" is obtained, which is largely employed in medicine in this and other countries.

The resin "podophyllin" was first prepared from the Indian root (rhizome) by the process of the British Pharmacopœia, which consists in exhausting the drug by percolation with alcohol, concentrating the percolate, and precipitating the resin by the addition of water. The resin so obtained is washed with water and dried by exposure to the air. The "podophyllin" is much lighter in colour than that made from *podophyllum peltatum*; this was found to be due to the large quantity of the colourless crystalline substance "podophyllotoxin" which it contains (30 per cent.), while the commercial American resin contains on an average about 20 per cent.

Dr. Mackenzie finds that the two resins (Indian and American) are identical in their medicinal effects, and that, therefore, there is no reason why the resin obtained from the Indian root should not be substituted for the American resin.

This is an important result, since the Indian root contains from two to three times as much of the valuable resin as the American root, and, is therefore, the more satisfactory source of the resin.

The following is a tabular statement embodying the results of estimations of the resin in the American plant, and in several specimens of Indian drug collected in various localities :—

(a.) *Podophyllum emodi*—

Name of District in India yielding the Root.	Percentage of Resin found.
Kulu	9.55
Bashahr	9.003
*Chamba	11.12
† "	12.03
Hazara	9.06

* Young roots.

† Old roots.

(b.) *Podophyllum peltatum*—

Four commercial specimens of roots gave—

- | | |
|--------------------|-------------------|
| (1) 4.17 per cent. | (3) 5.4 per cent. |
| (2) 5.2 per cent. | (4) 5.2 per cent. |

Scopolamine and i-Scopolamine. O. Hesse. Ber. 1896, 29, 2439.

A REPLY to the paper by Schmidt (this Journal, 1896, 613 and 737). The author finds that alkalis do not change the rotatory power of pure scopolamine (hyoscyne), and supposes that Schmidt must have used the commercial hydrobromide, since in Arch. der Pharm. 232, 395, the latter states that hydrobromide of i-scopolamine is very different to ordinary scopolamine hydrobromide, whilst in the former paper they were stated to be identical in appearance. From pure hyoscyne hydrobromide the author obtained no inactive scopolamine, but from the ordinary salt he obtained a substance in every respect similar to Schmidt's i-scopolamine hydrobromide, and this body after repeated recrystallisation yielded a considerable quantity of atropine hydrobromide. To the presence of this salt the difference in rotatory power of the different preparations is due.—A. C. W.

Camphor-Distilling from Leaves. D. Hooper. Chem. and Druggist, 1896, 59, 796.

THE author distilled two samples of leaves from camphor trees, in the ordinary way, for six hours. The first sample was a 50 lb. batch of fresh leaves from a camphor tree growing in the Government gardens at Ootacamund, Madras. They yielded 1 per cent. of essential oil of a pale yellow colour, and showing the following constants :—Sp. gr. at 15° C., 0.9322; optical rotation, + 9°·4 in a 200-mm. tube. Fractionation began at 175° C., with the following results :—Below 180° C., 20.6 per cent.; 180° to 185° C., 31.0 per cent.; 185° to 190° C., 15.5 per cent.; 190° to 195° C., 10.6 per cent.; 195° to 200° C., 5.6 per cent.; 200° to 205° C., 3.3 per cent.; residue, 8.6 per cent.;

total, 95.2 per cent. The loss was accounted for by the congelation of some of the oil in the condenser. The residual matter in the retort had a yellowish colour, a marked camphoraceous odour, and was solid at the ordinary temperature. The second sample was obtained from Naduvattam, in the Nilgiris, and the trees that yielded it were younger than those at Ootacamund, and grown at more than 1,000 feet less elevation. With this sample, the worm of the still was almost choked by the large quantity of camphor that condensed in it. About 4 fl. oz. of oil, containing suspended crystalline matter, was collected; after straining through cloth and pressing, the solid matter was recovered as a cake of camphor weighing 2 oz. The clear oil had a sp. gr. of 0.9314 at 15° C., and an optical rotation of + 54° in a 200-mm. tube. Fractionation began at 165° C., with the following results:—Below 185° C., 13.3 per cent.; 185° to 190° C., 20 per cent.; 190° to 195° C., 15.5 per cent.; 195° to 200° C., 20 per cent.; residue, 25 per cent. The oil from the Naduvattam leaves contained a total of 75 per cent. of camphor, soluble in rectified spirit, and having optical rotation, + 30°.—A. S.

Orycamphor. Manasse. Pharm. Zeit. **41**, 696.

A product of the oxidation of ordinary camphor, and recommended for relieving difficulty of respiration. It is soluble in water and is stated to have the composition represented by the formula $\text{C}_{10}\text{H}_{14}\text{O}_2$.—A. S.

Essential Oils. Duyk. J. Pharm. Chim. 1896, **4**, 453.

A CONTINUATION of articles abstracted in this Journal, 1896, 739 and 826.

Linalool Essence.—This is also called, according to its source, Rhodes wood oil, rose oil, and essence of *Licari Kandli*. The essence contains linalyl alcohol, an isomer of geraniol, converted by gentle oxidation into linal, identical with citral. On saponifying linalyl acetate a stereo-isomer, linalhodol, is obtained. Linalol is somewhat levo-rotatory; it boils at 97° C. under 15 mm. pressure, and at 20° C. has the density 0.867.

Oil of Lavender.—1 kilo. of the dry flowers of *lavandula vera* produces 3–6 grms. of the oil. Recently distilled the oil has an acid reaction, which is lost on keeping. The rotation, -8° , serves to distinguish this oil from the almost inactive oil of spike lavender, the latter also contains a much smaller amount of volatile acid. The oil contains large quantities of borneol, linalol, both free and in the form of acetic, butyric, valeric, &c., esters, cineol, and sesquiterpenes. On cooling no stearoptene is deposited. The French oil contains 30–40 per cent. of linalyl compounds, but the higher-priced Mitcham oil only 8–10 per cent. Generally, lavender oil is to be considered pure if it is soluble in three times its volume of 70 per cent. alcohol, and in the Abbé-Zeiss refractometer shows a refraction of 40° – 50° .

Oil of Spike Lavender contains, besides linalol and linalyl esters, much cineol and some camphor, also traces of geraniol, terpineol, and pinene. It is slightly dextro-rotatory and has an index of refraction of 1.4659.

Oil of Orange.—The essential oil of bitter orange, *citrus bigaradia*, is of higher value than that of the sweet orange, *citrus aurantium*. An oil of good quality, has the density of 0.8508 at 20°, and a rotation of $+92^\circ$. These oils are almost entirely composed of hydrocarbons, similar to limonene, and of small quantities of auranliol (linalol).

Oil of Petit Grain is obtained by the distillation of the young shoots and unripe fruits of *citrus aurantium* and *bigaradia*. The French oil is of better quality than the Paraguay; both contain linalol. The density of a good sample is 0.894–0.900 (Schimmel).—A. C. W.

Hazeline: Does it contain Formaldehyde? A. Gunn. Chem. and Druggist, 1896, **59**, 796.

THE author states that "hazeline" (distilled extract of witch-hazel) has an odour resembling that of a weak aqueous solution of formalin, and that it gives the formalin reaction by Helmer's test. The distillate from hazeline

made alkaline by potash solution, was declared to be formalin by several chemists, to whom it was submitted without mentioning the source.—A. S.

Chloroform. Pharm. Centralh. **37**, 715; Pharm. J. 1896, **57**, 377.

A new method of preparation consists in acting upon carbon tetrachloride with zinc and hydrochloric acid. Chlorine is replaced by hydrogen, and the hydrochloric acid formed acts upon the zinc with liberation of hydrogen, by which a further quantity of tetrachloride is reduced to chloroform. When there is no further formation of hydrochloric acid, the liquid is allowed to cool, and the layer of chloroform separated from the solution of zinc chloride.

—A. S.

Mydrol. [Iodo-methylphenylpyrazolone, *Febrifuge*.] Barbiano. Pharm. Centr. **37**, 718; Pharm. J. 1896, **57**, 378.

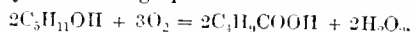
THIS name is given to the iodo-methylphenylpyrazolone. It is a white inodorous powder of bitter taste, freely soluble in water or alcohol, and insoluble in ether. It reduces the pulse and causes dilation of the pupil, and is stated to be non-poisonous.—A. S.

Action of Light on Amyl Alcohol. A. Richardson and E. C. Fortey. Proc. Chem. Soc. 1896, [169], 164–165.

IT was found that whereas in the case of methyl, ethyl, propyl, and butyl alcohols, an exposure extending over many months failed to produce any apparent change, the alcohols remaining neutral to litmus and containing no hydrogen peroxide, amyl alcohol gave strongly acid reactions and contained large quantities of hydrogen peroxide after only a few days' exposure. A similar change seemed to take place in the case of octyl alcohol, but to a very much smaller extent. The action of light on amyl alcohol was therefore studied in detail.

Amyl alcohol was exposed to light in presence of excess of water and of oxygen for a few days. A portion of the water was then tested with titanous acid, when the presence of hydrogen peroxide was shown by a deep brown coloration. Another portion was shaken with pure ether and potassium bichromate, when the ether assumed an intensely blue colour, leaving no doubt as to the presence of hydrogen peroxide in the solution. In another experiment liquid water was absent, amyl alcohol being exposed in presence of moist oxygen. Two days' exposure sufficed to bring about the formation of hydrogen peroxide, as shown by the titanous acid test. A third experiment was made with dry alcohol. A sample of amyl alcohol dried first from quicklime, then by distillation from sodium, was sealed in a bent tube containing oxygen and phosphorus pentoxide (care being taken not to allow the liquid to wet the pentoxide), and kept in the dark for seven weeks. After exposure the alcohol was found to contain abundance of hydrogen peroxide.

The acidity was found to be due to the presence of valerician acid, and the absence of carbon dioxide leads to the conclusion that the change is one of a comparatively simple nature, not involving the breaking down of the molecule. It seems, then, that the products formed by the oxidation of amyl alcohol in presence of sunlight and oxygen only differ from those formed when other oxidising agents are used in that hydrogen peroxide is formed instead of water. The change may, therefore, be represented by the following equation:—



It was found that the presence of sunlight was essential to the change, a sample of amyl alcohol kept in the dark at 100° for nine days remaining neutral to litmus and containing no hydrogen peroxide.

Ether, Action of Light on. A. Richardson and E. C. Fortey. Proc. Chem. Soc. 1896, [169], 165–166.

ETHER prepared from pure alcohol and pure sulphuric acid, and then treated with potassium bichromate, was dried by repeated distillation from phosphorus pentoxide in a specially constructed apparatus by means of which samples

could be sealed for use without contact with air. The ether was then exposed in a tube containing oxygen which had been dried by contact with phosphorus pentoxide for many weeks. After three days' exposure the liquid gave a well marked peroxide reaction when tested with titanous acid.

In order to investigate the other products formed, a sample of ether was exposed for many weeks in presence of water and oxygen. It was then rich in hydrogen peroxide, and gave an acid reaction with litmus. The neutralised solution was distilled on the water-bath. The distillate, consisting chiefly of ether, was also proved to contain aldehyde by its reducing action on ammoniacal silver nitrate, and by its restoring the colour to rosaniline hydrochloride, decolorised by sulphurous acid. The residue in the distilling flask gave a distinct red colour with ferric chloride and the characteristic smell of ethyl acetate on warming with alcohol and sulphuric acid, leaving no doubt as to the formation of acetic acid. No carbon dioxide was formed in the reaction, which may, therefore, probably be represented by the equation—



aldehyde being an intermediate product. Here, again, hydrogen peroxide takes the place of the water which is formed when ordinary oxidising agents are used.

Mercury Bichloride, New Application [Germicide], in Agriculture. A. Lomay. Bull. de l'Assoc. Belge des Chimistes, 10, [7], 277.

See under XVIII. C., page 917.

Methylene Ditannic Acids [Disinfectants], Improved Process for producing from Formaldehyde and Tannin. E. Dürkoff, Darmstadt, Germany. Eng. Pat. 816, Jan. 11, 1896.

See under XVIII. C., page 917.

Citric and Malic Acids, Detection and Separation of, by means of Quinine and Cinchonine. L. Lindet. Bull. Soc. Chim. 1896, 15, 1160.

See under XXIII., page 917.

Otto of Roses, Note on. Conroy. Chem. and Druggist 1896, 49, 771.

See under XXIII., page 924.

Otto of Roses, The Characters of. J. C. Unnoy. Chem. and Druggist 1896, 49, 795.

See under XXIII., page 924.

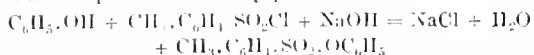
Ethereal Oils, Valuation of. Schinmel and Co. Chem. Centr. 1896 [22], 977.

See under XXIII., page 925.

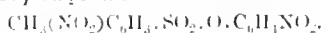
PATENTS.

Paranitrophenol and Homologous Ethers, and Ortho-nitrotoluene Parasulphonic Acid, Impts. in the Production of. La Société Chimique des Usines du Rhone, anct. Gilliard, P. Monet, and Cartier, Lyons, France. Eng. Pat. 21,194, Dec. 17, 1895.

The nitration of phenol produces varying amounts of *o*- and *p*-nitrophenols. According to the claims of this patent, phenol is combined with an aromatic sulphonic chloride, toluene sulphonic chloride by preference,



on nitration of the product, the *p*-nitrophenol ester of *o*-nitrotoluene-*p*-sulphonic acid is formed.

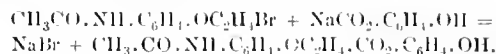


The nitration is performed by mixing the phenol sulphonic ester with potassium nitrate or concentrated nitric acid and adding in small quantities to sulphuric acid (66 B.), the

temperature being kept at 15° C. The nitrated ester is split up into *p*-nitrophenol and *o*-nitrotoluene-*p*-sulphonic acid by boiling with solution of sodium or caustic soda or potash in absolute alcohol, and after distilling off alcohol, distilling off the *p*-nitrophenol in a current of steam. From the residue, *o*-nitro-*p*-toluene sulphonic acid is precipitated by mineral acids.—A. C. W.

Hydroxy-Phenacetine-Salicylate, Manufacture of. O. Imray, London.—From Farbwerke, vorm. Meister, Lucius, and Brünig, Hoechst am Main, Germany. Eng. Pat. 24,517, Dec. 21, 1895.

HYDROXYPHENACETIN SALICYLATE is claimed as a new product, together with its process of manufacture by heating chloro- or bromo-phenacetin with sodium or other salicylates. The condensation takes place on heating for half an hour at 170–180° C.



—A. C. W.

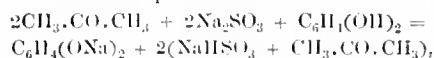
Saccharine, or Compounds thereof, or Mixtures containing the same, Impts. in the Manufacture of, and in the Production and Treatment of Materials for Use therein. C. Fahlberg, Salbke Westerhüsen, Germany. Eng. Pat. 17,101, Aug. 6, 1896.

In Eng. Pat. 10,955, 1895 (this Journal, 1896, 49), the separation of ortho- and paratoluene sulphonic acids by means of the magnesium salts was claimed. According to the present patent, the zinc salts may be used in the same process.—A. C. W.

XXI.—PHOTOGRAPHY.

Aldehydes and Acetones in Presence of Sodium Sulphite, Use of, in Photographic Development. Lumière Bros. and Seyewetz. Bull. Soc. Chim. 1896, 15, 1161.

It has been known for some time (cf. this Journal, 1890, 101) that the addition of formaldehyde to an organic developer considerably increases its power; but the mechanism of the reaction has not hitherto been discovered. The present authors find that most aldehydes and acetones have the same effect, even causing phenolic developers to act on the latent image without the assistance of any alkali; but the phenomenon is only to be observed in the presence of sodium sulphite. From a number of experiments it would seem probable that a decomposition of the subjoined nature must take place to a certain extent, proceeding during the operation of development—



and that the alkaline phenate so produced does the work of the alkali usually employed. It has not been found possible, however, to isolate the latter compound; but on evaporating a mixture composed as above, or containing pyrogallol instead of the quinol (hydroquinone), thoroughly drying the crystals, and boiling them with excess of alkali, a small quantity of acetone was set free, while in the absence of the phenol a negative result was obtained. Moreover, the presence of acetone causes ether to extract from the mixture a smaller amount of the phenolic body than would otherwise be the case, which appears to show that it is partly retained in the form of an alkaline salt.

From the practical point of view the authors find that acetone works best with "pyro"; and that in the case of hydroquinone (quinol) variations in the amount of sulphite employed make little difference to the result, whilst within certain limits the developing power increases with the quantity of acetone. The following formula is suggested:—hydroquinone (quinol), 3 grms.; sodium sulphite, 10; acetone, 10 c.c.; water, 100.—F. H. L.

XXII.—EXPLOSIVES, MATCHES, Etc.

PATENTS.

Explosives containing Saltpetre. Process for the Manufacture of. M. Bielefeldt, Wittenberg, Saxony. Eng. Pat. 17,204, Aug. 4, 1896.

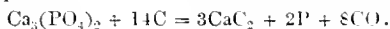
AN explosive, composed of sodium and potassium nitrates, sulphur, coal-tar (or, in place, or partly in place of the latter, resins, fatty drying oils, lacs, and varnishes), and potassium bichromate, permanganates, and manganates.

The following is given as a suitable composition:—Soda saltpetre, 69 per cent.; potash saltpetre, 5 per cent.; sulphur, 10 per cent.; coal-tar, 15 per cent.; potassium bichromate, 1 per cent.

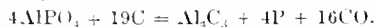
The comminuted ingredients are thoroughly mixed together and subsequently compressed between heated plates or rollers. When the pressure applied is sufficiently great the simultaneous heating may be omitted, particularly if the mixed ingredients have been moistened, or if adhesive agents have been added. The coherent mass obtained in this manner may be finally treated in any desired manner.—R. B. P.

Phosphorus, its Acids and Salts; Impts. relating to the Production of, from Mineral Phosphates, Bones, and other Materials containing Phosphoric Acid. [Heating in Electric Furnace with Carbon.] H. Hilbert, Biebrich-on-the-Rhine, and A. Frank, Charlottenburg, Germany. Eng. Pat. 18,785, Oct. 7, 1895.

ORDINARY tricalcium phosphate is mixed with carbon, and heated intensely, as in an electric furnace, to form calcium carbide and set free phosphorus, arrangements for collecting which are made. The proportions to be used are indicated by the equation—



Aluminium phosphate may be similarly treated, the proportions being—



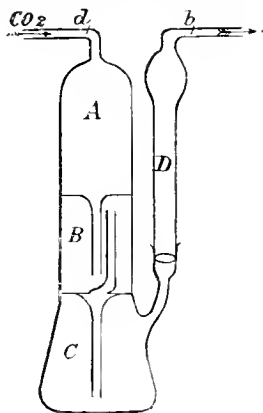
Mineral phosphates generally, bones, and phosphatic slags, may be used instead of a pure phosphate.—E. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Potash Bulb, A New Form of. M. Gomberg. J. Amer. Chem. Soc. 18, [11], 941–942.

IN the diagram, compartments B and C together contain as much of the strong potash solution as would completely fill



A, the latter serving as a safety reservoir in case of back-suction. D, which is fastened to the bulb by means of a ground-glass joint, contains solid caustic potash, or soda lime, supported by a plug of glass wool.—H. B.

PATENTS.

Butyrometers or like Fat-Testing Instruments, Impts. in or relating to. N. Gerber, Zürich. Eng. Pat. 18,282, Aug. 18, 1896.

THE neck of the butyrometer is made cylindrical in form, and is provided with one or more annular grooves. The india-rubber plug used to close the instrument at the bottom is of a cylindrical shape, and fits firmly into these grooves, so that there is less danger of the plug being blown out of the apparatus by the gases formed in the butyrometer by the action of the sulphuric acid on the milk or other substances under examination.—W. P. S.

Thermometers [Maximum and Minimum Upright], Impts. in. J. J. Hicks, Hatton Garden, London. Eng. Pat. 23,300, Dec. 5, 1895.

MAXIMUM and minimum thermometers are formed of vertical tubes having a thermometric bulb at the lower end and an expansion chamber at the upper. They contain a short length of mercury, say, from $\frac{1}{2}$ to $\frac{1}{4}$ in., a dense thermometric fluid, as creosote or sulphuric acid, and maximum and minimum indexes, which are set by a magnet in the usual manner. In another form, the vertical tube is connected at the top to a second tube parallel thereto, having an expansion chamber at its lower end. Both tubes are provided with recording indexes.—R. S.

INORGANIC CHEMISTRY.—
QUANTITATIVE.

Pettenkofer's Method for Determining Carbonic Anhydride in Air. Prof. Letts and R. F. Blake. Proc. Chem. Soc. 1896, [169], 192–193.

THE authors discuss the errors in the process of absorbing the carbonic anhydride by baryta from a sample of air collected in a glass vessel, and titrating with acid, and show that, in addition to the more obvious sources of error, the action of the alkaline absorbent on the glass is one of importance.

In order to avoid it, they coat both the receiver containing the air sample and the bottle holding the stock of standard solution of baryta with paraffin wax. By this means they at once obtained more concordant results in a series of determinations. They then proceeded to test the degree, both of accuracy and of delicacy, of Pettenkofer's process if carried out with all the available precautions which suggested themselves. For this purpose they employed paraffined receiving vessels, an apparatus for performing the titrations in a vacuum, and burettes of special construction. In addition, an apparatus was used for delivering very accurately measured volumes of pure carbonic anhydride into known volumes of air previously freed from that gas.

Experimenting with such mixtures of the two as occur in air, containing about 3 vols. of carbonic anhydride in 10,000, the authors show that with careful work the mean error in the determinations need not exceed -0.04 part. The actual quantity of carbonic anhydride added to each receiver full of air, in a series of five experiments, amounted to 0.927 c.c.; the mean amount, found to be 0.916 c.c., giving, therefore, a mean error of -0.011 c.c.

They thus show that Pettenkofer's process, if suitably performed, is one of great accuracy and delicacy.

Purifying Material [Gas Works], Testing the Regeneration of. Leybold. J. de l'Eclair. au Gaz, 44, [21], 407–409.

TWO methods, one direct the other indirect, of determining the degree of regeneration attained by the hydroxide of iron in the purifying material when exposed to the air in heaps, are proposed by the author. The first consists in measuring the volume of hydrogen sulphide evolved from a constant weight or volume of the substance under the action of nitric acid in an apparatus resembling Knop's nitrometer, and is performed as follows:—About 25 grms. of substance are placed in a small glass inserted in a wide-mouthed bottle, standing up to its neck in cold water, and containing some 50 c.c. of nitric acid of 20° B., diluted with an equal volume

of water. The caoutchouc stopper of the bottle is connected, by means of a tapped glass tube and caoutchouc tubing, with the upper extremity of a gas-testing tube, graduated from 0 to 500 c.c., which is immersed up to the zero mark in water. On tilting the bottle, the acid and substance are brought into contact, and the hydrogen sulphide rapidly given off, acts by downward displacement of air upon the surface of the water in the graduated tube. The amount of depression of the water column thus represents the volume of H_2S evolved. This operation is repeated after each turning of the heap, until all the iron sulphide is found to be oxidised. The samples should always be taken from the bottom of the heap, or the results will not afford correct indications of the progress of the regeneration.

The indirect method is performed by collecting samples of the gas given off by the heap by means of a lead pipe inserted into the bottom of the mass, the contents of the pipe being then tested for the proportion of oxygen present. When this has reached its maximum, or even when it attains 16 per cent., the regeneration will be complete.

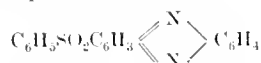
—C. S.

ORGANIC CHEMISTRY.—QUALITATIVE.

Benzenesulphinic Acid, A New Reagent. [Presence of Quinone and Quinonoid Groups.] O. Hinsberg and A. Himmelschein. Ber. 1896, 29, 2019—2023.

HINSBERG has shown (Ber. 27, 3259; 28, 1315; 29, 785) that benzenesulphinic acid combines with quinones and quinone-imides of the benzene and naphthalene series, forming derivatives of diphenylsulphone and phenyl-naphthylsulphone. The condition for the reaction is the presence in the molecule of the quinone or quinone-imide of a free hydrogen atom in an *o*- or *p*-position to one of the CO or $\text{C}:\text{NH}$ groups and the absence from the rings of hydroxyl- and amido-groups.

Phenazine reacts with benzenesulphinic acid, giving phenazylphenylsulphone—



a compound crystallising in pale yellow plates, m.p. 241°, and sparingly soluble in water and alcohol, but moderately soluble in acetic acid. It dissolves in concentrated sulphuric acid, with an orange colour, apparently forming with the acid a salt which is dissociated by water, as on the addition of the latter the free sulphone is precipitated. Alkalis at 100° have no action upon the compound, but zinc and hydrochloric acid, when heated with it, decompose it.

Its formation thus affords evidence of the quinonoid nature of phenazine.

The quinonoid condensation-derivative of *p*-amidobenzylalcohol, $\text{HN}:\text{C}_6\text{H}_4:\text{CH}_2$, obtained by heating this compound with dilute hydrochloric acid (O. and G. Fischer, Ber. 28, 881), reacts with benzenesulphinic acid with the formation of *amidotolylphenylsulphone*, $\text{C}_6\text{H}_5\text{NH}_2\text{CH}_2\text{SO}_2\text{C}_6\text{H}_4$. This forms yellow needles, m.p. 176°, is moderately soluble in hot water, and, on cooling, separates in colourless needles, which turn yellow on drying, owing, no doubt, to the loss of water of hydration. It combines with concentrated hydrochloric acid, giving a colourless salt, which is dissociated by water, dissolves in acetic acid with a yellow colour, and yields diazo-salts and azo-derivatives.—E. B.

Formula, Test for. Lebbin. Pharm. Zeit. 41, 681.

To a few cubic centimetres of a solution containing formic aldehyde, add about 0.05 gram. of resorcinol and an equal volume of caustic soda solution (50 per cent.), and heat the mixture to boiling. The yellowish colour first formed becomes red, and is permanent. This reaction does not appear to take place with other bodies besides formaldehyde, and is stated to be capable of detecting 1 part of formaldehyde in 10,000,000 parts of water. In the proportion of one millionth, the indication is very marked, and a volumetric method of quantitative determination may be adopted.—A. S.

Acid Magenta and Schiff's Reaction. L. Lefèvre. Bull. Soc. Chim. 1896, 15, 1169.

CAZENÈVE is in error when stating (Bull. Soc. Chim. 1896, 723; also this Journal, 1896, 560) that magenta S. does not yield the violet colour produced by rosaniline hydrochloride when its solution, decolorised by sulphurous acid, is mixed with aldehydes. The only difference is that the reaction is not instantaneous. Under certain abnormal conditions, the sulphonated compound may not give the reaction, but it will appear on addition of more aldehyde; just as it is possible, by adding three or four times the proper amount of bisulphite, to prevent the colour from being produced in the case of magenta itself. The nature of the aldehyde employed, also affects the rapidity of the test.

Schiff himself pointed out that his reaction did not depend on a simple regeneration of the magenta decolorised by the sulphurous acid, but on the formation of a new compound.

—F. H. L.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Mineral Oils: Estimation of Gas-producing Value.

F. Helfers. Zeits. f. ang. Chem. 1896, 650—654.

The method of estimating the value of a gas-oil by its colour, specific gravity, creosote percentage, and boiling point is unsatisfactory, and the only reliable process is to measure the quantity and quality of the gas yielded by a given amount of the oil. As carried out at the various experimental stations a large and costly apparatus requiring for each experiment, from 10 to 150 kilos. of oil, is employed. This is quite unsuitable for small works, and for their purpose the author gives the results of his experiments with the Wertheke laboratory gasifying apparatus, and shows that by working with 40 grms. of the oil correct values may be obtained.

The required data are the amount of residue, tarry distillate, and the quantity and photometric value of the gas obtained on destructively distilling a given weight of the oil. The apparatus consists of (a.) A reservoir for the oil. (b.) A retort capable of being heated to, and maintained at, a constant high temperature. (c.) A condenser in which the tar is collected. (d.) A gasometer to receive the gas. These parts are separable from each other, and (a.), (b.), and (c.) are weighed before and after each experiment.

The normal course of the distillation is judged and regulated by the colour of the gas and gas-tar formed, which should be brown and dark-coloured respectively. A too rapid addition of oil to the retorts gives a white gas and a pale-brown tar, whereas, should the rate be too slow, the gas becomes dark brown and the tar very thick. The flow should be kept steady during the experiment, and may vary from 10 to 30 drops per minute according to the nature of the oil investigated.

The values obtained are calculated to 100 kilos. of the oil; according to Hirzel's formula the lighting value = $\text{Yield of gas} \times \text{photometric value} \times 1.00$ where the 35 stands

for an hourly consumption of 35 litres. Now different conditions of experiment may give from 100 kilos. of oil, in one case 50, and in a second trial 60 litres of gas, leading to a 50 per cent. less value for the lighting power in the second than in the first case. The author overcomes the deficiencies of this formula by the following considerations. He finds with an hourly consumption of 35 litres, and employing the German standard candle as the photometric standard, that the increase or decrease of the light strength (Z) bears the same ratio to the difference between the obtained (A) and the assumed average gas volume (50 cb. m.) as the oil residue, coke + tar (C + T), bears to 100 parts by weight of the oil.

$$Z : (A - 50) = (C + T) : 100$$

$$\text{or } Z = (A - 50) (C + T) / 100$$

Now $I_{50} = L + Z$, where L is the observed photometric value, and I_{50} this value calculated to a gas yield of 50 cb. m. Therefore—

$$I_{50} = L + (A - 50) (C + T) / 100$$

The following table shows the value of the method and how far this formula leads to correct results:—

	Analysts.									
	Heurici.	Diamant.		Eisenlohr.						Helfers.
		1.	2.	1.	2.	3.	4.	5.	6.	
Gas yield in cb.m. per 100 kilos. of oil.	55.70	63.36	54.23	58.90	54.72	59.09	61.10	48.55	54.93	57.17
Light value in German standard candles.	9.00	5.59	9.50	7.30	9.50	6.60	6.50	12.00	9.20	8.25
Coke, per 100 kilos. of oil	7.37	9.64	5.51	8.70	5.15	9.20	9.56	3.84	5.85	6.69
Tar, " " "	11.83	35.15	41.63	37.60	39.95	40.11	36.38	42.88	38.07	40.60
L ₂₀	11.46	11.48	11.54	11.42	11.62	11.08	11.59	11.40	11.35	11.64

The experimental gas yield should, for correct results, not be allowed to fall below 45 cb. m., or to rise above 70—75 cb. m. per 100 kilos. of oil. In measuring the gas, no pressure correction is necessary; reduction to normal temperature may be avoided by always working at about 20° C., the difference in value obtained between the limits of 17°—23° C. correspond to about half a candle.

The author shows that the errors due to oxidation of the retort and incomplete condensation of the tar, are small and tend to balance each other.

A comparison between the laboratory results and those obtained at the investigation stations with two different oils and calculated to 100 kilos., is shown below:—

	Station A.		Station B.	Laboratory Apparatus.	
	1.	2.		1.	2.
Gas yield	52.00	53.00	60.63	59.00	63.05
Candle-power	10.00	9.17	6.70	6.50	5.00
L ₂₀	10.96	10.58	10.89	10.47	10.26
Gas yield	52.00	55.00	61.21	56.43	66.48
Candle-power	9.17	8.33	6.20	8.50	5.50
L ₂₀	10.13	10.58	10.55	11.30	11.02

—J. T. C.

Weighting in Silk Yarn. The Quantitative Estimation of Herzfeld. Leipziger Färber u. Zeugdrucker Zeit. 45, 485.

ACCORDING TO E. Königs, Director of the Conditioning Establishment at Crefeld, the weighting is thus estimated:—(1) Estimate moisture by drying; (2) fatty matters by extraction with ether; (3) boil out silk glue with water; (4) dissolve out Prussian blue with alkali, re-precipitate with acid, and ignite precipitate with addition of HNO₃; 1 part of Fe₂O₃ = 1.5 parts of Prussian blue; (5) estimate SnO₂ present in ash of silk and calculate as catechu-tannate of tin, 1 part of SnO₂ = 3.33 parts of catechu-tannate; (6) estimate total Fe₂O₃, subtract that present as Prussian blue, and the amount naturally in the silk (0.4—0.7 per cent.), and calculate the remainder as tannate; 1 part of Fe₂O₃ = 7.2 parts of tannate of iron (or 5.1 per cent., if present as ferrous compound).

Moyret's directions for the determination of the weighting materials are as follows:—(1) Dry at 120°—130° C., if the loss exceed 15 per cent. the silk is weighted with hygroscopic materials; (2) boil in distilled water; in solution are glycerin, sugar, magnesium sulphate, &c.; (3) extract with ether to obtain fatty matters; (4) determine the nature of the weighting further by treating for 15 minutes with dilute hydrochloric acid (1:2) at 30°—40° C. Tannate of iron is indicated by the silk being decolorised to reddish-yellow, and the solution showing a dirty brown colour, which does not change to violet on dilution with cold water. If the solution be reddish and on dilution become violet, logwood is present. If the fibre be dark green, the solution yellow, and unchanged on dilution, the silk has been dyed with Prussian blue; and if the fibre be green and the solution pink, changing to violet on the addition of water, the dye is logwood black on a ground of Prussian blue.—R. B. B.

Starch, New Method of Estimating in Cereals. J. Effront. La Bière, 4, [10], 145—147.

THE grain being ground to an impalpable powder, 3 grms. are freed from fat when necessary, as in the case of maize, either by extraction in a Soxhlet apparatus, or merely by leaving in contact with ether in a tapped funnel for five minutes; the operation being performed three times, followed by washing with the same solvent and drying for half an hour at 100° C. The flour is then triturated in a glass mortar with 20 c.c. of concentrated hydrochloric acid (say, 49.92 grms. per 100 c.c.), added by degrees, and at the end of six minutes the whole is transferred to a 100 c.c. flask containing sufficient water to arrest the action of the acid, which will thus be restricted to the solution of the starch and its partial conversion into dextrin, very little, if any, glucose being formed. When carefully filled up to the mark the whole is well agitated and filtered through a folded filter, the residue being tested with iodine and examined under the microscope: if the trituration has been properly performed no granules of starch will be found, only the solution surrounding the solid particles being coloured blue. An accurately measured quantity (say, 75 c.c.) of the filtrate is taken and neutralised by caustic soda solution, an alkaline reaction being avoided; then concentrated to one-half on the water-bath, care being taken to preserve the liquid very faintly acid. On making the liquid up to the original bulk (75 c.c.), again it is filtered through a paper and a little asbestos until clear, and examined in the polarimeter (40 cm. tube). The residual liquid is titrated warm by the aid of 5 c.c. of cupro-tartrate solution diluted with 80 c.c. of water, the amount of glucose (g) per 100 c.c. being—

$$\frac{0.025 \times 100}{N} \text{ (the quantity, 9 c.c., used in the titration).}$$

R being the original reading (Soleil polarimeter, 20 cm. tube), the addition to be made for the glucose present, which is, in this case, calculated to dextrin, is represented by $R' [= g \times 4.8 (3.7-1)]$, and the percentage of starch in the 3 grms. of substance taken will be—

$$\frac{R + R'}{17.75} \times \frac{100}{3}$$

The precision of the method depends on the accuracy of the polarimeter reading, and it is therefore advisable to use a 40 cm. tube and a Laurent or Soleil apparatus on account of the larger size of the degrees. The results obtained are lower than those of the Maercker method, but correspond exactly to the amount of matter susceptible of fermentation, and, the formation of glucose being very minute, will afford accurate indication of the amount of ready-formed glucose, and therefore, of the procedure to be adopted in mashing.—C. S.

Starch in Cereals, Estimation of. L. Lindet. Bull. Soc. Chim. 1896, 15, 1163.

ABOUT 10 grms. of the grains are pounded up, placed in a conical flask, covered with water containing 1.5 c.c. of hydrochloric acid and 2 parts of pepsin (in scales) per cent., and the whole allowed to stand at 40° or 50° C. for 12 or 24 hours with occasional agitation. The object of

the pepsin is to dissolve the gluten that envelopes the starch granules; while the acid prevents the diastase from attacking any of the starch during the operation. The mass is then wrapped up in fine silk, and kneaded in a large quantity of water as long as anything passes through the fabric. The liquids are sterilised with formalin or mercuric chloride, the starch collected on a tared filter and finally dried, first at 50° and afterwards at 150° C. The filtration may be hastened by the addition of a weighed quantity of pumice.

The process is specially valuable in the examination of malt.—F. H. L.

Citric and Malic Acids, Detection and Separation of, by means of Quinine and Cinchonine. L. Lindet. Bull. Soc. Chim. 1896, 15, 1160.

Cold methylic alcohol (95° Gay-Lussac) only dissolves 0.3 per cent. of the acid citrate of quinine, so that addition of the alkaloid to a 2 or 2.5 per cent. solution of citric acid in that solvent produces a copious crystalline precipitate the weight of which may reach 93 per cent. of the theoretical yield. An excess of quinine redissolves the acid salt, and after a time the normal citrate falls, but the solubility of this compound is 3.3 per cent. Under similar conditions the acid and normal malate remain in solution, their solubility being 8.2 and 8.0 per cent. respectively. The presence of this acid somewhat hinders the precipitation of the acid citrate, and if the proportion of malic acid is 25, 50, 100, or 200 per cent. of the citric acid, the weight of the acid citrate is only 99, 97, 94, or 83 per cent. of what would be recovered in the absence of the disturbing substance. The acid and normal oxalates of quinine (solubility, 9.2 and 8.2 per cent.) also remain in solution, but this acid hinders the precipitation of the citrate even more than malic acid. The crystals of citrate may also be mistaken for the acid tartrate or succinate of quinine; the solubility of these compounds being 2.4 and 1.2 per cent. respectively.

Employed in the same manner, cinchonine behaves with malic acid as quinine does with citric, for although the solubility of the acid malate of cinchonine is higher (2.5 per cent.) than that of the acid quinine citrate, all the other cinchonine salts are so very much more soluble that the reaction is quite characteristic. The acid tartrate has a solubility of 20.6 per cent. in cold methyl alcohol, whilst the corresponding citrate, oxalate, and succinate only crystallise from a syrupy liquid. All these acids, however, notably increase the solubility of the malate.

In order to make use of these reactions, the vegetable juice is evaporated *in vacuo* and taken up in the strongest methylic alcohol. Any potassium bitartrate and free tartaric acid are removed by treatment with alcohol and ether, and the addition of a suitable amount of potash. The acids are then obtained in the free state by precipitation with basic lead acetate followed by sulphuretted hydrogen. Tannin must be absorbed by means of some animal matter such as violin strings. The free acids are finally dissolved in a small quantity of methyl alcohol, a portion of the liquid diluted till its strength is about 2.5 per cent., and increasing amounts of powdered quinine (not exceeding 160 to 170 per cent. of the citric acid expected to be present) are added until the mass crystallises. The requisite quantity of alkaloid being thus determined, another portion of the undiluted alcoholic solution is precipitated with quinine, filtered after standing 12 or 24 hours, the deposit well pressed, and the mother-liquors treated over again. Should no precipitate be obtained, proving that citric acid is absent, a fresh portion of the liquid is treated in a similar way with cinchonine (employing not more than 140 to 150 per cent. of the probable malic acid). In the event of both acids being present, the cinchonine may be added to the filtrates from the quinine precipitate.

The author has succeeded in extracting the citric acid from lemons, strawberries, raspberries, and tomatoes; and malic acid from cherries and grapes by this process.

—F. H. L.

Otto of Roses, Note on. Conroy. Read before the Liverpool Chemists' Association. Chem. and Druggist, 1896, 49, 771.

The author states that both the physical and chemical tests for detecting adulteration of otto of roses are useless for practical purposes.

He found that the freezing point of 65°–68° F. allows of 11 per cent. admixture of geranium oil.

The specific gravity test at 86° F., ranging from 0.850 to 0.856, allows of 15.8 per cent. admixture of geranium oil.

The optical rotation test of –2.3° to –2.7° allows of 5.5 per cent. admixture of geranium oil, or with an unlimited amount, if the rotation figures of the geranium oil be rectified by the addition of 5 per cent. of citrene.

The author thinks that the odour forms the best test, and gives the following method of detecting it:—Dissolve one drop of the otto in about 20 drops of rectified spirit. Pour this into 1 oz. of warm water (about 100° F.) and shake up well. If the odour of this be compared with that of the best standard sample obtainable, treated in a similar manner, there should be no difficulty in detecting an admixture of 5 per cent. of geranium oil.—A. S.

Otto of Roses, The Characteristics of. J. C. Umney. Chem. and Druggist, 1896, 49, 795.

To test the truth of the statement that the odour test is more reliable for determining the purity and commercial value of otto of rose than any chemical or physical characters, the author examined several specimens (Turkish), with the choicest fragrance, of this year's distillation.

Specific Gravity.—This is a fairly reliable indication of the proportion of stearoptene present, and examination shows that the specific gravities of the choicest ottos vary from 0.856 to 0.860 at 30° C. (this temperature is the most convenient for observation). The presence of geranium oil raises the specific gravity considerably, and samples testing 0.861 and upwards should be viewed with suspicion.

Melting and Crystallising Points.—These points are not easy to determine, the rapidity of cooling and warming having a considerable influence on the readings obtained. The finest ottos crystallise at 20.4° to 21° C., a higher temperature indicating excess of stearoptene and a consequent weakening of odour value.

Percentage of Stearoptene.—This is determined by careful fractionation under reduced pressure, the portion not distilling below a temperature corresponding to 240° C. at ordinary pressure being dissolved in chloroform, precipitated by addition of absolute alcohol, and purified by repeated washing. The stearoptene thus obtained was found to melt at 34° C., and had a specific gravity of 0.866 at 15° C., whilst at 40° C., in a liquid condition, its specific gravity was below 0.800, owing to the great expansion. It was found that the finest ottos, having specific gravities of 0.857 to 0.859 at 30° C., and crystallising points of 20.1 to 21° C., contained 16 to 18 per cent. of stearoptene.

Determination of Alcoholic Constituents.—In the varieties of otto of roses having the finest odour, an alcoholic percentage (determined by the acetylation process, and calculated on the formula $C_{10}H_{15}(O)$ equal to 71 to 72.5 per cent. is indicated. An abnormal stearoptene percentage reduces this figure materially (see No. 5), whilst admixture with Turkish geranium oil, which usually contains almost 85 per cent. of alcohols, raises the percentage considerably (see Nos. 7 and 8).

By the application of these physical and chemical tests to a sample of otto of rose, it is quite possible to determine its quality: admixture with Turkish geranium oil raises the specific gravity and the proportion of alcoholic bodies present, whilst it lowers the crystallising point and the percentage of stearoptene. The characters of the finest ottos of this season's production are as under, and may be accepted as standards of excellence:—Specific gravity at 30° C., 0.856 to 0.860; stearoptene percentage, 16 to 18; crystallising point 20.4° to 21° C.; alcoholic percentage (by acetylation process), 71 to 72.5.

The following table contains the results of this examination:—

—	Specific Gravity at 30° C.	Crystallising Point.	Approximate Percentage of Stearoptene.	Percentage of Alcohols calculated on $C_{20}H_{34}O$.
No.		° C.		
1	0.8566	20.9	18	70.1
2	0.8599	20.4	16	72.3
3	0.8610	20.0	11	73.1
4	0.8590	20.6	16	72.3
5	0.8560	21.7	19.5	69.2
6 (impure)	0.8630	19.4	12.5	75.6
7 (impure)	0.8680	18.7	10	77.6
8 (impure)	0.8680	18.9	10	76.6

—A. S.

Ethereal Oils, Valuation of. Schimmel and Co. Chem. Centr. 1896, [22], 977.

Bergamot Oil.—Density, 0.882—0.886. Optical rotation at 15°—20°, +8° to 20° in 100-mm. tube. Adulteration with oils of turpentine, lemon, orange, also with alcohol, and distilled bergamot oil, lowers the density, whilst fatty oils, cedar oil, or Gurjun balsam oil increase it. The pure oil dissolves in half its volume of 90 per cent. alcohol, but does not give a clear solution in 80 per cent. alcohol, the insoluble constituents being probably waxes. The residue on distillation is 5—6 per cent.; more than this would indicate the presence of fatty oils. The important constituent is linalyl acetate; this is determined by boiling with $\frac{1}{2}$ N alcoholic potash for half an hour, adding water, and titrating with $\frac{1}{2}$ N sulphuric acid, using phenolphthalein as indicator.

Lemon Oil.—Density, 0.858—0.861 at 15°. Optical rotation, +59° to +67° at 20°, usually only +64°. The difference in rotation for 1° C. between 10°—20° is -9°, between 20°—30° it is -8.2°; thus an oil with the rotation +63° at 10° C., has only 61° 30' at 20° C. Adulteration with oil of turpentine alone is recognised by the lessened rotation, but if at the same time oil of orange is present the following method must be used:—10 per cent. of the oil is slowly distilled from a Ladenburg's distilling flask with three bulbs, and its rotation determined. Since pinene boils at a lower temperature than limonene, this fraction will have a considerably lower rotation if oil of turpentine be present. Thus, a lemon oil with the rotation +61° 52' gave a 10 per cent. fraction with the rotation +58° 55' at 20° C., but the same lemon oil after the addition of 7.1 per cent. of orange oil (rotation +96° 23'), and as little as 2.9 per cent. of French turpentine oil (rotation -28° 24'), gave a fraction of rotation 54° 28', showing a difference from the original rotation of -7° 17' as compared with -2° 57' when the pure oil was used. The results of the process depend so much on the manner of distillation that it is necessary to perform a check experiment with an oil of known purity.

Orange Oil.—Density, 0.848—0.852 at 15° C. Rotation, +96° to +98° at 20° C. in 100-mm. tube. All adulterants, oil of turpentine, spirit, oil of lemons, considerably decrease the rotation. Oil of turpentine may be detected as above described, but it is advisable to repeatedly fractionate with a dephlegmator. Bitter orange oil at times has a lower rotation, +92°.

Oil of Lavender.—Density, 0.883—0.895 at 15° C. Rotation, -4° to -8° in 100-mm. tube. The pure oil dissolves in three volumes of 70 per cent. alcohol. The important constituent is linalyl acetate, together with a little geranyl acetate. The value of an oil is in direct proportion to the ester content (compare Duyk, this Journal, 1896, 919), which is determined as in the case of bergamot oil; it should be at least 30 per cent.; very good oils may contain more than 40 per cent.

Oil of Cloves.—Methyl alcohol and furfural have been found. The latter is possibly the cause of the darkening of certain oils.

American Oil of Peppermint.—Amyl alcohol and small quantities of sulphur compounds (dimethyl sulphide) have been detected.

Oil of Rue.—Density, 0.833—0.840. Rotation, +0° 13' to +2° 10' in 100-mm. tube. The pure oil gives a clear solution in 2—3 parts of 70 per cent. alcohol, and crystallises at 8°—10° because of the separation of its principal constituent, methyl nonylketone.

Oil of Rosemary.—French and Italian. Density exceeds 0.900. Slightly dextro-rotatory. The pure oil gives a clear solution in half its volume of 90 per cent. alcohol and in 10 parts of 80 per cent.—A. C. W.

Caffeine, Notes on the Estimation of. W. A. Puckner. J. Amer. Chem. Soc. 18, [11], 978—981.

GOMBERG has stated that those methods of estimation are inaccurate which involve shaking out the caffeine with chloroform from an aqueous solution. The author supports Allen's opinion that four extractions with chloroform, from a solution slightly acidulated with sulphuric acid, effect complete extraction. He quotes experiments in which 0.1285 to 0.4416 gm. of anhydrous caffeine was dissolved in 50 c.c. of 1 per cent. sulphuric acid, and shaken successively with 25, 10, 10, and 10 c.c. of chloroform, the chloroform solution evaporated at a gentle heat, and the residue dried over sulphuric acid to constant weight. From 99.55 to 99.92 per cent. of the caffeine was thus recovered.

Gomberg quoted an experiment in which a solution of caffeine in "(1:10)" sulphuric acid, on shaking out 16 times with chloroform, gave less than 50 per cent. of the caffeine used. The author repeated the experiment, and obtained from 65 to 90 per cent. in the first three extractions. Such strongly acid solutions should not be used, else the extraction of the caffeine is hindered.—H. B.

Sherry Wine. E. W. Lucas. Pharm. J. 1896, 57, 397.

See under XVII., page 914.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Bromcyanogen, Preparation of, &c. R. Scholl. Ber. 1896, 29, 1822—1825.

A SOLUTION of 65 grms. of potassium cyanide of 96—98 per cent. strength, in 120 grms. of water, is cooled to 0° C. and added gradually (drop by drop), with frequent shaking and cooling with ice, to 150 grms. of bromine on the surface of which a little water has been placed. The reaction proceeds quantitatively. If, in spite of the ice cooling, the temperature of the mixture rise temporarily to 30° C., as it may, no injury results. Finally the liquid becomes a crystalline pasty mass. This is probably a double compound of bromcyanogen and potassium bromide. The cyanide should have been added until the bromine colour of the liquid just passes into yellow, but no farther. The whole mass is next transferred to a retort and distilled on the water-bath at a temperature of 65° to 70° C., whereby, from the 150 grms. of bromine used, about 90 grms. of damp bromcyanogen are obtained in snow-white needles (90 per cent. of the calculated quantity). It can be dried over calcium chloride.—E. B.

Nitrogen Iodide, Constitution of the so-called. F. D. Chattaway. Proc. Chem. Soc. 1896, [169], 172—174.

From the beginning of the present century, the black explosive compound formed when a solution of ammonia acts upon iodine, has almost continuously engaged the attention of the chemists. No definite conclusion as to its constitution has, however, been arrived at, although, from time to time, different formulae have been assigned to it, while, on account of its apparently variable composition, several distinct compounds have been supposed to exist.

The formulae NI_3 , NI , NH_2I , NH_4I , and NH_2NI_3 , have been adopted by various chemists, whilst others have suggested that a series of different but allied substances exist, derived either from NH_3 , or a hypothetical substance, $II_3N.NH_3$, by replacement of hydrogen.

On the whole, it seems that a single substance is formed by the action of ammonia on iodine, and that in this, one atom of nitrogen is associated with two atoms of iodine.

Whether the simplest formula that can be given to the substance is NH_4I_2 or NH_4I_2 can only be finally settled by a very careful investigation of all its reactions under the most varied conditions; but at present the formula NH_4I_2 seems best to accord with the reactions of the substance and to express the known facts regarding it.

New Books.

CHEMISTRY FOR ENGINEERS AND MANUFACTURERS. A Practical Text-book. By BERTRAM BLOUNT and A. G. BLOXAM. With Illustrations. Vol. II.—Chemistry of Manufacturing Processes. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1896. Price 16s.

VOL. I. received descriptive notice in this Journal, 1896, 225, the present book being Vol. II., and completing the work. The text fills 436 pages, and there is an alphabetical index covering 43 pages, immediately preceded by a bibliographic index of 3½ pages. The leading subjects treated of in this section of the work—Vol. II.—are the following:—I. Sulphuric Acid Manufacture; pages 1–17. II. Manufacture of Alkali and its By-Products; 19–53. III. Destructive Distillation; 55–104. IV. Artificial Manure Manufacture; 107–114. V. Petroleum; 117–124. VI. Lime and Cement; 126–141. VII. Clay Industries and Glass. VIII. Sugar and Starch. IX. Brewing and Distilling; 189–222. X. Oils, Resins, and Varnishes; 223–246. XI. Soap and Candles; 247–255. XII. Textiles and Bleaching; 257–265. XIII. Colouring Matters, Dyeing and Bleaching; 270–343. XIV. Paper and Pasteboard; 344–347. XV. Pigments and Paints; 349–366. XVI. Manufacture of Leather, Glue, and Size; 367–395. XVII. Explosives and Matches; 398–411. XVIII. Minor Chemical Manufactures, 413–434, among which are included the Chromates, Manganates, and Sulphates, Potash Salts, the Halogens, Cyanogen Compounds, and Bisulphide of Carbon.

TABELLARISCHE UEBERSICHT DER IN HANDEL BETRIEBLICHEN KÜNSTLICHEN ORGANISCHEN FARBSTOFFE. Von GUSTAV SCHULTZ und PAUL JULIUS. Dritte vollständig umgearbeitete und stark vermehrte Auflage. Herausgegeben von Dr. GUSTAV SCHULTZ. Hermann Heyfelder, Berlin. H. Grevel and Co., 33, King Street, London. 1897. Price M. 20.

NOTICE of the Second Edition of this work appeared in this Journal, 1891, 662. The present Third Edition is completely re-written, and contains many additions of value. There is a preface, a table of contents, list of abbreviations, and indexes of initials representing certain typical constitutional forms, technical terms for certain chemical compounds, and abbreviations for journals and works of reference. The tables extend from page 2 to page 201, and give descriptions of 504 different colouring matters, whilst the alphabetical index fills 14 pages. It is worthy of mention that whereas 401 dyestuffs were described in the last edition, 87 have since 1891 been abandoned, as no more in the trade, whilst 187 new ones have appeared, and are described in the present volume.

NOTES: QUALITATIVE ANALYSIS. Arranged for the Use of Students of the Reusscher Polytechnic Institute. W. P. MAXON, Professor of Chemistry. Third Edition. Chemical Publishing Co., Easton, Pa., U.S.A. 1896. Price 0·8 dol.

THIS little work contains preface and 56 pages of text. It contains, first, the reactions of ordinary bases and acids, &c., and after these, tabulated schemes for qualitative analysis. Then follows an appendix, with methods for the preparation of reagents, coloured flame- and borax bead-reactions, examinations on charcoal before the blow-pipe flame, &c.

THE CHEMICAL ANALYSIS OF IRON. A Complete Account of all the best known Methods for the Analysis of Iron, Steel, Pig-Iron, Iron Ore, Limestone, Slag, Sand, Coal, Coke, and Furnace and Producer Gases. By ANDREW ALEXANDER BLAIR, Chief Chemist, United States Board

appointed to test Iron, Steel, and other Metals, 1875, &c. Third Edition. J. B. Lippincott Company, Philadelphia, U.S.A.; and 10, Henrietta Street, Covent Garden, London. 1896. Price 18s.

LARGE 8vo volume, containing dedication, prefaces to Third, Second, and First Editions, table of contents, and subject-matter filling 313 pages. An appendix on the Determination of Nickel and Aluminium in Steel follows, and thereafter the alphabetical index. The work is illustrated by 103 engravings, representing forms of apparatus, &c., and between pages 303 and 313, a series of tables of constants, factors, and data for Reducing Volumes of Gases to the normal state.

After descriptive paragraphs on apparatus for the preparation of samples, and for general laboratory purposes, the work treats of the following themes:—Reagents; Methods for the Analysis of Pig-iron, Bar-iron, and Steel. Determinations of Graphitic Carbon, Combined Carbon, Titanium, Copper, Nickel and Cobalt, Chromium and Aluminium, Arsenic, Antimony, Tin, Tungsten, Vanadium, Nitrogen, Iron. Methods for the Analysis of Iron Ores; for the Analysis of Limestone; Clay; Slags; Fire-Sands; Coal and Coke. Methods for the Analysis of Gases.

DEUTSCHLAND'S SODA-INDUSTRIE IN VERGANGENHEIT UND GEGENWART. Ein kritischer Beitrag zur Geschichte der deutschen Zollpolitik. Von Dr. J. GOLDSTEIN. Mit einem Vorwort von WALTHER LOTZ. J. G. Cotta'schen Buchhandlung Nachfolger, Stuttgart, Germany. 1896. Price M. 2·40.

8vo volume containing 108 pages of subject-matter, preceded by bibliographic table, table of contents, and preface by W. Lotz, of Munich. The text is classified into three chapters:—I. Treaty of Commerce with France. The New Tariff. The Position of the German Soda Industry at the beginning of the Year 1860. The Salt Monopoly. Import and Export of Products of the Soda Industry. Treaty of Commerce with England. Removal of the Salt Monopoly. Position of the Industry at the beginning of 1870. Tariff Reform of 1873. II. Commercial Crisis and Protective Duty Agitation. Society for Guarding the Interests of German Chemical Industry and the Soda Duties. Reduction of the Prices of Alkali and the Reasons. Extension of the Ammonia-Soda Manufacture, &c. III. Present Position of the Alkali Industry in England and Germany. Complaints of those interested, and the Reality. Retrospect, &c. This work is one of a series published by L. Brentano and W. Lotz, and entitled, "Die Münchener Volkswirtschaftlichen Studien," the present being the thirteenth of a series.

EINFÜHRUNG IN DAS STUDIUM DER ALKALOIDE, mit besonderer Berücksichtigung der vegetabilischen Alkaloide und der Ptomaine. Von Dr. IGILIO GUARESCHI. Mit Genehmigung des Verfassers in Deutscher Bearbeitung. Herausgegeben von Dr. HERMANN KUNZ-KRAUSE. Erste Hälfte. 1896. Hermann Heyfelder, Schönebergerstrasse 26, Berlin, S.W. H. Grevel and Co., 33, King Street, Covent Garden, London. Price M. 18.

THIS is the translation into German from the Italian of Guareschi's "Introduzione allo Studio degli Alcaloidi." The translation has been undertaken by Dr. Hermann Kunz-Krause. The translated work is published in two parts, and the present is Part I. It is a quarto volume, unbound, and containing preface to the German edition, and 304 pages of subject-matter. The completed work, it is claimed, will furnish a full and systematic review of the whole subject of the nitrogen compounds in general which possess a basic character, *i.e.*, Alkaloids in the full sense, and also the Ptomaines and Leucomaines. The first section of the work is subdivided as follows:—I. Bases with open chain. II. Bases with closed chain. III. Arrangement of those natural organic bases the constitution of which has been determined with certainty. IV. Those Alkaloids, arranged according to the natural botanic orders, the constitution of which yet remains either doubtful or unknown. V. The Ptomaines and Leucomaines, treated according to their position in the classification adopted, as also in their relations to Chemical Jurisprudence and Pathology.

Trade Report.

OFFICIAL NOTICE.

UNHEALTHY OCCUPATIONS.

Chem. Trade J., Dec. 12, 1896, 374.

The Home Secretary certifies that the process of *vulcanising india-rubber* by means of bisulphide of carbon, and the processes incidental thereto, are dangerous or injurious to health. The Chief Inspector of Factories may, consequently, serve on the occupier of the factory or workshops a notice in writing either proposing such special rules or requiring the adoption of such special measures as appear to be reasonably practicable and meet the necessities of the case.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

GERMANY.

Freights for Manures.

A notice has appeared in the *Reichsanzeiger* to the effect that the Prussian Government have agreed, in view of the depressed condition of agriculture, to extend the 20 per cent. reduction in freights for manures which was granted on the State Railways from March 1, 1895, to May 1, 1897, for a further period of five years.

INDIA.

Adulterated Goods and the Merchandise Marks Act.

1. The Government of Madras referred, for orders, a question as to the trade descriptions which should be affixed, under the Indian Merchandise Marks Act, IV. of 1889, on packages containing adulterated goods, such as oils, turpentine, paints; and the attention of the Government of India was drawn to the diversity of practice at Madras and Calcutta in the matter of amending the descriptions on such packages.

2. At Madras, packages containing adulterated linseed oil and red lead are not permitted to pass into consumption unless the word "adulterated" is plainly stencilled on the drums containing the articles, whereas at Calcutta such goods are passed if they are marked "reduced," "mixed," or "mineral," on every label describing them.

3. On inquiry from the Government of Bombay it has been ascertained that at the Bombay Custom-house no objection is taken to the importation of packages of adulterated linseed oil and red lead if they are described as "boiled" oil and "reduced" red lead. It is stated, however, that the term "reduced" used in connection with red lead is only applied to a composition which contains at least 50 per cent. of red lead; if the quantity of red lead is less than 50 per cent., the actual percentage of red lead must be indicated on the drums.

4. The practices at Bombay and at Calcutta are substantially the same, and they appear sufficiently to carry into effect the provisions of the Merchandise Marks Act. As there should be uniformity in such matters, it is expedient that the practice should be adopted at all other ports in India.

ITALY.

The Importation of Patent Medicines into Italy.

The official *Bollettino di Notizie Commerciali*, in a recent issue, publishes, *in extenso*, a list of patent medicines, the importation of which into Italy is permitted; and, likewise, a list of medicines in which the quantity of spirit contained therein or consumed in their manufacture has been determined.

These lists may be seen at the Commercial Department of the Board of Trade, 7, Whitehall Gardens, S.W., between the hours of 11 and 5.

UNITED STATES.

Customs Decisions.

Naphthalene is exempt from duty as a coal-tar preparation other than medicinal, under paragraph 443.

Refined carbonate of potash is dutiable at 25 per cent. *ad valorem*, under paragraph 60, as a chemical salt.

Colours of any kind, in tubes, are assessed at 25 per cent., under paragraph 18.

WESTERN AUSTRALIA.

Customs Duties Repeal Act, 1896.

The Board of Trade have received from the Registrar-General of Western Australia copy of an Act assented to on Sept. 30 last, by which the Customs duties on the following articles are repealed from Oct. 1 last:—

Asbestos; asphaltum; boiler fluid; candle makers' materials, including Japan wax; crucibles; cyanide; dyers' materials; metals not otherwise enumerated; oil and turpentine, other than in bottles; paper (unprinted) in the flat, in original wrappers; quicksilver; resin, pitch, and tar; retorts; smelting material not otherwise enumerated; soap-makers' materials, (including caustic soda, resin, cocoa-nut oil, palm oil, and olein); soda ash and nitrate of potash; tanning materials—sumach, myrobolams, valonia.

NEW CUSTOMS TARIFF OF VICTORIA.

The following is a statement of the duties now leviable on articles imported into the Colony of Victoria:—

Note 1. All articles not specially mentioned as dutiable, or which cannot be classified under one of the dutiable headings in this list, will be admitted free.

2. The Customs and Excise Duties Act, 1895, provides that the articles mentioned as free in this list, and no others, shall be exempted from the payment of the duties which, but for their specific exemption, would otherwise be payable thereon.

3. Where a number appears before any item, it is to be understood that the wording is that of the Customs and Excise Duties Act, 1895.

Import Duties.

No.	Articles.	Rate of Duty.
	Acids, viz.:—	
1	Acetic, containing not more than 30 per cent. acidity.	3 <i>d.</i> per pint or lb.
	Acetic, for every extra 10 per cent. or part of 10 per cent. above 30 per cent.	1 <i>d.</i> per pint or lb.
2	Muriatic, nitric	5 <i>s.</i> per cwt.
3	Sulphuric	1 <i>s.</i> per cwt.
	Ammonia (liquid)	Free.
	" carbonate	2 <i>d.</i> per pint or lb.
37	Bitumen, bone pitch, Egyptian and Assyrian asphaltum, sweated or prepared pitch, Swedish asphaltum, Stockholm pitch.	Free.
38	Blacking, including burnishing ink, dressing, harness polishing, and paste.	2 <i>s.</i> <i>ad val.</i>
39	Black lead and polishes made of plumbago, in packages of less than 2 lb. weight.	20 " <i>ad val.</i>
	Blue	2 <i>d.</i> per lb.
	Candles	1 <i>d.</i> per lb.
		(Jan. 1st, 1897.)
	Carbons (electric)	Free.
113	Cement, including plaster of Paris and other products having sulphate of lime as a basis.	1 <i>s.</i> per cwt.
	Cements, liquid	20 " <i>ad val.</i>
114	Charcoal and coal (ground)	20 " <i>ad val.</i>
115	" (animal, ground)	Free.
	Chemicals and drugs, packed ready for retail sale or consumption, including medical compounds containing spirits not exceeding the strength of proof by Sykes' hydrometer.	25 " <i>ad val.</i>
117	China ware and porcelain	15 " <i>ad val.</i>
118	" being photographic, scientific, and telegraphic materials.	Free.
	Chlorodyne	Free.
	Cocculus indicus	1 <i>s.</i> per lb.
	Cocoa	3 <i>d.</i> per lb.
121	" raw	Free.
	Cocoa-nut oil, in bulk	Free.
124	Colours, artists'	Free.
	Crucibles (metal)	Free.
	Driers, patent	2 <i>d.</i> per ton.

NEW CUSTOMS TARIFF OF VICTORIA—*cont.*

No.	Articles.	Rate of Duty.
	Essences and essential oils, not containing alcohol.	Free.
	Essences, culinary. <i>See</i> "Spirits."	
	Essential oils and essences, not containing alcohol.	Free.
149	Explosives, being fine meal powder, not sporting, in bulk and in packages of not less than 25 lb. each.	Free.
150	Common blasting powder.	Free.
151	Powder, sporting.	3d. per lb.
152	Other explosives.	1d. per lb.
	Fuse.	1d. per coil of 21 ft.
	Fireclay goods, not otherwise enumerated.	2d. <i>ad val.</i>
	Fireclay, or brown or cane, medical and sanitary ware (earthenware).	8d. per cubic foot.
158	Fireworks.	20° <i>ad val.</i>
	Glucose.	6s. 6d. per cwt.
203	Glue, liquid, and liquid gum and cements.	20° <i>ad val.</i>
204	Glue.	2d. per lb.
136	Glycerine, pure.	1d. per lb.
137	" crude.	1d. per lb.
241	Ink, printing (coloured).	6d. per lb.
242	Inks, writing, liquid or powder.	10° <i>ad val.</i>
	Ink, burnishing.	25° <i>ad val.</i>
255	Lead, sheet and piping.	28. 6d. per cwt.
256	Leaf, gold and silver.	20° <i>ad val.</i>
	Leather:—	
257	Being crust or rough-tanned calf, goat, horsekin, sheep, or kangaroo, when not exceeding 7 lb. each skin; English bend, sometimes called butt.	Free.
258	Kid, calf kid, mock kid, and patent calf.	Free.
259	Hoeskins.	Free.
	Beltine (machine).	35° <i>ad val.</i>
260	Furniture, bootmaking and book-binding morocco (except black), Persian sheep, roan and skivers.	35° <i>ad val.</i>
261	Black morocco and goat levant.	20° <i>ad val.</i>
262	Not otherwise enumerated.	6d. per lb.
	Maize-flour or corn-flour.	2d. per pint or lb.
	Maizena.	2d. per pint or lb.
280	Matches, wood safety.	Free.
		12s. per gallon of the strength of proof by Sykes' hydrometer, and so in proportion for any greater or less strength than the strength of proof, when not dutiable at a higher rate under the heading of medicines liable to 25° <i>ad val.</i>
	Medical preparations containing alcohol.	25° <i>ad val.</i>
		10° <i>ad val.</i>
	Mineral waters.	6s. per cwt.
	Molasses, refined.	5s. per cwt.
	" in bond.	2s. per cwt.
	" unrefined.	2s. per cwt.
	Morphia.	Free.
	Muntz metal, in circles not less than 24 inches in diameter.	Free.
	Nitrate of silver.	Free.
	Nux vomica.	Free.
412	Oil and paste, furniture.	20° <i>ad val.</i>
	Oil and other floorcloth (except cord and jute matting otherwise dutiable).	15° <i>ad val.</i>
413	Oil in bulk, being cocoa-nut, 1-lb. of all sorts, mineral refined, of which the point of ignition is below 80° F.; kerosene, palm, lubricating, of which the chief component part is mineral, and resin.	Free.
	Oil silk.	Free.
	Oleomargarine and butterine.	1s. per lb.
424	Opium, including all goods, wares, and merchandise (except medical preparations) mixed or saturated with opium, or with any preparation or solution thereof, or steeped therein respectively.	17. per lb.
		17. per lb. of opium contained therein, when not dutiable at a higher rate under the head of medicines liable to 25° <i>ad val.</i>
125	Medical preparations containing . . .	Free.
	Optical, surgical, and scientific instruments (glassware).	Free.

NEW CUSTOMS TARIFF OF VICTORIA—*cont.*

No.	Articles.	Rate of Duty.
	Optical and scientific instruments (metal).	Free.
	Paints and colours:—	
428	Ground in oil, including patent dryers and putty.	2d. per ton.
429	Mixed ready for use, from or of any substance.	4d. per ton.
439	Paraffin wax.	1d. per lb.
	Parclement, cut.	20° <i>ad val.</i>
	" vegetable (used for packing or wrapping butter).	Free.
	Paste and polishing, harness.	25° <i>ad val.</i>
	Perfumery.	20° <i>ad val.</i>
453	Pitch.	25° <i>ad val.</i>
	Plaster of Paris.	1s. per cwt.
	Powder. <i>See</i> "Explosives."	
459	Powders, baking, scidlitz, washing.	20° <i>ad val.</i>
	Shoepwash (tobacco), including tobacco soaked on the landing thereof from the importing ship, or on delivery from the warehouse, in turpentine, oil, or other fluid in the presence of some officer of Customs, sons to render it unfit and useless for human consumption.	Free.
486	Soap, perfumed and toilet.	4d. per lb.
487	" other.	2d. per lb.
488	Soda crystals.	2d. per ton.
491	Spirits, cordials, liquors, or strong waters, sweetened, or mixed with any article so that the degree of strength cannot be ascertained by Sykes' hydrometer (including all alcohol diluted or undiluted with water or other non-trim, and containing in solution any essence, essential oil, ether, or other flavouring or other substance, whether of natural or artificial origin).	12s. per gallon.
	Spirits:—	
492	Methylated.	1s. per liquid gallon.
493	Perfumed.	1d. 1s. per gallon.
		12s. per gallon of the strength of proof by Sykes' hydrometer, and so in proportion for any greater or less strength than the strength of proof.
494	Culinary essences.	2d. per lb.
497	Starch.	1d. per lb., and after 1/198 1d. per lb.
516	Stearine.	Free.
	Strychnine.	12s. per cwt.
	Sugar, not being produce of cane.	6s. per cwt.
	" produce of sugar cane.	2s. per gallon.
577	Varnish, including lithographic.	6d. per gallon.
579	Vinegar, not being acetic acid or crude, aromatic or raspberry.	2d. per ton.
	White lead, dry.	Free.
	Zinc, sheet.	Free.

UNTAXED ALCOHOL FOR THE MANUFACTURES AND ARTS IN THE UNITED STATES.

Textile Colorist, 1896, 337; and *Oil Paint and Drug Reporter*, Nov. 30, 1896, 17.

The Joint Select Committee, created at the last session of Congress to investigate and report upon the question of the use of alcohol free of tax in the manufactures and arts, have prepared a series of interrogatories, which will be distributed throughout the country to such parties as are thought to be interested in the question.

The report of Mr. Henry Dalley, jun., who was commissioned to investigate the workings of foreign laws governing the use of untaxed alcohol in the manufactures and arts, contains very full and extremely valuable data covering Great Britain, Germany, France, Belgium, and Switzerland, and is given below.

It is the earnest desire of the Committee to secure all possible information bearing upon the subject, and it is hoped that parties interested will submit their views to the Committee promptly. Sets of the circular letter and blank for replies will be supplied to any applicant by addressing the Chairman, Room 21, Senate Annex, Washington, D.C.

The following is the letter of inquiry:—

Joint Select Committee of Congress on Alcohol in the Manufactures and Arts.

DEAR SIR,

At the last session of Congress a Joint Select Committee of the two Houses was created to obtain information with regard to the use of alcohol in the manufactures and arts free of tax, and to investigate all matters relating thereto. In furtherance of this object will you communicate to the Committee any information at your command upon the following points:—

1. How much alcohol is used in the United States in the business in which you are engaged, according to your best information?

2. How much do you use in your individual business?

3. Would there be an increased use of it in the trade with which you are connected if it were free of tax?

4. If so, to what extent?

5. Do you use wood alcohol or grain alcohol, or both, and if both, in what relative proportion?

6. Would methylated or unmethylated spirits be substituted for wood alcohol and other substances if they could be used free of tax in your manufacture?

7. What is the present difference of cost in this country between wood alcohol and grain alcohol, and has this difference fluctuated to any great extent?

8. Is the alcohol used in your business consumed in the process of manufacture, or does it form a part of the product offered for sale, or is it recovered?

9. What proportion of the total cost of the product manufactured by you is tax-paid alcohol?

10. If the alcohol remains in the product, could it be profitably recovered so as to be resold as alcohol either in the case of methylated spirits or of pure alcohol?

11. Would the use of alcohol free of tax in the business in which you are engaged lead to frauds upon the Treasury and a consequent loss of revenue? Please state fully.

12. Would the use of free alcohol in such business result in stimulating or increasing the exportation of your product?

13. Will you put yourself in communication with other parties engaged in your branch of business so that representatives of your industry may be prepared to give the fullest possible information upon the points above indicated, in addition to the reply which you make to this letter?

14. Is there an association representing your industry? If so, please give me the names of the officers and prominent members thereof, with their post office addresses.

Following is the text of the Commissioner's report upon the practical operation of the free alcohol laws of Great Britain, Germany, Belgium, and Switzerland:—

Great Britain—Distilling of Spirits.

The distilling of spirits in Great Britain is authorised by a license issued by the Commissioners of Inland Revenue. The distilled spirits must be stored in a "spirit store" at the distillery, in charge of a revenue officer, into which store all spirits distilled in the distillery must be conveyed. From this "spirit store" the spirits may be removed without payment of excise tax to an excise warehouse duly authorised by the Commissioners of Inland Revenue, said warehouse to be under the charge of an officer of the Inland Revenue, or the spirit may be warehoused without payment of tax in a distiller's warehouse.

Excise Tax and Drawback.

The present excise tax is 10s. 6d. per gallon, which must be paid upon withdrawal from warehouse for consumption, unless withdrawn for methylation. A reduction of tax for deficiency in quantity, indicated by regauging, and a specific allowance of 2d. per gallon upon withdrawal, are authorised by law.

Upon exportation of domestic spirits upon which the excise tax has been paid the allowance of drawback is 10s. 6d. per gallon, to which is added 4d. per gallon in the case of compounded spirits.

Methylation.

The English laws governing the use of alcohol free of tax relate exclusively to the use of methylated spirits. This system of tax-free methylated spirits originated in 1855.

The methylation of spirits must be done by either a distiller or a rectifier, authorised by the Commissioners of Inland Revenue, or by a methylator duly licensed by said Commissioners.

Methylation must take place in a warehouse provided by the Commissioners of Inland Revenue, in a building or room provided by the methylator and approved by said Commissioners. The spirits to be methylated must be at least 50 per cent. above proof, or, if rum be used, at least 20 per cent. above proof, and must be methylated in quantities of not less than 450 gallons, or, in the case of foreign spirits, the full contents of the cask in which the spirits were imported must be methylated. The methylating substance shall be approved by the Commissioners, and may be provided by the Government or the methylator, as the former shall determine, and shall equal at least one-ninth of the bulk of the spirits. The methylation must take place in the presence and under the direction of two Government officers, and when such methylation shall have been certified to by said Revenue officers, the spirits can be disposed of by the authorised methylator, subject to the limitations heretofore named.

Exportation of Medicinal and other Spirits.

Respecting the bearings of the English excise and export laws upon their different industries, the merchants were agreed in approving the Government's methods in vogue. The prime object of these English (as well as Continental) laws appears to be to foster to the fullest extent the exportation of home products. The result of this, as the history of the commercial world proves, is that England maintains its position as the leading nation in promoting this foreign commerce, and that its manufactures are found in all parts of the world, carried in English bottoms.

Not the least important element in the execution of these laws is the fact that the exportation is not only freely carried on by the merchants, but every assistance is furnished by the Government to accelerate and stimulate such exports. For instance, no delay is experienced between the notice of intention to export and the examination of the goods by the Government officials, and the examination is made at the place of manufacture; no unnecessary inquisitorial examination is made, the character of the merchants counting for something in the eyes of the law; no delay occurs in the filing of the certificate of shipment; and finally the drawback is payable on demand, although the custom of most merchants is to permit the drawbacks to accumulate for a month, when, by making a simple demand upon the proper fiscal officer, the amount standing to the merchant's credit, as shown by the certificates of shipment already filed, is promptly paid.

Frauds on the Revenue.

Special attention is called to an article in the Appendix relative to the frauds which have been discovered during the existence of the English laws governing the methylation of spirits, covering a period from 1855 to the present time.

The notable feature of this statement is that fraud is minimised, and that the policy of the Government is to extend rather than to limit the use of methylated spirits.

Germany.

The internal revenue tax in the United States on a proof gallon of alcohol is 1.10 dols. Absolute alcohol is gauged by a standard of 200°, and a proof gallon under U.S. law is "that alcoholic liquor which contains half its volume of alcohol."

The German internal revenue tax is about 72 cents per gallon on absolute alcohol.

The difference in the amount of internal revenue tax paid in the respective countries results in an advantage to the German over the American user of alcohol as follows:—

The American manufacturer starts out burdened with a tax of 1.10 dols. per gallon and a minimum cost of production

of 16 cents per gallon for the spirits, while the German manufacturer pays a tax of only 36 cents per gallon, and his cost for production of the spirits is but 12½ cents per gallon. The German manufacturer gains a still further advantage by the remission of the tax on alcohol, thus making competition in the foreign markets on the part of the American an impossibility and the holding of this domestic market very difficult under existing customs duties.

Again, the lowest customs duty in Germany on a gallon of absolute alcohol is about 1.35 dols., while the highest duty is equivalent to 3.67 dols. The duty on products containing alcohol (that is, beverages) is equivalent to 3.67 dols. per gall., the maximum duty. This duty is levied by weight upon the entire compound, and subjects the whole article to the highest alcoholic duty, regardless of the other component parts, thus in many cases subjecting the article to treble and even quadruple the duty which would be imposed did it consist entirely of alcohol, and this duty must be paid on the container also, which, being weighty, as in case of glass bottles, adds still further to the duty and makes it practically prohibitory. The effect of this policy is illustrated by the fact that during the year 1895 there were imported into the German Empire only 37,195 hectolitres, equivalent to 982,691 wine galls. of alcohol, mostly rum and brandy, and not alcohol for industrial purposes.

The importation of alcohol into Germany is rendered still more impracticable by the refusal to allow drawback upon it when exported, either as spirits or as alcoholic products.

Following the above illustration in respect to the German customs duty and internal revenue taxes, it is pertinent to the question to show that the German Government persistently pursues the policy of fostering home industries, even going so far as to do so at the expense of the general public, as illustrated in the bonus over and above the internal revenue tax which is paid to the exporter of domestic alcohol, and which is a drain upon the general revenues. Their internal revenue tax on alcohol amounts to the equivalent of 36 cents per gallon, United States measure, and this is refunded to the exporter of such alcohol or of products in which domestic alcohol is a component part, and in addition thereto a bonus equivalent to 75 cents per hectolitre, which is upon the cost of the alcohol (say 10 cents per gallon), about a 50 per cent. margin. This consists of bounty paid to the exporter of domestic alcohol or alcoholic products supplemented and made still further effective by the failure to allow a drawback on imported spirits exported.

Methylated Spirits.

The method of methylation in England is so complete that I deem it proper to suggest that if laws permitting the use of methylated spirits free of tax in the United States are enacted the Government could do no better than to pattern regulations after the English system, limiting such laws, however, to methylation at the distillery. I will not, therefore, go into the actual procedure of methylation as followed by the German Government, but will refer to the system in general, the policy of the Government relating to it, and the results which are obtained from its practice.

In a general way it may be said that the materials used for methylation and prescribed by the Government are wood alcohol, and in more recent years, that substance mixed with the pyridine bases (which are certain products of the residuum of coal tar, and are now largely known in commerce). This methylation is done by mixing four parts of wood alcohol with one part of the pyridine bases, and this is added to the pure spirits in the proportion of 2½ galls. of the methylating material to 100 galls. of pure spirits. Other methylating agents are used for specific purposes, full particulars of which will be found in the detailed report.

It may be well that I should state here that both in England and Germany the authorities admitted that methylated spirits could be partially purified, but in both countries the statement was made by the officials of the Government in the most unqualified manner that the frauds perpetrated in this way were so small the Government pays no special attention to them.

The methylation is performed under the supervision of the Government officials, and usually at the distilleries. Unlike the English system, there are no licensed methylators, and after methylation Government supervision ceases.

The German Government has in every way sought to make the policy of untaxed domestic spirits so complete as to be adaptable to every branch of industry requiring the use of spirits. Hence in the methylation of spirits many different agents have been devised to cover new fields of industry as they developed.

It should be noted that while these various methylating agents are specially permitted, their use is allowed only when the general methylating agent of wood alcohol and the pyridine bases is impracticable.

Untaxed Unmethylated Alcohol.

The system under which unmethylated alcohol is used in the arts and manufactures free of tax is as follows:—

The user (that is, the manufacturer) submits to the Government an approximate estimate of the quantity which he is likely to use within a year. As he has occasion he buys the alcohol to the best advantage, in quantities to suit, and notifies the Government of his purchases. The alcohol is then shipped to him from the distillery under the Government seal and surveillance, and the amount of spirits is charged against his estimated requirements.

He must then account for the use of this alcohol from time to time to the satisfaction of the Government officials, and at the end of the year, if any remains on hand, the quantity so remaining is charged against his requirements for the ensuing year. If during the year he requires more than his estimated quantity, and if his reputation is such as to command confidence, he is permitted to make further purchases according to his needs.

Manufacturers having occasion to use untaxed unmethylated alcohol for medicinal, scientific, and industrial purposes, are required to keep accurate books of account, and through these records to show how all the alcohol is disposed of. These books come from time to time under the examination of Government officials, to ascertain that the alcohol has been legitimately used, and that the quantities received, consumed, and remaining on hand properly tally. Such manufacturers are required to take account of stock semi-annually, and a Government inspection of their establishment takes place monthly.

Although this system of untaxed alcohol is working to the satisfaction of the German Government, without apparent fraud or friction, it would seem as if even more beneficial results would undoubtedly come from a system which would provide, first, for the payment of the internal revenue tax on all alcohol, and, second, for the refunding of this tax by the Government upon proof submitted by the manufacturer that the alcohol has been used according to the provisions of law.

From such a system would come, it seems to me, two very important results: first, the avoidance of minute and onerous espionage; second, the Government would, for the period prior to the refunding of the tax (say six months, or perhaps even a year), have the use of a considerable sum of money, which would remain in the treasury; third, the expenses of supervision would be largely reduced.

Belgium.

In Belgium there has been a High Commission investigating the laws of foreign countries relating to the use of alcohol free of tax in the arts and manufactures. This Commission has heretofore made a comprehensive report, containing much valuable data as the result of such investigation.

It seems to be well understood in Belgium that free alcohol under the most restricted conditions that are compatible with absence of fraud is demanded by the people, and that any legislature which ignores their expressed wishes in this direction would soon be retired. Therefore, measures in this direction are constantly under consideration, and sooner or later Belgium will be in line with the nations of Europe on this subject.

Switzerland.

The Government controls all the alcohol that is manufactured, imported, or sold in Switzerland. Distillers are permitted to manufacture to an extent which is limited by the authorities. Under these limitations they manufacture alcohol, and when their part of the process is completed, the alcohol, in a semi-crude state (that is, with more or less impurities), passes from the stills through pipes into the control of the Government officials. Account of the amount thus made is taken, and the distiller is paid so much per hectolitre for his product, the price being determined by the Government according to the conditions which may prevail in respect to the agricultural interests.

As to the system of methylation prevailing in Switzerland, suffice it to say that ordinary methylation has hitherto been done with methyl alcohol and pyridine bases, as in the case of other countries; but the Swiss Government is continually investigating other processes of methylation and adopting the superior methods.

Methylation for pharmaceutical and chemical products and for perfumery is done by the use of materials which are a part of the finished product.

DUTY ON CYANIDE OF POTASSIUM.

Eng. and Mining J., Dec. 5, 1896, 538.

In this case duty was assessed on cyanide of potassium at 25 per cent. *ad valorem* as a chemical salt under paragraph 60 of the customs law. Appellants claimed that it should be entered free under paragraph 443 as a coal-tar product. The appeal was overruled and the assessment under paragraph 60 was sustained. Schoellkopf, Hartford, and MacLagan, appellants, vs. Collector of the Port of New York; United States Board of General Appraisers.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

CHEMICAL TRADE OF TURKEY IN ASIA.

Imp. Inst. J., Dec. 1896, 447.

The German Consul in Bagdad reports that, up to the present, drugs, chemicals, and pharmaceutical articles generally, are chiefly imported from Paris and Marseilles. Last year, however, Berlin manufacturers had begun to compete, and although thus far their share in the business is a small one, their goods have been favourably received. The aniline and general colour trade is entirely in the hands of German and Swiss firms. It is reported that some of the large German colour factories intend to establish in Bagdad a transit depot for supplying the western provinces of Persia with their goods. Within the last few months German and Austrian manufacturers from Karlsruhe, Zeitz, and Vienna have commenced to pay attention to this market.

THE DEVELOPMENT OF NEWFOUNDLAND.

Imp. Inst. J., Dec. 1896, 433.

An official report on the mineral resources of the colony, published in August last, gives an interesting account of the iron ore formation of Bell Island, in Conception Bay. Although not a high-grade ore, its abundance so near the surface, with unusual facilities of raising and shipping it, may render this a most valuable property. The present lessees have established plant capable of dealing with an output of 500 tons per diem when in full working order. At Tilt Cove, a mass of pyrites, said to be 200 ft. in thickness, and to contain 2 or 3 per cent. of copper, has been worked for some time. Pyrites occur in very many localities, and in almost all the great bays, in more or less quantity. With regard to the more generally useful ores of iron, the island possesses an abundance of the following:—Magnetite, chromite, clay iron ore, and hematite of several varieties, such as specular iron, red hematite, red ochre, jaspery iron ore. The deposits of magnetite are sometimes enormous; one band at Union Mine, Tilt Cove, ranges from 4 to 30 ft. in thickness, and is of very superior quality. The most extensive deposits, however, are found on the west coast of the island, near Bay St. George. An analysis

of this ore gives 65.05 per cent. metallic iron, but it contains a varying percentage of titanate acid. It is, however, absolutely free from sulphur and phosphorus. A large deposit of magnetic iron is indicated at a point in the interior, near the head of Bay d'Est river, amongst a set of serpentine and chloritic rocks. Chromic iron, or chromite, occurs very frequently, especially associated with the magnesian group of rocks, usually termed here serpentines; and hematite and its varieties are also of common occurrence in various parts of the island. With regard to coal, the report shows that at present there are two distinct coal areas that have been partially explored, one on St. George's Bay, and the other in the Grand Lake District. In the latter the coal measures are on both sides of the line of railway already built, and in close proximity to it, but the coal obtained will have to be conveyed over 45 miles of the line to reach the nearest point on the Humber river at which it could be shipped. In the St. George's Bay area, which the railway has now reached, there will be, under any circumstances, not less than 35 miles of railway carriage for the coal before it can be shipped at Port au Basque. For any continuous shipment of coal all the year round this port will have to be used, as it is free from ice in the winter. It is believed, after local tests, that the Newfoundland coal is a stronger and better coal than that of Sydney, with which it will have to compete in the market; but as the latter is run straight from the mine to the ship, the former will be heavily handicapped by the cost of railway carriage, unless mining labour can be obtained more cheaply in Newfoundland than in Sydney. It, therefore, remains a question whether Newfoundland coal—plentiful as it may be—can compete with the Sydney coal, even for the supply of the wants of the colony.

GENERAL TRADE NOTES.

THE WORKING OF THE INDIAN MERCHANDISE MARKS ACT.

Times of India, through Bd. of Trade J., Dec. 1896, 690.

THE reimposition of the import duties has had the effect of increasing, to the extent of something like 70 per cent., the number of detected infringements of the Merchandise Marks Act.

The total number of detentions during the year was 1,622, as compared with 955 in the previous year, and 1,287 in 1893-94. In Bombay the number of detentions was 918, as against 352 in the previous year; while in Calcutta the number was less than 400, which is, roughly speaking, the average of the five years during which the Act has been in operation. In Madras, including outports, the detentions number 101, as against 54 in the previous year, and 16 in 1891-92. Kurrahee's total was 136, as compared with 223 in the previous year, and 365 in 1892-93.

In Bombay there were only three cases of false trade marks, one being in respect of paper, and the other two in respect of alizarine dye, in spurious brands of which a very large trade used to be done a few years ago.

Some of the Bombay investigations revealed frauds of the most impudent kind. A large consignment of bottles was landed, for instance, all of which were marked "Quinine C." It was suspected that this so-called quinine was not genuine, and a sample was forwarded to the chemical analyser to Government. That gentleman reported that not only was the "quinine" not genuine, but that it contained no quinine at all; being, in fact, a cheap alkaloid of the cinchona bark. The ingenious contention of the manufacturers was that so long as they did not actually call the article "Quinine," but only "Quinine C.," no offence was committed. The plea, of course, was not entertained; but the Customs authorities allowed the fraud to pass on the payment of a penalty after an alteration had been made in the label, and no doubt it has long since passed into the bazaar as genuine quinine.

Then, again, there were several consignments of imitation gold and silver thread, made up and labelled in imitation of real gold and silver thread; and a large number of cases, in which an article labelled "Best 100 B touch Mexican Vermilion" was found to contain absolutely no vermilion whatever. In both these instances the goods were

passed on the payment of a fine, instead of being confiscated and destroyed.

Japan was, as usual, a great offender against the Act. The daring of her exporters seems to know no limit. Their ingenuity during the year under review was mainly confined to the export of pencils, clocks, soaps, umbrellas, and matches, all of which were fraudulently marked. In another instance, a case of false trade description was revealed by the exporters themselves, who wrote to the Customs authorities to say that although they called their consignment by the name of the Belmont Spermi candles, they did not contain a particle of spermaceti in their composition, and they asked therefore that the articles should be assessed at the lower rate for common candles. These too ingenious exporters now send their goods marked "Stearize" instead of "Spermi," which is, no doubt, the more excellent way, though it probably does not pay so well. Perhaps the most impudent of all the contentions urged by the manufacturer of spurious goods is that of a firm which exported a large quantity of what was described as a well-known drug. This was proved to be simply a cheap substitute for the genuine balsam, but it was urged that, medicinally speaking, it served the same purpose as the genuine article, so that there was no harm in calling it so! In the case also of the spurious balsam, it was allowed to pass on the payment of penalties and the alteration of the label.

It is probable, however, in this, as in the other cases cited, in which fraudulent goods were allowed to pass on these terms, that the inelasticity of the Act itself is more to blame than the Customs officials; and if this is so, it only demonstrates with added force the crying need which exists for an Adulteration Act for India on the lines of the English Food and Drugs Act.

THE JAPANESE BREWING INDUSTRY.

Bd. of Trade J., Dec. 1896, 729.

The chief expert of the Yebisu Beer Brewing Co. has been sent to Germany for two years to study the condition of the German brewing industry with its latest improvements.

The brewers of Japan have not only succeeded in nearly putting a stop to the import of most malt liquors into Japan, but now export their produce to China and Singapore, and even as far as Bombay. In fact, the supply is hardly adequate to meet the growing demand. There are at present only four breweries in Japan carrying on business on a large scale, namely, the Kirin (Japan Brewery Co., Ltd.), the Asahi, the Sapporo, and the Yebisu. The output of these four breweries does not exceed 50,000 koku* per annum. Compared with the yearly output of saké, amounting to 1,000,000 koku, the quantity of beer produced in Japan does not exceed $\frac{1}{20}$, while from the point of view of the alcohol contained in the two, the ratio falls to 1 in 300. Consequently, if the steady increase in the consumption of Japanese beer in foreign markets be taken into consideration, the quantity of beer brewed in Japan may be increased by 10 or even 20 times the amount now manufactured. Of the various fermenting industries of Japan, beer-brewing is generally admitted to be one of the most profitable, and this even though malt is imported from abroad. The profits would, therefore, be very much greater were this material produced at home. The Yebisu Beer Co. is paying earnest attention to this point, and is manufacturing malt experimentally from German barley with the latest appliances available. It was for the purpose of investigating this important branch of the industry that the company decided to despatch its expert to Germany. Success in producing malt in Japan would mark an epoch in the history of beer-brewing in the country. It is said that the Yebisu Co. has decided to establish another brewery capable of producing 16,000 koku, so that, on the completion of this scheme, the total output of the company will be increased to about 60,000 koku. For this purpose the Company's capital is to be increased from 600,000 yen to 1,300,000 yen.

* Koku = 39.7 galls.

THE TANNING INDUSTRY OF INDIA.

Bd. of Trade J., Dec. 1896, 730.

According to an article in *Capital* (Bengal), the tanning industry in British India has now assumed important dimensions. The value of last year's exports of tanned skins and hides by sea to foreign countries aggregated over four crores, indicating, after a steady annual expansion, an increase of 42 per cent. within the past five years. The trade is one in regard to which there seem to be prospects of still further development on a large scale. In the case of finished leather goods, a very general impression has hitherto prevailed that English leather was infinitely superior to the Indian article, and to a great extent Government and private purchasers have been content to pay the considerably higher cost of British-made articles in the belief that they were getting relatively better value for their money. This, however, can no longer be accepted as a general rule, practical experience in numberless instances proving the contrary.

The foremost leather manufacturers in India keep well abreast of the time, and have shared in all that the application of modern science has done for the tanning industry. Recent comparative experiments undertaken in England between artillery harness made of Indian leather turned out in the Government harness and saddlery works at Cawnpore, and the same made in England of home-produced leather, proved the former to be the stronger; and, presumably, there could hardly have been a severer test. Cawnpore is the centre, no doubt, of a great leather industry, but one which is probably only in its infancy as yet. Operations locally are, in the meantime, apparently confined to the production of material sufficient in quantity to meet the demands for manufactured articles. In the foreign export trade in tanned hides and skins, Madras stands far to the front; five-sixths of the total exports from India being shipped from that seaport, the tanned goods of the Southern Presidency finding, it is said, a better market in Europe than any other province. Other provinces, in fact, export hides and skins largely to Madras, but it is not likely that the advantage which that Presidency has hitherto enjoyed in the superior descriptions of tanning bark produced in Southern India will long survive the recent introduction of other tanning materials which, as far as reagents are concerned, place all provinces on a par.

NEW PETROLEUM AND OZOKERITE FIELDS IN RUSSIA.

Eng. and Mining J., Dec. 5, 1896, 538.

For many years petroleum and ozokerite have been known to exist in the island of Cheleken, in the Caspian Sea. According to a recent German report, the oil is forced to the surface by numerous springs of hot sulphur water (102° F.), and accumulates in wells dug by the Turcomans. In 1876 the first attempt in the direction of a rational exploitation was made by T. Palankowski, a well-known oil operator of Baku. The attempt, however, did not result successfully, because the upper sands were almost exhausted by the diggings of the Turcomans. The operations commenced by Nobel Brothers, in 1881, were also stopped after a short time, partly because of lack of labour, as the Turcomans refused to work; partly on account of the intention at that time to concentrate the production and manufacture of petroleum on the Apsheron peninsula. This field was then forgotten until quite recently. The attention of prospectors has been called again to the island, especially by the authorities of the Transcaucasian territory, who were looking for a cheap liquid fuel for the Transcaucasian Railway, and caused the resumption of operations on the island, which were accompanied by favourable results. The firm of Nobel Brothers has now resumed operations. Analytical tests made in the laboratory of the Technical Committee of Baku have shown that the crude oil of Cheleken Island possesses very peculiar properties. It is of thick consistency at 9° C., like salve, and becomes solid at a little below 0° C. Its water content is hard to eliminate, and this circumstance proves a serious obstacle in the distillation. Its specific gravity at 15° C. is 0.868, the flashing point 51.5° C.

The residue possesses at ordinary temperature, 22·5°, the consistency of salve or jelly, a specific gravity of 0·900, and can be worked up directly to vaseline. Another characteristic of this oil is its high content of paraffin, amounting to 5·5 per cent., which, after being refined, furnished about 3 per cent. of white amorphous paraffin wax.

PRODUCTION, DELIVERIES, AND EXPORTS OF SULPHATE OF AMMONIA, 1890 to 1895.

J. Gas Lighting, 68, Dec. 1, 1896, 1073.

Messrs. Bradbury and Hirsch's "Review of the Sulphate Market for 1895" gives the production, exports, and home consumption, &c. of sulphate for the past 10 years.

	1890.	1891.	1892.
Produced (tons).....	134,000	143,000	150,000
Exported.....	85,000	90,000	105,000
Home consumption.....	42,000	43,000	42,000
Stock.....	6,000	10,000	3,000
PERCENTAGE ON PRODUCTION.			
Exports.....	64·2	62·9	70·0
Home consumption.....	31·3	30·0	28·0
Stock.....	4·5	7·1	2·0

Average price per ton..... £ 11 9 0 10 15 5 10 1 10

	1893.	1894.	1895.
Produced (tons).....	151,500	160,000	171,000
Exported.....	112,000	103,000	112,000
Home consumption.....	37,500	41,000	39,000
Stock.....	2,000	16,000	20,000
PERCENTAGE ON PRODUCTION.			
Exports.....	73·9	64·4	65·5
Home consumption.....	24·8	25·6	22·8
Stock.....	1·3	10·0	11·7
Average price per ton..... £	12 11 4	13 3 8	9 15 4

—Bradbury and Hirsch.

From the table it will be seen that there is an increased production of 11,000 tons as compared with 1894, which is made up as follows:—Gas works, 2,500 tons; iron works, 1,500 tons; and shale works, 7,000 tons; total, 11,000 tons. This shows that the bulk of the extra production was from Scotland—brought about probably by the immunity from labour troubles. Compared with production, the exports show a slight falling off since 1893. The increased production from coke ovens in Germany may account for the decrease in the exports to that country, as it is a noticeable fact that Germany, Holland, and Belgium show a falling off of some 5,000 tons as compared with 1894. Taking the year 1895 as a whole, however, the exports to the Continent show an increase of about 9,000 tons over the previous year; but the home consumption, which has been on the decline since 1891, fell 2,000 tons short of 1894.

CORSICAN MINES.

Ch. of Commerce J., Nov. 1896, 203.

The British Consul says that the antimony mines of the Cape Corse are the only mines at work. They are the Luri mine, owned in England, and the Meria and Ursa mines, owned locally. They produced between them an average per annum during the last five years of 1,300 tons of ore containing 45 per cent. of metal, and 300 tons of ore containing 30 per cent. of metal. Almost all this goes to London to be smelted, and is used for making star antimony, chiefly used in alloys and type-metal. Japan, being a large producer, has been able to undersell Corsican and all European antimony ores owing to the low price of silver giving such an enormous advantage on

exchange. The result is a reduction in output in Europe, only the best mines, such as the Corsican, being able to compete with Japan. With silver rising in value somewhat, the prices for ores are improving, and at the present moment demand for Corsican ores exceeds the production. With the advance in value of copper more attention is being paid to the copper lodes which undoubtedly exist, but have been little proved. A local company is now opening up an important deposit of pyrites carrying 6 per cent. of copper and 45 per cent. of sulphur, and will shortly be turning out 500 tons monthly. Another mine, which has not been worked for years, is about to be offered at public sale by Government, on the advice of the chief engineer of mines that it is too important to remain in the hands of concessionaires who do not work it. The Consul adds that he will be happy to supply full details of these and other mines to any persons applying to him.

THE TIN PRODUCTION OF BOLIVIA.

Eng. and Mining J., Nov. 21, 1896.

Through the courtesy of Sr. F. G. Grauert, of Sucre, we have received the following statement, giving the exports of tin from Bolivia to England for eight years past. These exports practically represent the production, and the figures are taken from the Bolivian Government reports, the quantities being in metric tons.

Exports of Tin from Bolivia.

Year.	Barra.	Barrilla.	Fine.	Bars.
	Tons.	Tons.	Tons.	Tons.
1888	440	1,120	923	1,363
1889	590	1,229	999	1,389
1890	565	1,087	1,006	1,664
1891	663	1,379	896	1,559
1892	1,076	2,681	2,743	2,819
1893	1,362	2,380	1,547	2,909
1894	1,305	3,350	2,199	3,482
1895	1,612	4,824	2,485	4,997

The Bolivian ores, as a rule, are very rich, some of the best being reported as carrying 65 per cent. metal. This far exceeds those of any other country. It will be seen that in the last four years there has been a large increase.

NEW SOUTH WALES DRUG TRADE.

Chem. and Druggist, Dec. 5, 1896, 814.

A lengthy and interesting German consular report on the trade of New South Wales states that the principal pharmaceutical articles imported into the colony, in addition to crude drugs, are acetic, sulphuric, and tartaric acids, bicarbonate of soda, caustic soda, soda ash and crystals, cream of tartar, glycerine tinctures, and extracts. The value of the importation in 1895 was 272,974*l.*, an increase of 8,514*l.* upon the preceding year. As a rule, fine drugs and chemicals are imported direct from Germany, while the staple articles are from Britain. In 1895 Germany supplied drugs to the value of 7,660*l.*, acetic acid 979*l.*, tartaric acid 1,315*l.*, cream of tartar 1,675*l.*, and various chemicals 2,019*l.* These figures show that the direct imports from Germany are still very small, for the total value of importation was as follows:—Drugs, 138,572*l.*; cream of tartar, 26,107*l.*; alkalis, 26,073*l.*; acids, 20,259*l.* The importation of paints and colouring materials shows a considerable decrease, but the German share therein is insignificant, and amounts to only a few dry colours and common brushes. The market in photographic materials, especially cameras and dry plates, is entirely in British and American goods, and the German Consul states that for the present it would seem to be hopeless to expect interference with this trade, especially as the articles now supplied are of good workmanship, and low in price. On the other hand, photographic chemicals, albuminised paper, and mounts are mostly of German origin. The total import of photographic articles amounted to 15,756*l.* in value, of which about 20 per cent. came from Germany.

DISCOVERY OF ICHTHYOL.

Chem. and Druggist, Dec. 5, 1896, 813.

Up to the present we believe that the raw material for ichthyol, the pharmaceutical product distilled from fossilised fish-remains, has only been found in the Tyrol. Recently, however, another ichthyol deposit has been discovered on the coast of the Adriatic. The bituminous product is said to yield on an average 18 per cent. of pure ichthyol.

THE RUSSIAN QUICKSILVER INDUSTRY.

Chem. and Druggist, Dec. 5, 1896, 813.

The quantity of quicksilver exported by the mines of the firm of Auerbach and Co. at Nikotovka, in the government of Ekaterinoslav, in the course of last year amounted to 10,706 bottles, which went to various European countries, China, India, and to the Transvaal. For consumption in Russia itself 1,595 bottles were sold. The output is steadily increasing, and is likely to be considerably larger this year than last.

THE MARKET FOR GAS RESIDUALS.

W. E. Price. J. Gas Lighting, 1896, 68, 958-961.

This paper, which is accompanied by well compiled tables and diagrams, gives a review of the course of the residuals market over the last four years.

Coke.—Since the middle of 1894 the market has been and is still in a very unsatisfactory condition, the demand having been below the average of previous years owing to climatic conditions.

Coal Tar.—This has greatly improved in value since 1893, at which period it had an average value of 13s. 7½d. per ton, whereas the average value of nine months this year has been 21s. 6½d. This increase has been brought about by the rise in the value of pitch, benzene, and naphthalene.

Pitch.—This material advanced in price during 1894-5, and has kept steady this year at an average value for nine months of 32s. 7½d. per ton.

Benzene.—A notable rise has taken place this year after a period of very low market value. At Michaelmas 1895 "90 per cent. benzol" was 11½d. per gallon; at Michaelmas 1896 it was 3s. 9½d. The low price in 1894-5 offered an inducement to apply it to gas-enriching purposes, and large quantities were consumed with great success.

Anthracene.—This product has been fairly steady in price, with a slight decline, from 1s. per unit per cwt. in 1893 to 10½d. at Michaelmas 1896.

Naphthalene.—This material has been in good demand, and has had an average value this year of 55s. 6d. per ton.

Sulphate of Ammonium.—The average price in 1893 was 12l. 11s. 1d. per ton; in 1894, 13l. 6s. 5d.; in 1895, 9l. 15s. 9d.; and in 1896 (nine months), 8l. 1s. 8d. From a diagram showing the annual values from 1867 to 1896, also the equivalent value of sodium nitrate since 1880, it appears that a comparatively steady period for "sulphate" prevailed between 1886 and 1892, the value being 11l. to 10l. per ton. This was succeeded by a considerable rise and fall in the following four years. Nitrate, on the other hand, has experienced a downward tendency since 1895 from 10l. to 8l. per ton. There is not much evidence to show that the one has any influence on the other, or at any rate to which the influence belongs. The reduction in sulphate is due to over-production and the circumstance that the competition with other nitrogenous materials in the market for artificial manures has been very severe of late.—D. B.

SULPHUR IN THE UNITED STATES.

Eng. and Mining J., Dec. 12, 1896, 552.

The recent rapid increase in the price of sulphur through the operations of the Sicilian combination, and the probability that prices can be kept up to or at least near the present level, has turned attention very generally to the possibilities of an extended use of pyrites in the manufacture of sulphuric acid, or to obtaining new supplies of sulphur. The first thing, of course, is to secure the raw materials, and the conditions now present an opportunity to the owners of deposits to make a market for their product such as has probably never before existed. A few weeks ago, brimstone

was selling at 26 dols. and 28 dols. per ton, an advance of from 50 to 60 per cent. over the price of last July; and even now the price is 22 dols. to 24 dols. per ton. There are a number of deposits of pyrites in the South, which could furnish a supply, but unfortunately most of them are so located that the expense of transportation from the mines is very heavy. Thus it is now a fact that the fertiliser factories of Atlanta, Ga., have used imported pyrites, although there are large deposits within 150 miles of them; but these deposits are 40 miles from a railroad, and the expense of hauling that distance over mountain roads has been greater than the cost of freight across the ocean. A further objection to the use of pyrites in many cases is the expense of altering plants, or perhaps of putting in new furnaces, which might be necessary.

The present conditions certainly present a favourable opportunity for the development of our own deposits of sulphur, which has heretofore proceeded very slowly. It seems probable that if the Sicilian operators hold together and succeed in keeping up the price, an increase in domestic supplies, both of sulphur and pyrites, may be expected. In our market columns last week reference was made to the Texas sulphur deposits, which are believed to be of great value, and to the possibility of an early beginning of work upon them. It is to be hoped that the company referred to will be successful in exploiting its property, and that Texas brimstone will soon be a recognised factor in the market.

BOARD OF TRADE RETURNS

SUMMARY OF IMPORTS.

Articles.	Month ending 30th November	
	1895.	1896.
Metals.....	£ 1,488,235	£ 1,581,522
Chemicals and dyestuffs.....	401,828	374,377
Oils.....	816,316	897,822
Raw materials for non-textile industries.....	4,098,354	3,914,085
Total value of all imports.....	39,006,941	42,502,969

SUMMARY OF EXPORTS.

Articles.	Month ending 30th November	
	1895.	1896.
Metals (other than machinery).....	£ 2,658,478	£ 2,720,569
Chemicals and medicines.....	737,786	591,898
Miscellaneous articles.....	2,740,465	2,682,539
Total value of all exports.....	19,540,333	18,539,853

IMPORTS OF METALS FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Copper:—			£	£
Ore..... Tons	7,305	4,844	27,067	49,861
Regulus..... "	6,334	7,623	167,351	180,312
Unwrought..... "	3,079	4,621	138,585	227,439
Iron:—				
Ore..... "	239,229	277,420	189,656	188,450
Bolt, bar, &c..... "	10,027	5,293	77,421	43,310
Steel, unwrought..... "	1,519	1,320	9,954	9,270
Lead, pig and sheet..... "	11,693	12,422	149,133	139,505
Pyrites..... "	59,734	42,493	80,812	71,573
Quicksilver..... Lb.	21,524	16,026	1,948	1,333
Silver ore..... Value £	..	..	90,828	130,232
Tin..... Cwt.	86,247	72,356	282,283	241,802
Zinc..... Tons	5,164	8,289	78,495	139,531
Other articles..... Value £	..	..	193,272	188,993
Total value of metals.....	..	..	1,488,235	1,581,522

IMPORTS OF CHEMICALS AND DYE-STUFFS FOR MONTH
ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	17,767	14,652	£ 11,979	£ 8,385
Bark (tanners', &c.) ..	31,760	22,190	12,312	7,530
Brimstone..... "	48,078	56,180	10,176	12,322
Chemicals..... Value £	..	..	101,436	21,270
Cochineal..... Cwt.	853	1,228	5,741	7,556
Cutch and gambier Tons	1,645	3,281	31,621	54,822
Dyes:—				
Alizarin..... Value £	..	..	32,411	24,365
Anilin and other ..	..	..	12,880	40,744
Indigo..... Cwt.	2,048	712	28,910	10,661
Nitrate of potash ..	22,035	18,780	20,416	15,341
Valonia..... Tons	2,825	762	31,234	8,025
Other articles... Value £	..	..	132,712	90,356
Total value of chemicals	..	..	461,828	374,377

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR
MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Brass..... Cwt.	9,105	10,769	£ 38,997	£ 44,859
Copper:—				
Unwrought..... "	54,723	25,306	133,569	64,655
Wrought..... "	26,408	22,292	74,404	70,092
Mixed metal..... "	29,991	21,021	65,760	49,595
Hardware..... Value £	..	..	174,666	178,329
Implements..... "	..	..	119,035	116,986
Iron and steel... Tons	253,234	298,972	1,783,449	1,957,506
Lead..... "	2,923	2,549	37,290	33,481
Plated wares... Value £	..	..	44,693	43,177
Telegraph wires ..	..	..	70,459	48,371
Tin..... Cwt.	10,774	12,453	37,010	39,018
Zinc..... "	21,071	12,150	14,423	9,262
Other articles .. Value £	..	..	64,732	66,138
Total value .....	..	..	2,658,478	2,720,569

IMPORTS OF OILS FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Cocoa-nut..... Cwt.	36,875	27,816	£ 40,823	£ 32,623
Olive..... Tons	1,586	919	57,357	31,185
Palm..... Cwt.	94,200	86,183	96,287	100,556
Petroleum..... Gall.	21,721,489	18,914,067	403,088	381,767
Seed..... Tons	3,165	3,657	59,930	77,810
Train, &c..... Tons	2,388	2,167	39,174	39,230
Turpentine..... Tons	33,018	41,823	33,471	40,428
Other articles .. Value £	..	..	86,216	104,193
Total value of oils...	..	..	816,346	807,822

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH
ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Alkali..... Cwt.	644,136	414,780	£ 155,407	£ 107,161
Bleaching materials ..	158,183	111,174	47,195	37,428
Chemical manures Tons	19,723	17,837	125,247	101,406
Medicines..... Value £	..	..	99,832	85,379
Other articles... "	..	..	309,905	260,624
Total value .....	..	..	737,786	591,998

IMPORTS OF RAW MATERIALS FOR NON-TEXTILE
INDUSTRIES FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Bark, Peruvian .. Cwt.	1,222	3,568	£ 1,647	£ 6,361
Bristles..... Lb.	287,994	398,951	39,304	49,784
Caoutchouc..... Cwt.	29,496	37,421	324,588	495,490
Gum:—				
Arabic..... "	5,884	4,392	17,618	11,453
Lac, &c..... "	9,295	10,467	52,757	52,565
Gutta-percha..... "	3,743	3,162	26,925	32,330
Hides, raw:—				
Dry..... "	40,014	27,999	100,541	62,749
Wet..... "	49,104	77,636	108,006	165,603
Ivory..... "	520	825	23,491	33,723
Manure:—				
Guano..... Tons	2,112	687	11,775	2,005
Bones..... "	9,263	2,722	40,805	9,122
Nitrate of soda..... "	11,983	8,106	95,901	64,157
Phosphate of lime ..	26,376	16,196	45,064	24,620
Paraffin..... Cwt.	89,993	77,104	81,422	75,181
Linen rags..... Tons	2,656	1,565	20,993	16,637
Esparto..... "	13,542	13,364	61,198	51,134
Pulp of wood..... "	32,198	25,851	162,487	145,183
Rosin..... Cwt.	60,165	150,605	13,354	40,897
Tallow and stearin ..	249,467	147,976	290,965	153,413
Tar..... Barrels	3,867	10,219	3,292	8,074
Wood:—				
Hewn..... Loads	163,562	155,049	317,533	308,491
Sawn..... "	528,070	502,982	1,094,346	1,083,776
Staves..... "	14,873	10,247	63,631	38,462
Mahogany..... Tons	2,434	3,860	20,149	35,469
Other articles... Value £	..	..	1,069,162	945,808
Total value .....	..	..	4,098,954	3,914,085

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH
ENDING 30TH NOVEMBER.

Articles.	Quantities.		Values.	
	1895.	1896.	1895.	1896.
Gunpowder..... Lb.	542,700	543,900	£ 13,348	£ 12,942
Military stores.. Value £	..	..	143,718	97,255
Candles..... Lb.	2,057,900	1,921,600	33,139	27,784
Caoutchouc..... Value £	..	..	113,851	105,537
Cement..... Tons	31,169	24,965	51,562	40,426
Products of coal Value £	..	..	148,656	160,641
Earthenware ... "	..	..	176,182	130,543
Stoneware..... "	..	..	11,125	13,438
Glass:—				
Plate..... Sq. Ft.	80,974	119,698	5,540	6,724
Flint..... Cwt.	8,035	7,218	21,561	18,604
Bottles..... "	67,719	61,599	31,589	29,596
Other kinds.... "	17,480	20,513	13,681	16,000
Leather:—				
Unwrought "	12,625	11,052	127,250	104,558
Wrought..... Value £	..	..	30,680	34,279
Seed oil..... Tons	3,982	5,424	80,215	97,577
Floorcloth Sq. Yds.	1,605,700	1,418,000	65,682	59,840
Painters' materials Val. £	..	..	132,597	126,494
Paper..... Cwt.	75,209	84,905	122,479	127,078
Rags..... Tons	3,954	3,965	24,000	21,924
Soap..... Cwt.	75,392	41,928	80,043	45,992
Total value .....	..	..	2,740,465	2,682,539

Besides the above, drugs to the value of £85,821½, were imported, as against 72,960½, in November 1895.

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

- 25,794. J. S. Raworth. Improvements in apparatus for compressing air and other gases. Nov. 16.
 25,842. J. G. Chamberlain and J. Weddell. Improvements in evaporative surface condensers. Nov. 17.
 26,112. J. Critchlow and T. Shore. Improvements in filter presses. Nov. 19.
 26,141. F. C. Weedon. Improved means for determining the expansion of solids. Nov. 23.
 26,705. G. Rose. Improvements in portable noiseless furnaces and oil-gas apparatus for welding, puddling, and smelting, steam-raising, humidifying, and glass manufacturing; also applicable for cooking stoves and hot-water heating apparatus. Complete Specification. Nov. 25.
 26,937. J. W. Hall. Certain improvements in or connected with regenerative furnaces. Nov. 27.
 27,009. P. H. Rosenkranz. Improvements in diaphragms. Nov. 27.
 27,177. J. Grossé. See Class XVII.
 27,494. E. Riepe and G. Oppermann. Improvements in regenerative furnaces. Complete Specification. Dec. 3.
 27,778. H. Niewerth. Improved manufacture of articles and vessels for holding and resisting acids and alkalis, and for other purposes. Dec. 5.
 27,969. F. P. Candy. Improvements in apparatus for the removal of deposit from settling tanks. Dec. 8.
 27,989. F. M. Ashby. Improvements in sterilising apparatus. Complete Specification. Dec. 8.
 28,072. J. Kent. An improvement in the manufacture of thermometers. Dec. 8.
 28,289. S. Sherratt and W. A. Richards. Improvements in the method of and apparatus for filtering, washing, and drying crystalline, granular, and other materials. Dec. 10.
 28,411. S. Straker. Improvements in apparatus for evaporating water containing salts and calcareous matter, and in heating furnaces for removing the incrustations from the coils of such evaporating apparatus. Complete Specification. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.*

1895.

- 22,713. J. Y. Johnson.—From The Verein Chemischer Fabrik. Apparatus for drying superphosphates and the like. Dec. 2.
 22,900. W. P. Abell. Centrifugal machines for drying sugar and other granular substances. Dec. 2.
 23,385. G. Platt. Metallurgical furnaces. Dec. 9.
 23,664. E. Ljungström. Evaporating or heating apparatus. Dec. 9.
 24,337. L. A. Chevalet and W. Boby. Apparatus for heating and purifying water. Nov. 25.
 24,499. G. P. Wallis. Hydraulic presses for expressing oil from seeds and such like. Nov. 25.
 24,835. W. Raydt. Apparatus for filtering liquids and impregnating the same with gases. Dec. 9.

1896.

1112. D. A. Quiggin. Evaporators, condensers, and the like. Dec. 2.
 1177. C. S. Meacham. New or improved apparatus for separating bodies of different specific gravity when immersed in a liquid. Nov. 25.

3572. S. S. Bromhead.—From Dierks and Mollmann. Sterilising apparatus. Dec. 9.

1241. C. G. J. Moller and P. Pfeifer. Drying apparatus. Dec. 16.

18,717. A. J. Boulton.—From C. A. Macdonald. Method and apparatus for cooling, purifying, and drying air for chilling and freezing purposes. Nov. 25.

19,405. E. Dieble. Improved continuous counter-current saturation apparatus. Nov. 25.

20,982. J. Van Ruymbeke and W. F. Jobbins. Distilling apparatus. Nov. 25.

22,060. W. F. E. Casse. Apparatus for heating, pasteurising, and cooling liquids. Nov. 25.

23,991. L. Sterne.—From The De la Vergne Refrigerating Machine Co. Refrigerating and ice-making apparatus. Dec. 2.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

- 25,762. M. Arndt. Gas-absorbing apparatus for ascertaining the quantity of a particular gas in a gaseous mixture. Nov. 16.
 25,827. E. Sfriwan. Improvements in the method of and means for binding mantles for incandescent lights. Nov. 17.
 25,884. M. M. Oppenheimer. Improvements in mantles for use in incandescent lighting. Nov. 17.
 25,887. F. J. Collin. Improvements in or relating to coke furnaces. Complete Specification. Nov. 17.
 26,041. E. Edwards.—From R. Turr. Improvements in apparatus for applying acetylene gas to the purpose of incandescent lighting or heating. Nov. 18.
 26,121. W. H. Royle. Apparatus and method for generating and producing gases at pressure for use in motors. Nov. 19.
 25,167. B. Puchmüller. An improved process for the manufacture of fluid for impregnating bodies or suitable fabrics, threads, fibres, or the like, for illuminating or lighting purposes. Complete Specification. Nov. 19.
 26,191. E. T. Zohrab. Improvements relating to the production of peat charcoal, and to apparatus therefor. Nov. 19.
 26,228. T. Mitchell. Improvements in or relating to fuel. Nov. 20.
 26,261. J. C. Mewburn.—From F. G. Bates. Improvements in and in apparatus for the manufacture of combustible gas, including illuminating gas in motor engines driven by such gas, and in steam generators. Complete Specification. Nov. 20.
 26,284. F. O. Prince. Improved manufacture of hydrogen gas and apparatus therefor. Nov. 20.
 26,304. R. Van de Ghinste. Improvements in means for incandescence gas-lighting. Complete Specification. Nov. 20.
 26,359. J. M. Somerville. Improvements in the manufacture of illuminating gas. Nov. 21.
 26,363. R. E. Middleton. Apparatus for improving the quality of hydrocarbon oils. Nov. 21.
 26,376. W. P. Thompson.—From La Société Egrot and Grange. An improved apparatus for producing acetylene gas. Nov. 21.
 26,468. F. O. Prince. Improved apparatus for generating carburetted hydrogen. Nov. 23.
 26,509. A. Wilson. Improvements in apparatus for cleaning gas. Nov. 23.
 26,516. G. Treseureuter. Method and apparatus for producing gas from liquid combustible materials. Nov. 23.
 26,618. J. F. Duke. Improvements in the manufacture of mantles or incandescing bodies for incandescent gas lamps. Nov. 24.
 26,647. R. Kuhn. Improvements in acetylene gas apparatus. Filed Nov. 24. Date applied for, April 27, 1896, being date of application in Switzerland.

26,732. J. Worthington. For improvements in apparatus and method for increasing the illuminating power and heating purposes of gas. Nov. 25.

26,784. R. Moll and A. Palmer. A new or improved method of manufacturing incandescent mantles or caps for gas and other burners. Complete Specification. Nov. 25.

26,870. J. Kranz, I. Saxl, and A. Wallesz. Improvements in apparatus or lamps for the generation of acetylene from calcium carbide. Nov. 26.

26,873. W. B. Hartridge. An improvement in fuel blocks applicable as fire-lighters. Nov. 26.

26,897. J. Vaughan-Sherrin. Improvements in and connected with apparatus for the production and utilisation of acetylene gas. Nov. 26.

27,085. S. D. Gillet, G. Forest, and J. E. O. Bocande. A new or improved arrangement of apparatus for lighting by acetylene gas. Complete Specification. Filed Nov. 28. Date applied for, May 30, 1896, being date of application in France.

27,086. S. D. Gillet, G. Forest, and J. E. O. Bocande. A new or improved burner for lighting by acetylene or other gases rich in carbon. Complete Specification. Filed Nov. 28. Date applied for, May 30, 1896, being date of application in France.

27,137. J. A. Cumine and E. J. Dexter. An improved illuminant. Nov. 30.

27,194. A. J. de Pimental Hargreaves. Improvements in the manufacture of acetylene gas and in apparatus therefor. Nov. 30.

27,212. J. Wetter.—From G. Meyer. Improvements in apparatus for generating acetylene gas. Nov. 30.

27,338. B. T. L. Thomson. Improved process and apparatus for the manufacture of acetylene gas. Dec. 1.

27,457. S. Braun and H. Schlesinger. Process and apparatus for producing a new lighting gas. Complete Specification. Dec. 2.

27,574. E. Gossart and H. Chevallier. Improvements in or relating to means for regulating the production of acetylene gas and in lamps therefor. Filed Dec. 3. Date applied for, May 5, 1896, being date of application in France.

27,697. H. H. Lake.—From V. Hanotier and G. Hostelt. Improvements in acetylene gas generators. Dec. 4.

27,744. A. Kiesewalter. Process of manufacture of a carbide which, by its decomposition by water, produces acetylene gas. Filed Dec. 5. Date applied for, May 6, 1896, being date of application in Belgium.

27,945. T. Holmes, G. S. Holmes, R. W. Stewart, and R. T. Barnes. An improved method of and apparatus for producing and burning inflammable gas. Dec. 8.

28,083. E. J. Feuillette. Improvements in apparatus for generating acetylene gas. Dec. 8.

28,101. J. A. Sinclair. Improved means for lighting by electricity and incandescence. Dec. 8.

28,206. T. R. Fowler. Improvements in and connected with acetylene gas generator, purifier, and container. Dec. 10.

28,265. E. Barker. The incandescent fire ball. Dec. 10.

28,279. Sir C. S. Forbes, Bart. Improved apparatus for automatically regulating the supply of liquid fuel. Dec. 10.

28,280. Sir C. S. Forbes, Bart. Improved apparatus for vaporising and burning liquid fuel. Dec. 10.

28,290. F. V. C. Brokk. An improved vaporiser for liquid combustibles for incandescent lighting or heating purposes. Dec. 10.

28,302. A. J. Bonlt.—From L. Serres. Improvements in or relating to the generation of acetylene gas, and in apparatus therefor. Dec. 10.

28,425. H. T. Marks and J. T. Todman. Improvements in apparatus for generating gases for illuminating and other purposes. Dec. 11.

28,432. T. Holmes, G. L. Holmes, R. W. Stewart, and R. T. Barnes. An improved method of and apparatus for producing inflammable gas. Dec. 12.

COMPLETE SPECIFICATIONS ACCEPTED

1895.

24,008. B. Barriere. Preparation and production of bodies for use in what is known as incandescent gas lighting. Dec. 2.

1896.

361. H. Bower. Improvements in methods of separating the cyanogen compounds from gas liquor or other solutions containing cyanogen compounds. Dec. 16.

1351. J. Hawley. Construction of wood grids for gas purifiers. Dec. 2.

1521. N. T. M. Wilshire.—From D. Little. Improvements in incandescent gas or oil lighting. Dec. 2.

1841. P. Steins. Incandescent mantles. Dec. 16.

2269. J. Moeller. Incandescent gas lamps. Dec. 16.

3560. A. Quentin. Apparatus for burning liquid fuel. Dec. 9.

18,207. R. P. Pictet. Manufacture of acetylene, and apparatus therefor. Dec. 9.

18,208. R. P. Pictet. Purification of acetylene, and apparatus therefor. Dec. 2.

23,079. O. Streiber and P. Kiefer. Factory fuel. Dec. 2.

23,812. R. Haddan.—From H. Colberg. Apparatus for the automatic production of acetylene gas. Dec. 2.

24,809. A. Schoenemann. Drying peat. Dec. 16.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

APPLICATIONS.

26,771. G. Schultz. An improved process for obtaining benzol and similar aromatic hydrocarbons. Nov. 25.

27,527. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improvements in the manufacture of preparations of guaiacol, creosote, and other higher phenols. Dec. 3.

IV.—COLOURING MATTERS AND DYES.

APPLICATIONS.

25,725. I. Levinstein and Levinstein, Lim. Production of a new colour base and of colouring matters therefrom. Nov. 16.

26,019. Read, Holliday, and Sons, Lim., J. Turner, and H. Dean. Improvements in the production of sulpho acids and colouring matters therefrom. Nov. 18.

26,020. Read, Holliday, and Sons, Lim., J. Turner, and H. Dean. Improvements in the production of sulpho acids and colouring matters therefrom. Nov. 18.

26,139. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co. The manufacture or production of chemical compounds of the aromatic series. Nov. 19.

26,183. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik. Improvements in the preparation of colouring matters. Nov. 19.

26,210. W. H. Claus, A. Ree, and L. Marchlewski. Production of new azo colouring matters. Nov. 20.

26,666. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. The manufacture of isomeric unsymmetrical acetonealkamines and acetyl derivatives therefrom. Nov. 24.

26,972. L. D. Huguenin and Co. Manufacture of colouring matter of the series of oxazines. Nov. 27. Date applied for, April 27, 1896, being date of application in France.

27,147. A. Ashworth and J. Burger. Improvements in the production of colouring matters. Nov. 30.

27,660. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. The production of aminopiperidines and of acetonealkamines therefrom. Dec. 4.

27,775. J. Ville. New red colouring matters of the triphenylmethane series and the method of producing the same. Filed Dec. 5. Date applied for, Dec. 2, 1896, being date of application in France.

27,896. O. Imray. — From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of basic disazo dyestuffs. Dec. 7.

28,499. A. G. Green. Improvements in the production of paranitraniline red. Dec. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,523. I. Levinstein and Levinstein, Lim. Manufacture or production of new azo colouring matters. Dec. 9.

24,193. G. B. Ellis. — From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet, and Cartier. Production of para-nitro-phenol and ortho-nitro-toluene-para-sulphonic acid. Nov. 25.

1896.

2446. S. Pitt. — From L. Cassella and Co. Manufacture of azo dyes. Dec. 16.

2765. W. H. Clans and A. Ree. The production of blue colouring matters. Dec. 9.

3000. O. Imray. — From The Farbwerke vormals Meister, Lucius, and Brüning. Manufacture of colouring matter from substituted fluoresceines. Dec. 16.

3028. S. Pitt. — From L. Cassella and Co. Production of polyazo dyestuffs. Dec. 16.

V.—TEXTILES, COTTON, WOOL, SILK, Etc.

APPLICATIONS.

25,789. A. V. Newton. — From A. Nobel and R. W. Strehlenert. Improvements in the manufacture of artificial silk or other fibre. Nov. 16.

25,913. D. Scott. The manufacture of new or improved garments and articles from a new or improved proofed fabric. Nov. 17.

26,024. H. K. Tompkins. Improvements in the manufacture and treatment of artificial fibres. Nov. 18.

26,485. J. S. Brown. Improved process and apparatus for preparing vegetable fibres for textile purposes. Nov. 23.

27,050. K. T. Sutherland and G. Esdaile. Improvements connected with the degumming, cleansing, and treatment of vegetable leaf and stalk and animal fibres. Nov. 28.

27,483. H. C. Longsdon. Improved yarn-drying apparatus. Dec. 3.

27,484. H. C. Longsdon. Improved means or apparatus applicable for use in the drying of wool and other fibrous substances. Dec. 3.

27,679. F. Morane, jun. Improvements in apparatus for the production of artificial silk. Dec. 4.

28,376. H. Giesler. Improvements in the manufacture of mixed or parti-coloured fabrics. Dec. 11. Date applied for, June 3, 1896, being date of application in France. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

1370. F. N. Turney. Apparatus for degreasing and cleansing wool, cotton waste, and like fibrous material. Nov. 25.

8323. C. M. White. — From The Electro Waterproofing and Dye-Fixing Co. A new or improved process of electrically treating fabrics for waterproofing and other purposes. Dec. 16.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

25,502. P. Jensen. — From M. Petzold. Improvements in apparatus for dyeing and bleaching warp, cop, twist skeins, and loose material. Nov. 17.

26,495. A. Vogelsang. Improved process for treating dry materials (more particularly fibrous substances) with liquid. Complete Specification. Nov. 23.

27,218. E. Thomas. Improvements in circulating dyeing apparatus. Complete Specification. Nov. 30.

27,409. A. Leven. New process for dyeing a thread in different colours. Dec. 2.

27,742. H. W. Kearns and J. Barnes. Improvements in the production of fast colours upon vegetable fibre. Dec. 5.

28,266. A. F. B. Gomess. Improvements in bleaching textile vegetable fibres, yarns, and fabrics. Dec. 10.

COMPLETE SPECIFICATION ACCEPTED.

1896.

2844. A. H. Brownlow and J. Stansfield. Method of dyeing. Dec. 9.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

25,740. T. Twynam. Improvements in the production of caustic alkalis and alkaline carbonates. Nov. 16.

25,938. P. G. W. Typke. Improvements in the manufacture of phosphorus compounds. Nov. 17.

26,423. H. Maxim. An improved method and apparatus for the production of calcium carbide, applicable also to the reduction of metals from their oxides and to analogous purposes. Nov. 21.

26,508. C. Schwarz and A. Weishut. Process of manufacturing muriatic acid or chlorine and chloride of potassium from calcium chloride and chloride of magnesium and other suitable chlorides. Nov. 23.

26,824. F. Dresser. Improvements in the manufacture of carbide of calcium and the like. Nov. 26.

26,837. A. J. Bambridge and G. Weddell. An improved method of manufacturing bicarbonate of soda. Nov. 26.

26,889. F. J. Seyfried. Improvements in the preparation of caustic soda solution from soda residues. Complete Specification. Nov. 26.

27,769. E. Dyson. Improvements in apparatus for concentrating sulphuric and other acids. Dec. 5.

28,163. G. Sisson. Improved method of and process for producing carbonic acid gas. Dec. 9.

28,199. H. H. Lake. — From C. Pieper. An improved method or process of treating substances containing nitrogen for the manufacture of ammonia. Complete Specification. Dec. 9.

28,294. E. A. Goddin and R. Lees. An improved process and apparatus for obtaining common salt and other like salts from their solutions. Dec. 10.

28,322. T. Twynam. Improvements in the recovery of ammonia from producer gas, blast-furnace gas, and other gases. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

335. H. R. Angel. Manufacture of caustic soda, carbonate of soda, and sulphide of sodium. Nov. 25.

20,290. J. Walter and C. Lehmann. Nitric acid regenerator. Dec. 16.

21,572. M. P. E. Letang. Process for the treatment of carbide of calcium. Nov. 25.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

26,046. D. Laffan, G. Moore, and T. J. Glynn. Improvements in apparatus for forming glass bottles or other glass ware. Nov. 18.

26,212. W. Illingworth. Improvements in thimbles for the purpose of supporting pottery ware while being fired in ovens and kilns. Nov. 20.

26,374. T. W. Simpson and W. H. Bradshaw. Improvements in the manufacture of glass bottles and in apparatus for the same. Nov. 21.

26,890. W. Preston. Improvements in glass-annealing furnaces or leers. Nov. 26.

26,937. P. B. W. Kershaw. An improved method and means for the mechanical formation of bottles or other articles in glass. Nov. 27.

27,200. W. Brothers. Improvements in the manufacture of plaster of Paris and other useful products. Nov. 30.

27,828. J. Morton. A new means and method of enamelling or glazing bricks, tiles, and the like. Dec. 7.

28,146. W. Stockton. An improvement treating with the process of decorated ceramics. Dec. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

1794. J. W. Ormrod. Improvements in kilns for use in the manufacture of bricks, terra-cotta goods, tiles, and the like. Dec. 2.

23,814. W. H. Godwin and T. Pickerill. Improvements in slabbing tiles, mosaics, and other similar appliances. Dec. 16.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

25,876. W. White. Improvements in treating clay. Nov. 17.

25,880. A. H. van der Vygh, H. van der Vygh, and G. van der Vygh. An improved fire-proof artificial stone. Complete Specification. Nov. 17.

26,306. G. Scott. The improved concrete building construction. Nov. 21.

26,792. H. Brockhues. Process for manufacturing a material for covering walls and floors. Nov. 25.

26,847. J. J. Moffat. Improvements in connection with fireproof floors, ceilings, walls, and partitions. Nov. 26.

27,200. W. Brothers. See Class VIII.

27,648. A. Taylor. Improvements in the manufacture of artificial stone for building, paving, and other suitable purposes. Dec. 4.

27,835. C. Musker and A. Musker. Improvements in or connected with the manufacture of artificial stone. Dec. 7.

27,975. S. R. Thompson. A composition or cement for making pipe and other joints. Dec. 8.

28,291. E. Edwards.—From C. J. R. Le Mesurier. An improved composition or cement for making artificial mill stones, grind stones, and the like. Dec. 10.

28,317. J. Ripley. A hollow brick for ordinary building purposes. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,018. E. Coulon and J. J. Defalque. Manufacture of artificial stones. Nov. 25.

24,967. M. Hoeft. Production of marble-like stucco or plaster-work suitable for walls, ceilings, and the like. Dec. 16.

1896.

68. W. R. Taylor. Apparatus for burning cement-making materials, lime, chalk, and the like, and the obtaining therefrom of carbonic acid gas. Dec. 16.

1408. G. L. Falconar. Manufacture or production of blocks or slabs for use for flooring, paving, or in step or staircase or wall construction, and for analogous purposes. Dec. 2.

2451. D. J. J. Froment. Treatment of marble and similar stone. Dec. 16.

2614. F. W. Maxwell and W. Beer. New or improved manufacture of artificial stone for building, decorative, and other purposes. Dec. 16.

2843. H. Simmonds and J. Delaney. Kilns or furnaces applicable for burning lime, cement, and other minerals. Dec. 9.

6232. F. L. Schauermaun and J. S. Cowper. Composition for use in imitation of or in substitution for wood. Dec. 9.

16,525. E. Selberg. New or improved building and insulating material. Dec. 9.

17,281. M. Bernstein. Process for producing artificial veined coloured marble. Dec. 16.

20,432. J. Grunhut. Manufacture of artificial stone. Dec. 16.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

25,738. C. Hornung. An improvement in the charging apparatus of blast furnaces. Nov. 16.

26,066. D. White and T. M. Simpson. An improved method and apparatus for extracting precious metals from slimes or other finely-divided material containing the same. Complete Specification. Nov. 18.

26,297. J. Campbell. Improvements in the method of and apparatus for treating refractory gold and silver and other metal-bearing ores and materials. Nov. 20.

26,412. F. Ellershausen. Improvements in and connected with the treatment of refractory lead ores. Nov. 21.

26,423. H. Maxim. See Class VII.

26,493. T. B. McGhie and E. G. Ballard. Improvements in the beds or tests of cupellation furnaces, assay cupels, and the like. Nov. 23.

26,507. C. Schwarz and A. Weishut. Process of manufacturing ferro-manganese or copper-manganese, or copper and sulphur or sulphuric acid from sulphurated iron or copper ores. Nov. 23.

26,698. T. Hampton. Improvements in the manufacture of steel. Nov. 25.

26,770. G. V. Frankish. A composite compound or alloy of steel. Nov. 25.

26,851. J. de F. Maunder. Improvements in the manufacture of zinc. Nov. 26.

26,906. T. C. Fawcett, Lim., and J. Swallow. Improvements in or relating to the treatment of purple and other ores, and by-products obtained from chemical works for the extraction of iron. Nov. 26.

27,311. G. J. Atkins. Improvements in the extraction of gold and silver by amalgamation from ores and sands containing them. Dec. 1.

27,346. J. J. Sheddock. Improvements in extracting metals from their ores and apparatus therefor. Dec. 1.

27,577. R. Appleyard. Improvements relating to the coating or permeation of substances with mercury or with amalgams, and to the use of substances thus coated or permeated in the extraction of gold and other metals from ores, tailings, and the like, by amalgamation, and for other purposes. Dec. 3.

27,776. P. Marino. Improvements in or connected with the obtaining of metals or alloys by electrolysis or hydro-electro-chemical action. Dec. 5.

27,801. C. Crocker and W. T. Lougher. Improvements in coating metal plates and other articles with lead. Dec. 5.

27,874. C. Strobrawa. Improvements in the manufacture of iron or steel. Dec. 7.

27,899. H. Imray.—From La Compagnie Anonyme des Forges de Chatillon et Commentry. Method of pouring steel ingots. Dec. 7.

27,927. A. J. Boulton.—From H. L. Sulman. Improvements in or relating to the treatment of ores. Dec. 7.

28,011. E. Manby. The vacuum treatment of steel, brass, and other alloys. Dec. 8.

28,361. M. M. Marcus. Process for making metal alloys. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,052. H. R. Lewis and C. Gelstharp. Improvements relating to the extraction of gold and other metals from ores, tailings, slimes, and other compounds containing the same, the apparatus therefor, and to the preparation of solvents for use in such extraction. Dec. 2.

23,385. G. Platt. See Class I.

23,192. W. H. James and C. J. Norris. Extraction of precious metals from their ores. Dec. 9.

1896.

202. E. Placet. Treatment of metals and products resulting therefrom. Nov. 25.

1325. F. A. Ellis. Drawing and planishing tubes of aluminium alloy, and means employed therefor. Dec. 16.

1469. E. L. Oppermann. Apparatus for effecting the amalgamation of gold and the like metals in ores with mercury. Dec. 16.

2997. E. J. M. Servais and P. Gredt. Process for the direct production of iron and steel and other metals from their ores. Dec. 2.

9514. W. Kirkham and D. Evans. Method of casting ingots, and moulds and appliances connected therewith. Dec. 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

25,798. J. Greenwood. Improvements in the manufacture or production of chlorates and hypochlorites of potassium and sodium by electrolysis, and in apparatus therefor. Nov. 16.

25,799. F. W. Schneider. Improvements in the construction of electrodes for accumulators. Complete Specification. Nov. 16.

25,804. Dieffenbach. Improvements in the electrolytic production of zinc and alkalis. Complete Specification. Nov. 16.

25,965. J. P. Brooks and J. Holt. Improvements in the electro-deposition of metals. Nov. 18.

26,059. C. C. Connor. Improvements in electrodes. Nov. 18.

26,100. H. Leitner. Improvements in and in connection with the manufacture of electrodes for secondary electric batteries. Complete Specification. Nov. 19.

26,184. G. J. Epstein. Improvements in electrodes for secondary or storage batteries. Nov. 19.

26,247. A. E. McKecknie. An improved manufacture of moulded battery cells and other moulded articles. Nov. 20.

26,281. K. Klie. Improvements in or relating to the manufacture of metal sheets or strips by electro-deposition. Complete Specification. Nov. 20.

26,419. M. F. X. Fuchs. An improved primary battery. Nov. 21.

26,452. P. L. Norrington. Improvement in electric storage batteries. Nov. 23.

26,491. I. Lelestre. Improvements in and relating to electric accumulators. Complete Specification. Nov. 23.

26,737. H. Fewson. Improvements in and relating to electric batteries. Nov. 25.

26,828. J. D. Bell. Improvements in electric accumulators or storage batteries and primary batteries. Nov. 26.

27,167. C. E. O. Keenan. Improvements in electrical batteries. Nov. 30.

27,262. O. Rothmund, E. von Burgwall, and L. Offenschussl. An improved primary element with interchangeable electrodes and regenerable positive electrodes. Complete Specification. Dec. 1.

27,701. H. Leitner. Improvements in and in connection with the manufacture of electrodes for secondary electric batteries. Dec. 4.

27,812. E. Saarburger. An improved electric battery. Dec. 7.

28,043. E. M. Grant. An improvement in secondary voltaic batteries. Dec. 8.

28,139. A. Dodd. Improvement in lead accumulators. Dec. 9.

28,223. F. MacKinley, H. Brecknell, and E. M. Munro. A method of and means for decomposing stable salts and generating electricity. Dec. 10.

28,288. T. R. Canning. Improvements in anodes for the electro-deposition of nickel. Dec. 10.

28,314. R. Kennedy. Improvements in electrical storage batteries and cells. Dec. 11.

28,511. L. Lucas. Improvements in the manufacture of electric accumulators or secondary batteries. Dec. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,459. E. Andreoli. Electro-depositing on and stripping gold from cathodes. Dec. 16.

1896.

986. J. C. Graham. Electro-deposition of metals. Nov. 25.

1401. A. A. Naville, P. A. Guye, and C. E. Guye. Electrical gas-reaction apparatus. Dec. 2.

20,077. T. F. Boland, C. J. Hubbell, and H. C. Hubbell. Primary batteries. Dec. 9.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

25,774. W. McDonnell. Improvements in or connected with and apparatus for the manufacture of margarine. Nov. 16.

26,007. W. R. Harrison and E. Stephenson. Improvements in the method of and apparatus for brightening and clarifying crude oils. Nov. 18.

26,285. E. G. Scott. Improvements in the manufacture of soap. Nov. 20.

26,396. R. Gesell. Improved process for making soap. Complete Specification. Nov. 21.

27,263. A. Cawood. An improved preparation or composition for scouring or washing wool, woollen textiles, or any other suitable animal or vegetable fibre. Dec. 1.

27,906. F. W. Wright and The United Alkali Company, Ltd. Improvements in the manufacture and production of dry soap or soap powder. Dec. 7.

27,923. F. B. Aspinall and G. Wise. Improvements in purifying oils. Dec. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

24,418. E. S. Wilson and E. Stewart. Separation and purification of colouring matter from crude cotton-seed oil. Dec. 16.

24,714. A. E. Morgans. Treatment of oleaginous and fatty substances of all kinds, and hydrocarbons, for purification and other purposes. Dec. 16.

1896.

10,955. G. Drimmond. An improved soap composition for washing flannel and the like. Dec. 9.

17,379. C. Schmidt. Processes for producing chemical combinations from raw wool fat. Nov. 25.

19,257. F. M. Sanders and The Digby Patents Company. Manufacture of soaps. Nov. 25.

22,873. J. G. Hargrave and A. Hargrave. Processes for purifying and deodorising butter and other solid fats and oils. Dec. 16.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

APPLICATIONS.

25,779. H. Helbing and G. Pertsch. Improvements in the preparation and application of coating and insulating materials for medical and other purposes. Nov. 16.

25,863. R. Bell. Process and method of manufacture of artificial rubber. Nov. 17.

26,015. A. Schmidt. Improved process for obtaining turpentine from wood and wood waste. Complete Specification. Nov. 18.

26,322. J. Fairlie. Improvements in the manufacture of red lead. Nov. 21.

26,548. F. Fenton. Improvements in the production of artificial gutta-percha and caoutchouc-like substances. Nov. 24.

26,695. F. H. Smith and C. Macintosh and Co., Lim. Improvements in the manufacture of rubber compounds and fabrics. Nov. 25.

26,833. R. D. Waddell and D. A. Sutherland. Improvements in the manufacture of insulating materials. Nov. 26.

26,874. F. W. Burger. A new and improved method of manufacturing white lead. Nov. 26.

27,038. J. E. Bedford and C. S. Bedford. Improvements in the manufacture of varnish. Nov. 28.

27,138. J. A. Cumine and E. J. Dexter. A process for producing carbon from asbestos. Nov. 30.

28,283. W. A. Hall. Improvements in water-paints. Complete Specification. Dec. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

23,137. R. Langhans. Manufacture or production of coatings composed of oxides of the earth metals. Dec. 2.

24,546. R. Langhans. Manufacture or production of coatings composed of earthy oxides. Dec. 9.

1896.

654. E. Serullas and F. Hourant. Process of obtaining and purifying gutta-percha. Dec. 9.

2219. C. Sullivan. Production of paint. Nov. 25.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

25,894. Sir John Turney and J. T. Wood. A new or improved method of bating skins. Nov. 17.

25,955. E. V. Springborn. Artificial imitation leather. Nov. 18.

26,170. J. Hargreaves. Improvements in the manufacture of gelatine and glue, and in apparatus therefor. Nov. 19.

26,287. J. Pullman and E. E. Pullman. Improvements in the method of dressing chamois leather. Nov. 20.

27,410. J. J. Mann and F. Chaplet. Improvements in the treatment of skins or hides for industrial purposes. Dec. 2.

28,067. E. A. Muskett and J. B. Seammell. Improvements in or relating to the treatment of raw hides. Dec. 8.

XV.—AGRICULTURE AND MANURES, Etc.

COMPLETE SPECIFICATION ACCEPTED.

1896.

22,666. C. H. Langdale and A. W. Langdale. Treatment of ground slags intended for use as fertilisers. Nov. 25.

XVI.—SUGARS, STARCHES, GUMS, Etc.

APPLICATIONS.

27,471. R. Goernemann. A new or improved process for the manufacture of crystallised starch from maize. Complete Specification. Dec. 2.

28,188. A. J. Boulton.—From L. Jaussens and Co. Improvements in or relating to the production of sugar. Complete Specification. Dec. 9.

XVII.—BREWING, WINES, SPIRITS, Etc.

APPLICATIONS.

25,852. J. Schneible. Improvements in the manufacture of fermented liquors. Nov. 17.

26,655. C. Zimmer. Improved process for brewing. Nov. 24.

26,690. T. S. Manning. Improvements in brewing apparatus. Nov. 25.

27,477. J. Grossé. An improved evaporating or vacuum apparatus for the granulation of crystallisable liquids. Complete Specification. Dec. 3.

COMPLETE SPECIFICATION ACCEPTED.

1896.

21,118. J. Kwiatkowski. New or improved process for adding iron to beer. Nov. 25.

XVIII.—FOODS, SANITATION, Etc., AND

DISINFECTANTS.

APPLICATIONS.

A.—Foods.

26,498. W. F. E. Casse. Improvements in the Casse freezing process for preserving milk and cream. Complete Specification. Nov. 23.

26,635. P. M. Justice.—From M. W. Marsden. An improved product obtained from corn or maize stalks, and a process of and apparatus for making the same. Complete Specification. Nov. 24.

27,114. S. P. Sorenson and A. P. Heyman. An improved manufacture of artificial food for swine, cattle, and the like. Complete Specification. Nov. 28.

27,733. A. J. T. Digby. A new method of preserving meat for culinary purposes. Dec. 5.

27,735. J. Hogarth. Improvements in and relating to the treatment of alimentary substances. Dec. 5.

B.—Sanitation.

25,949. J. T. Norman. The purification and treatment of acid waters or effluents. Nov. 17.

26,148. M. F. Purcell. An improved process and means used therein for purifying and revivifying confined air for constant inhalation. Nov. 19.

26,506. H. Pape and W. Henneberg. Method and apparatus for producing fresh water from water containing salts. Complete Specification. Nov. 23.

26,667. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering. Improvements in disinfecting and in apparatus therefor. Nov. 24.

27,513. F. P. Candy. Improvements in the purification of sewage and polluted waters. Dec. 3.

28,050. E. Manville and C. von Buch. Improved method of and means for the purification and revivification of confined atmospheres. Dec. 8.

C.—Disinfectants.

26,262. L. Conz. New anti-septical composition for laundry use. Nov. 20.

COMPLETE SPECIFICATIONS ACCEPTED.

A.—Foods.

1896.

1827. M. C. A. Ruffin. Manufacture of an edible fat from cocoa or coprah oil. Dec. 9.

C.—Disinfectants.

1896.

2197. E. Hermite, E. J. Paterson, and C. F. Cooper. Preparation of electrolysed chloride solutions for disinfecting and like purposes. Dec. 16.

XIX.—PAPER, PASTEBOARD, Etc.**APPLICATIONS.**

25,986. D. Forbes. A composition for use as a substitute for ivory, bone, celluloid, and the like, applicable also to other purposes. Nov. 18.

26,045. C. Marter. Improvements in or relating to artificial ivory. Nov. 18.

26,461. J. A. Wilkinson, F. C. Wilkinson, and A. T. Wilkinson. An improved machine for softening paper. Complete Specification. Nov. 23.

27,105. H. de Gronsilliers. Improved manufacture of transfer paper for transferring designs on to ceramic and other objects. Nov. 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.**APPLICATIONS.**

25,778. H. Helbing. Improvements in the preparation and application of menthol. Nov. 16.

25,786. A. J. Boulton.—From L. Fromm and R. Schmidt. Improvements in vegetable extracts and the method of obtaining the same. Complete Specification. Nov. 16.

25,905. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Manufacture of a new salt of piperazine. Nov. 17.

26,078. W. B. Bishop. Improvements in the treatment of piperazine. Nov. 19.

26,350. A. J. Boulton.—From F. Fritzsche and Co. A new or improved process for the manufacture of artificial essence or essential oil of violets. Nov. 21.

26,397. H. E. Aspinall. Improvements in the manufacture of artificial camphor. Nov. 21.

27,655. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improvements in the manufacture of benzoic sulphimide. Dec. 4.

27,656. G. B. Ellis.—From La Société Chimique des Usines du Rhone, anciennement G. P. Monnet et Cartier. Improvements in the production of formic aldehyde vapours. Dec. 4.

COMPLETE SPECIFICATIONS ACCEPTED.

1896.

1202. J. Y. Johnson.—From Vereinigte Chininfabriken, Zimmer, and Co. The manufacture or preparation and production of new medical compounds. Nov. 25.

4991. J. Y. Johnson.—From Vereinigte Chininfabriken, Zimmer, and Co. The manufacture and production of new pharmaceutical preparations. Dec. 16.

9076. T. P. Sims and W. Terrill. Manufacture of white arsenic. Dec. 16.

19,603. P. Anchinachie. Distillation of aromatic waters, such as elder-flower water, rose-water, and the like. Dec. 9.

XXI.—PHOTOGRAPHY.**APPLICATIONS.**

25,980. J. Liddle.—From The International Photographic and Supply Company. Process of printing photographs on textile fabrics, and solutions connected therewith. Complete Specification. Nov. 18.

26,891. A. Hill and The Cresco-Fylma Company, Lim. A new or improved emulsion for photographic printing purposes. Nov. 26.

COMPLETE SPECIFICATION ACCEPTED.

1895.

22,138. A. Baumgarten. Coloured plates for photographic colour printing. Dec. 2.

XXII.—EXPLOSIVES, MATCHES, Etc.**APPLICATIONS.**

26,253. Vickers, Sons, and Co., Lim., A. T. Dawson, and G. T. Buckham. Improvements in primers for ordnance. Nov. 20.

26,334. T. A. Bayless and H. M. Smith. Improvements in or relating to the manufacture of primers or fuses in connection with cartridge cases, shells, and the like. Nov. 21.

26,819. T. Jenkins. Improvements in the charges of detonating railway fog-signals. Nov. 26.

27,197. A. Nobel. An improved manufacture of explosive compounds. Nov. 30.

27,684. L. Braly, L. Legat, A. Tachauer, and A. Delpey. An improved paste for the manufacture of matches. Dec. 4.

28,220. G. Beneke. Improved manufacture of explosives. Dec. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1895.

16,311. H. Maxim. Manufacture of smokeless explosives. Dec. 9.

16,862. H. Maxim. Manufacture of explosives and apparatus therefor. Dec. 16.

22,698. W. J. Orsman. Manufacture of explosives applicable for use in coal or other fiery mines. Dec. 2.

24,847. H. H. Lake.—From W. Greaves and E. M. Hann. Explosives. Dec. 2.

1896.

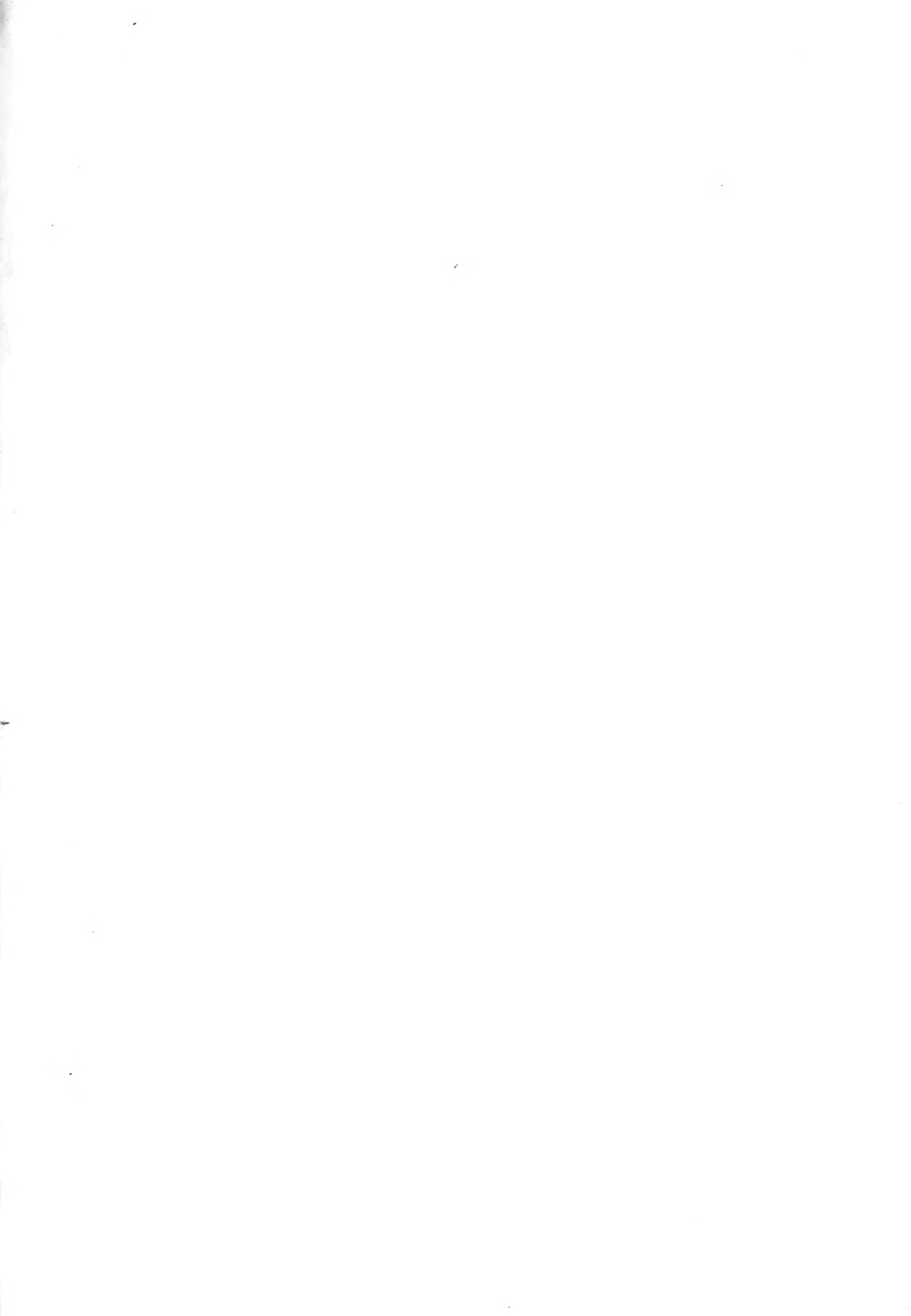
3023. H. H. Lake.—From Sprengstoff Actien Gesellschaft Carbonit. Method and apparatus for measuring the power or the volume of the gases resulting from the explosion of explosives. Dec. 16.

20,069. W. P. Thompson.—From La Société des Explosifs Industriels. Manufacture of explosives. Dec. 9.

XXIII.—ANALYTICAL CHEMISTRY.**COMPLETE SPECIFICATION ACCEPTED.**

1895.

22,303. G. Craig. A new or improved process for estimating the carbonic acid or other constituents in gases or products of combustion, and apparatus therefor. Nov. 25.





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